PSYCHOMETRIC PROPERTIES OF TWO INTERRELATED MEASURES:

«Conceptions of learning» and «Preferences for different types of courses and teaching»

Av Tore Bonsaksen og Mikkel Magnus Thørrisen

Tore Bonsaksen er dosent ved ergoterapeututdanningen ved Institutt for ergoterapi og ortopediingeniørfag ved Høgskolen i Oslo og Akershus, og dosent II ved VID vitenskapelige høgskole. E-post: tore.bonsaksen@hioa.no

Mikkel Magnus Thørrisen er stipendiat ved Institutt for ergoterapi og ortopediingeniørfag ved Høgskolen i Oslo og Akershus

«CONCEPTIONS OF LEARNING» AND «PREFERENCES FOR DIFFERENT TYPES OF COURSES AND TEACHING»

Abstract

Background: The quality of students' learning in higher education depends on the quality of the teaching and the learning environment, but may also depend on the students' own perceptions of what learning is and what teaching should be like. Valid and feasible measures are needed to examine students' conceptualizations of learning and preferences for teaching. This study examined the factor structure of two measures taken from the Norwegian version of the Approaches and Study Skills Inventory for Students (ASSIST), and examined the relationships between the derived scales.

Methods: Occupational therapy students (n = 160) from one education program completed the ASSIST and provided sociodemographic information. A Principal Components Analysis (PCA) was performed on the two ASSIST measures, and factor extraction was controlled using Parallel Analysis. Reliability was analyzed with Cronbach's alpha and inter-item correlations. Bivariate associations were assessed with Pearson's correlation coefficient *r*.

Results: The PCA confirmed the factors as previously established. «Conceptions of learning» consisted of a «deep» concept of learning as understanding, and a «surface» concept of learning as reproducing knowledge. However, the Parallel Analysis suggested that all items in this measure were expressions of the same latent factor. «Preferences for different types of courses and teaching» consisted of a preference for teaching as «supporting understanding» and as «transmitting information».

Conclusions: The Norwegian «Conceptions of learning» and «Preferences for teaching» scales may prove useful for educators who want a quick insight into occupational therapy students' views on learning and their preferences for teaching.

Keywords: factor analysis, higher education, occupational therapy, psychometrics, students

Manuset ble mottatt 28.10.16 og godkjent for publisering 04.03.17
Det er ingen kjente interessekonflikter.

BACKGROUND

Approaches to studying refer to students' general orientation towards learning in academic situations (Richardson, 2013). Entwistle and Ramsden (1983) categorized three types of approaches to studying: the deep, surface, and strategic approaches. The deep approach was described as studying with the purpose of understanding – connecting the ideas in study materials to construct personal meaning. The surface approach, on the other hand, was described as studying with the aim of passing exams making as little effort as possible. The strategic approach was described as oriented towards achievement: the strategic student aims at the best possible grade.

Approaches to studying, often measured with *the Approaches and Study Skills Inventory for Students* (ASSIST; Tait, Entwistle, & McCune, 1998) have been found in a range of studies to predict academic outcomes among students. Deep and strategic approaches have been found to relate to better learning outcomes and exam grades, whereas worse outcomes have been predicted from employing a surface approach to studying (e.g., Brodersen, 2007; Diseth & Martinsen, 2003; May, Chung, Elliot, & Fisher, 2012; Richardson, Abraham, & Bond, 2012; Salamonson et al., 2013; Subasinghe & Wanniachchi, 2009; Ward, 2011).

Approaches to studying are, however, not only characteristics of individuals, but exist in close relationship to the student's learning environment (Baeten, Kyndt, Struyven, & Dochy, 2010; Kreber, 2003; Lizzio, Wilson, & Simons, 2002; Richardson, 2010; Trigwell, Prosser, & Waterhouse, 1999). For example, Sun and Richardson (2016) analyzed relationships between age and gender, approaches to studying, perceptions of the learning environment, and academic outcomes. Outcomes were mainly influenced by approaches to studying and perceptions of the learning environment, as measured with the Course Experience Questionnaire (CEQ; Ramsden, 1991). Students who scored higher on CEQ scales (appropriate assessment, appropriate workload, emphasis on independence, and good teaching) and on approaches to studying scales (relating ideas, use of evidence, organized studying, and alertness to assessment demands) also produced higher ratings of course satisfaction (Sun & Richardson, 2016). Moreover, there was a bidirectional relationship between study behaviors and perceptions of the learning environment: productive study approaches were associated with viewing the learning environment more positively and vice versa.

Educators have been encouraged to adapt their teaching, courses, and assessments in a way that encourage students to use a productive approach to studying (i.e., deep and/or strategic approaches). Such adaptations have included students working in groups (Hall, Ramsay, & Raven, 2004), providing support for students' writing skills (English, Luckett, & Mladenovic, 2004), and using case-based studies (Ballantine, Duff, & Larres, 2008). With particular relevance for occupational therapy, the use of problem-based learning was found to be associated with higher scores on the deep approach scale, and with lower scores on the surface approach scale (Sadlo & Richardson, 2003). This indicates that the quality of the occupational therapy students' learning may be improved by emphasizing teaching methodologies that require the students to engage actively in a process of inquiry and reasoning. However, the quality of occupational therapy students' learning may also depend on their own perceptions of what learning is and what teaching should be like.

In addition to the well-known «Approaches to Studying» measure of the ASSIST, the instrument consists of two other measures: these are «Conceptions of learning» and «Preferences for different types of courses and teaching». In 1990, an early version of the «Preferences for different types of courses and teaching» was subjected to factor analysis, and a distinct pattern related to preferences for «deep» versus «surface»-oriented courses, teaching, exams, and tutors was found (Entwistle & Tait, 1990). For example, a preference for lecturers who «tell us what to put in notes» (surface teaching) was distinctly different from lecturers who «show what they think» (deep teaching). Later on, relationships have been suggested between different conceptions of learning, actual approaches to studying, and preferences for types of courses, teaching, and assessment (Entwistle, 1998; Tait et al., 1998). Students who conceive learning mainly as reproducing information are thought to adopt a surface approach to studying and to prefer teaching to be oriented towards transmitting knowledge. Conversely, students who think of learning mainly as personal meaning construction are thought to adopt a deep approach to studying and to prefer teaching

DEL A: HVA ER LÆRING? Når du tenker på begrepet «**LÆRING**», hva innebærer dette for deg? Tenk nøye gjennom hvert av disse utsagnene, og ranger dem så etter hvor like de er **din egen** måte å tenke på begrepet på.	
Utsagn	M (SD)
A1) Forsikre deg om å huske ting godt	3.88 (0.76)
A2) Utvikle deg som person	4.23 (0.75)
A3) Bygge opp kunnskap gjennom tilegnelse av fakta og informasjon	4.48 (0.61)
A4) Kunne bruke den informasjonen du har ervervet	4.41 (0.68)
A5) Forstå nytt materiale for din egen del	4.28 (0.71)
A6) Se ting på en ny og mer meningsfull måte	4.25 (0.74)

Table 1
The Norwegian version of the «Conceptions of learning»: instructions, items, and sample mean scores (n = 160).
Note. 1 = svært forskjellig, 2 = ganske forskjellig, 3 = ikke så nær, 4 = ganske nær, 5 = svært nær.

to be oriented towards supporting the students' understanding. Empirically, this reasoning was supported by a factor analysis of an early version of the ASSIST. A conceptualization of «learning as reproducing» loaded on the same factor as «surface» study approaches as well as a preference for «surface» types of teaching, courses, and assessments. Conversely, a conceptualization of «learning as understanding» loaded on another factor together with preferences for «deep» teaching, courses, and assessments (Entwistle, 1998).

The approaches to studying measure of the ASSIST has received considerable research attention. It has been extensively scrutinized in terms of measurement properties, and the deep, strategic, and surface dimensions have been well established across a range of disciplines and settings (e.g., Byrne, Flood, & Willis, 2004; Diseth & Martinsen, 2003; Entwistle, Tait, & McCune, 2000; Kreber, 2003). However, similar validation procedures have not been conducted with the «Conceptions of learning» and «Preferences for teaching» measures (Entwistle, 2016), which appears also to be the case with the Norwegian version (Diseth, 2001). The need to validate instruments is considered basic, and introducing an instrument to new populations or settings should be accompanied by studies of its measurement properties within the new population and setting (Kielhofner, 2006).

Research using the ASSIST with occupational therapy students is increasing (e.g., Bonsaksen, Thørrisen, & Sadeghi, 2017; Brown et al., 2016; Brown & Murdolo, 2016). Occupational therapy educators may find the shorter scales of the ASSIST useful for obtaining an understanding of how students conceptualize learning, as well as their preferences for types of courses and teaching. Having insight into occupational therapy students' views on learning and teaching may potentially enable educators and course instructors to tailor their teaching and course activities to the needs of individual students, or to targeted student groups. They may also use this insight to work on students' attitudes toward learning. In turn, teaching and course activities better suited to the students' needs may result in improved learning and better learning outcomes. However, in order to gain such insight into the students' needs in the educational context, valid and feasible assessment tools are needed. Brevity is a matter of great importance: The longer the inventory, the poorer are the chances that students will care to complete it and that staff will be inclined to use it (Entwistle & McCune, 2004; Pettersen, 2010). Thus, the validation of the short sections of the ASSIST may have the potential to respond to these needs.

STUDY AIM

The aim of the current study was to contribute to the validation of the Norwegian version of the ASSIST. Specifically, we examined the factor structures of the ASSIST's «Conceptions of learning» and «Preferences for different types of courses and teaching» in occupational therapy students in Norway. In addition, we examined the reliability of the resulting scales, and examined the associations between them.

Methods

DESIGN AND SETTING OF THE STUDY

The study had a cross-sectional design using factor analysis as the main analytic procedure. The occupational therapy program in Oslo, where the study was conducted, is a three-year full time undergraduate program.

DEL C: PREFERANSER FOR ULIKE TYPER STUDIER OG UNDERVISNINGSMETODER Prøv å unngå bruk av 3 (usikker) med mindre du virkelig må, eller dersom utsagnet ikke gir mening i din studiesituasjon.	
Utsagn	M (SD)
C1) Forelesere som forteller oss akkurat hva vi skal notere	4.19 (1.03)
C2) Forelesere som oppmuntrer oss til å tenke selvstendig og viser oss hvordan de selv tenker	4.28 (0.85)
C3) Eksamener som tillater meg å vise mine egne tanker rundt studiematerialet	4.41 (0.77)
C4) Eksamener eller prøver hvor alt vi trenger er materiale vi har tilgang til gjennom forelesningsnotater	4.01 (1.05)
C5) Studier hvor det går tydelig fram akkurat hvilke bøker vi skal lese	4.61 (0.62)
C6) Studier hvor vi er oppfordret til å gjøre mye av lesingen rundt emnet selv	3.11 (1.23)
C7) Bøker som utfordrer meg og gir forklaringer som går dypere enn forelesningene	3.60 (1.18)
C8) Bøker som gir klare fakta og informasjon som er lett å lære	4.72 (0.57)

Table 2
The Norwegian version of the "Preferences for different types of courses and teaching": instructions, items, and sample mean scores (n = 160).
Note. 1 = misliker sterkt, 2 = misliker i noen grad, 3 = usikker, 4 = liker i noen grad, 5 = liker godt.

PARTICIPANTS AND RECRUITMENT

The inclusion criteria for the study were:

1) student enrollment in the occupational therapy education program in Oslo; and
2) students provided informed consent to participate in the study

.A non-teaching member of staff, who distributed the questionnaires to students during breaks in classrooms, collected the data in January 2015. The students either completed the questionnaires in the classroom, or at a time and a place of their own convenience, within a week after receiving the questionnaire. The questionnaires were returned to the principal researcher in sealed envelopes accompanied by a written consent form.

MEASURES

In this study, the «Conceptions of learning» and «Preferences for teaching» measures of the ASSIST were used (Tait et al., 1998), and we used a Norwegian translation where only the «Approaches to studying» has been previously validated (Diseth, 2001). The «Conceptions of learning» consists of six statements representing different conceptualizations of learning. Three statements relate to an instrumental approach to learning, and these reflect a conception of learning as reproducing knowledge. Three other statements relate to personal involvement and meaning construction, and these reflect a conception of learning as understanding and personal development. Students are asked to rate their level of agreement with each statement on a 1-5 scale, 1 indicating that the statement content is «very different» from the student's own thinking and 5 indicating that it is «very close» to it.

The «Preferences for different types of course and teaching» consists of eight statements concerning teaching, course content, syllabus, and forms of assessment. Four of the statements reflect preference for teaching that supports the students' understanding, whereas four other statements reflect preference for teaching oriented towards transmitting information. The students are asked to rate on a 1-5 scale how much they like the type of teaching, course content, syllabus, or assessments described, 1 indicating «strongly dislikes», and 5 indicating «likes very much».

The statements included in the Norwegian version of the «Conceptions of learning» and the «Preferences for different types of courses and teaching» measures are displayed in Table 1 and Table 2 respectively, along with the sample mean scores. In addition to the ASSIST, information regarding the participants' age and gender were collected using a brief questionnaire.

DATA ANALYSIS

All data were entered into the computer program IBM SPSS version 23 (IBM Corporation, 2015). Descriptive analyses were performed on all variables, using means (M) and standard deviations (SD). With the purpose of assessing latent factors, two Principal Component Analyses (PCA) were performed, one with each of the ASSIST measures. For the factor-analytic procedures, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (Kaiser, 1974), in combination with

Bartlett's Test of Sphericity (Bartlett, 1954), were used to assess whether the data were adequate for factorization. The KMO value should exceed 0.60 in order to proceed (Cerny & Kaiser, 1977; Kaiser, 1974). The extraction of factors was determined by

1) visual inspection of the scree plots, in combination with
2) assessing the Eigenvalue estimates and
3) the Parallel Analysis (Horn, 1965). According to statistical convention, we retained factors with Eigenvalue > 1. The Parallel Analysis (Horn, 1965), however, is known to be more restrictive with a view to the number of factors to extract (Zwick & Velicer, 1986). It suggests that one should retain factors with an actual Eigenvalue exceeding the randomly generated Eigenvalue of the corresponding factor in a random dataset with the same number of variables and respondents. As the factors were expected to be interrelated, the Direct Oblimin rotation method was used in order to obtain a clearer structure matrix.

First, an exploratory approach to analysis was used. Then, building on results from the Parallel Analysis (Horn, 1965) and on the theoretical assumptions underpinning the ASSIST (Tait et al., 1998), confirmatory analyses, using a fixed number of factors to extract, were conducted. The six statements in the «Conceptions of learning» are proposed to reflect two different conceptions of learning: three statements relating to a concept of «learning as understanding», and three relating to a concept of «learning as reproduction of knowledge». According to theory, thus, a two-factor solution should be applied to the data. Similarly, the eight statements in the «Preferences for teaching» are proposed to reflect two types of preferences: four statements relating to a preference for teaching as «supporting understanding», whereas the other four statements reflect a preference for teaching as «transmitting information». Thus, theory suggests that a two-factor solution should be applied. In addition to the Eigenvalue estimates, the statistical measures reported from the factor analyses include communalities (the variance proportion of each variable explained by the factors together) and factor loadings (estimates of the impact from each variable on each factor). Factor loadings > 0.40 were considered high.

The reliability (internal consistency) of the scales detected from the PCA and the Parallel Analysis was examined with Cronbach's coefficient alpha and with inter-item correlation coefficients. Estimates of internal consistency are known to vary according to the number of items belonging to a scale and with the size of the sample producing the data (Streiner & Norman, 2008). Cronbach's alpha > 0.70 is usually considered good for scales consisting of fewer than seven items and derived from a sample of fewer than 100 persons (Ponterotto & Ruckdeschel, 2007; Streiner & Norman, 2008). However, scales with very few items may be unable to produce satisfactory alpha estimates. In such cases, an inspection of the inter-item correlations is preferred, and a mean inter-item correlation of 0.20 is usually considered satisfactory (Briggs & Cheek, 1986).

Bivariate correlation analysis was conducted with all variables included in each of the measures. These analyses were also used in order to examine associations between the two differing concepts of learning; between the two differing preferences for course and teaching; and between concepts of learning and preferences for course and teaching. Pearson's correlation coefficient r was used for these procedures. Statistical significance was set at $p < 0.05$.

ETHICS

Approval for the study was obtained from the Norwegian Data Protection Official for Research (project number 40314). The students were informed that completion of the questionnaires was voluntary, that their responses would be kept confidential, and that there would be no negative consequences from opting not to participate in the study. Written informed consent was provided from all participants.

Results

PARTICIPANTS

The participants in this study were 160 students, representing all three year levels (first year n = 57, second year n = 50, and third year n = 53) of the occupational therapy education program in Oslo. At the time of the data collection, there was a total of 245 students enrolled in the education program, yielding a response rate of 65.3 prosent (Bonsaksen, Kvarsnes, & Dahl, 2016). Missing scores on individual items constituting the scales were minor (≤ 3 missing responses on each of the scales), and were therefore neglected. The mean age of the sample

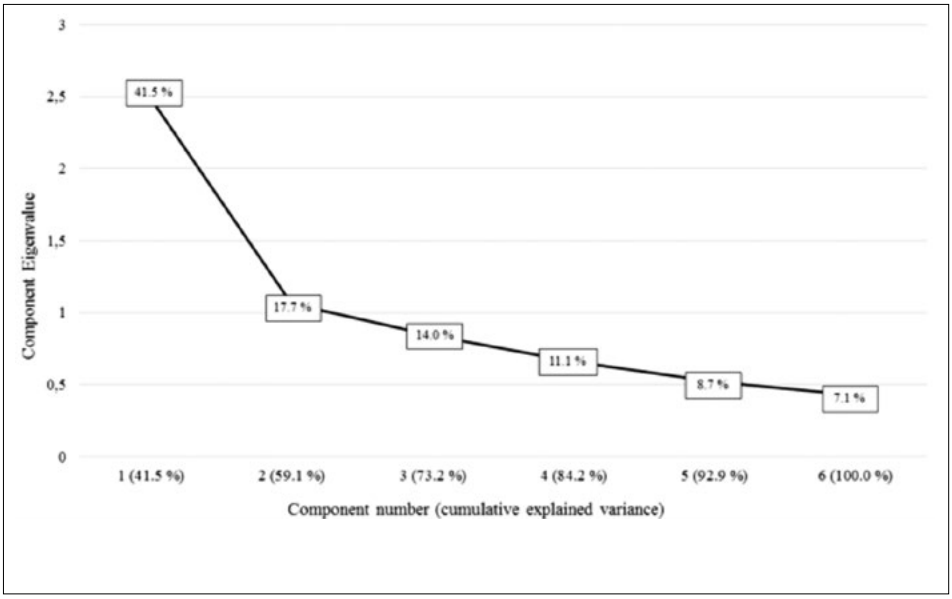

Figure 1. «Conceptions of learning»: Scree plot showing Eigenvalues for each component (vertical axis), explained variance for each component (indicated on the graph), and cumulative explained variance for the components (indicated on the horizontal axis).

was 23.9 years (SD = 4.5 years), and there was a predominance of female students (*n* = 126, 78.8 prosent) compared to male (*n* = 34, 21.3 prosent).

FACTOR STRUCTURE AND INTERNAL CONSISTENCY OF THE «CONCEPTS OF LEARNING» MEASURE

The correlations between the variables included in the «Concepts of learning» varied between 0.07 and 0.53. Many of them exceeded a strength of 0.30 and most were statistically significant. The KMO value was 0.73 and Bartlett's test of sphericity was statistically significant ($p < 0.001$), all of which indicating a dataset appropriate for factor analysis.

Principal component analysis revealed two factors with corresponding Eigenvalues > 1: Factor 1 Eigenvalue = 2.49, explaining 41.5 prosent of the variance, and Factor 2 Eigenvalue = 1.06, explaining an additional 17.7 prosent of the variance in the data (cumulative 59.1 prosent explained variance). The communalities of the variables after the extraction of two factors were between 0.49 and 0.65. The scree plot in Figure 1 depicts the Eigenvalue estimates for the six initial components, suggesting that two factors should be extracted.

Table 3 shows the factor structure resulting from the PCA with Oblimin Rotation, with factor loadings sorted by size. Three variables (A3, A1, and A4) had high loadings (all > 0.70) on the first factor, whereas two variables (A2 and A6) had high loadings (both > 0.80) on the second factor. A5 had «split loadings»: 0.46 on the Factor 1 and -0.42 on Factor 2. In view of the split loadings, scale reliability analyses were performed with and without A5, for both factors. When including A5 in Factor 1, Cronbach's alpha was 0.66. Deleting A5 from this factor resulted in a Cronbach's alpha of 0.61 – thus, this factor's reliability was reduced, but not drastically, by omitting A5. However, when examining the reliability of this factor including only items A1, A3, and A4, its reliability increased to 0.69 if also A1 was deleted. Considering the inter-item correlation matrix, A1 correlated moderately with A3 (r = 0.23) and A4 (r = 0.29), but the inter-item correlation between A3 and A4 was considerably higher (r = 0.53). Considered together, this suggests that A1 measures a slightly different aspect of Factor 1, compared to A3 and A4. However, A1 was retained within Factor 1 for three reasons:

1) deleting it would reduce the scale to two items only, which would make it much more sensitive,
2) A1 loaded very strongly (0.74) on Factor 1, and
3) the theory underpinning the scales suggests that it should be part of this factor.

The mean inter-item correlation between the items belonging to Factor 1 (A1, A3, and A4) was 0.35.

When including A5 with Factor 2 (together with A2 and A6), Cronbach's alpha was 0.61. Removing A5 from the factor resulted in a Cronbach's alpha of 0.60 – a small reduction of the internal consistency between the items.

Pattern matrix			Structure matrix			
Items	Factor 1	Factor 2	Items	Factor 1	Factor 2	Communalities
A3	**0.75**	-0.14	A3	**0.78**	-0.34	0.51
A1	**0.74**	0.26	A4	**0.77**	-0.41	0.65
A4	**0.71**	-0.22	A1	**0.67**	0.07	0.63
A5*	0.46	**-0.42**	A5	0.57	**-0.54**	0.63
A2	-0.01	**-0.81**	A2	0.21	**-0.81**	0.49
A6	0.00	**-0.80**	A6	0.22	**-0.80**	0.64
Eigenvalue	2.49	1.06				
Mean inter-item correlation	0.35	0.35				
Cronbach's alpha	0.61	0.61				
Explained variance	41.5 %	17.7 %				
Total explained variance	**59.1 %**					

Table 3
Factor structure of the Norwegian version of the "Conceptions of learning": factor loadings, communalities, Eigenvalue estimates, reliability estimates (mean inter-item correlation and Cronbach's alpha), and variance explained by the factors (n = 160).
*Note. Results derived from Principal Component Analysis with a forced 2-factor solution, using Direct Oblimin rotation with Kaiser Normalization. *A5 had high loadings on both factors, and the item is included in the reliability estimates for Factor 2.*

If any of the other items were deleted, scale consistency would drop to 0.51 (by removing A2) or to 0.42 (by removing A6). Considering this information, A5 was kept within Factor 2 because

1) deleting it would reduce the scale to two items only,
2) deleting it would – although only marginally – reduce the scale items' internal consistency, and
3) because theory suggests that A5 should belong to this factor.

The mean inter-item correlation between the items belonging to Factor 2 (A2, A5, and A6) was 0.35.

In contrast to the theory, the inspection of the scree plot and the conservative assessment of Eigenvalue estimates, however, the results from the Parallel Analysis suggested that only one factor should be extracted: the Eigenvalue of the second factor was 1.060, which was lower than the randomly generated Eigenvalue of 1.135 from the Parallel Analysis. Table 4 shows the results associated with the suggested one-factor solution, with factor loadings sorted by size. All factor loadings were considered high (i.e., > 0.40), but again, item A1 showed the lowest factor loading (0.42). Factor loadings for the other items were between 0.60 and 0.76. Cronbach's alpha for the six-item scale was 0.70, and the mean inter-item correlation was 0.29. If item A1 was removed from the scale, the internal consistency of the scale would increase to 0.72. Removing any of the other items from the scale would decrease its internal consistency.

FACTOR STRUCTURE AND INTERNAL CONSISTENCY OF THE «PREFERENCES FOR DIFFERENT TYPES OF COURSES AND TEACHING» MEASURE

The correlations between the variables included in the «Preferences for different types of courses and teaching» varied between 0.00 and 0.40. The correlation pattern was somewhat different in comparison to the first measure: it consisted of several correlations that indicated no association, but also of several strong correlations. The KMO value was 0.62 and Bartlett's test of sphericity was statistically significant ($p < 0.001$), indicating that factor analysis was appropriate.

The scree plot assessment, the assessment of Eigenvalue, and the Parallel Analysis all suggested the extraction of two factors from this measure. The communalities were found to be between 0.36 and 0.61. Both factors had Eigenvalues > 1: Factor 1 Eigenvalue = 2.01, explaining 25.1 prosent of the variance, and Factor 2 Eigenvalue = 1.66, explaining an additional 20.8 prosent variance (cumulative 45.9 prosent explained variance). A potential third (omitted) factor had an Eigenvalue of 0.96, explaining an additional 12.0 prosent of the data variance. However, the Eigenvalue of this factor was below the threshold value and below the corresponding Eigenvalue (1.116) derived from the Parallel Analysis.

The scree plot in Figure 2 depicts the Eigenvalue estimates for the eight initial components.

Table 5 shows the factor structure resulting from the PCA with Oblimin Rotation, with factor loadings sorted by size. Four variables (C5, C8, C4, and C1) had high loadings (all > 0.65) on the first factor, whereas the other four variables (C6, C7, C2, and C3) had high loadings (all > 0.58) on the second factor. No variables had high loadings on both factors. Cronbach's alpha for Factor 1 and Factor 2 was 0.60 and 0.51, respectively. The mean inter-item correlation between the items belonging to Factor 1 was 0.32, and it was 0.21 for the items belonging to Factor 2. Removing any of the items belonging to any of the factors would result in lower reliability estimates.

ASSOCIATIONS BETWEEN CONCEPTS OF LEARNING AND PREFERENCES FOR TEACHING

As a final step in the analysis, the associations between the scales resulting from the factor analyses were examined. When applying the two-factor solution to the «Conceptions of learning» measure, the two resulting scales were positively related to each other (r = 0.44, p < 0.001). In essence, this means that students who rated «Learning as reproducing knowledge» at a high level also rated «Learning as understanding» at a high level. The sum scores for the two factors derived from the «Preferences for teaching», tentatively labeled «Transmitting information» and «Supporting understanding», were unrelated to each other (r = -0.05, ns). Higher scores on the «Learning as understanding» factor was positively associated with stronger preference for the «Supporting understanding» type of course and teaching (r = 0.20, p < 0.05), but was unrelated to the «Transmitting information» type (r = 0.01, ns). Higher scores on the «Learning as reproducing knowledge» factor was positively associated with a stronger preference for both types of teaching: there was an association with the «Supporting understanding» type (r = 0.17, p < 0.05), as well as with the «Transmitting information» type (r = 0.18, p < 0.05).

When applying the one-factor solution to the «Conceptions of learning» measure (i.e., the sum score of all six items), the scale score showed a statistically significant positive association with the «Supporting understanding»

	Component matrix	
Items	Factor 1	Communalities
A4	**0.76**	0.57
A3	**0.73**	0.53
A5	**0.70**	0.49
A6	**0.61**	0.37
A2	**0.60**	0.36
A1	**0.42**	0.17
Eigenvalue	2.49	
Mean inter-item correlation	0.29	
Cronbach's alpha	0.70	
Explained variance	**41.5 %**	

Table 4
One-factor solution applied to the Norwegian version of the «Conceptions of learning»: factor loadings, communalities, Eigenvalue estimates, reliability estimates (mean inter-item correlation and Cronbach's alpha), and explained variance (n = 160).

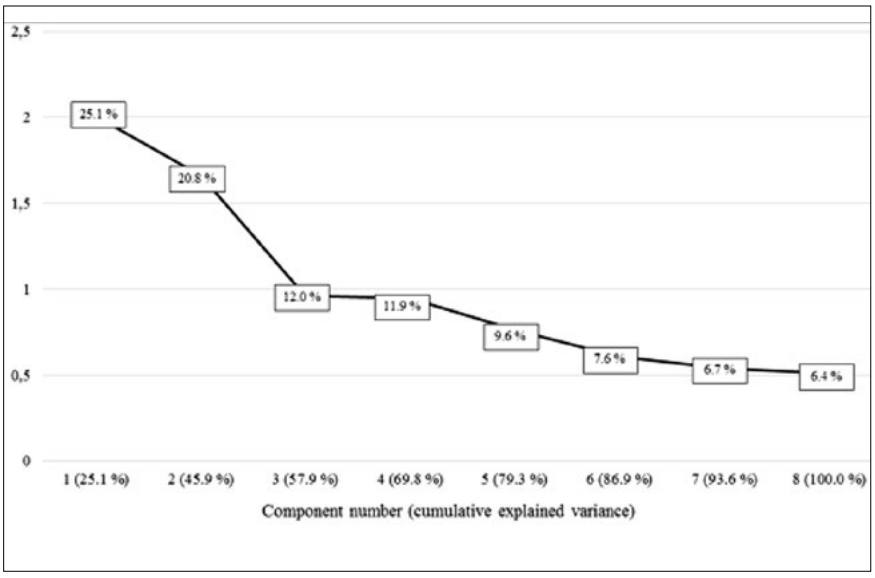

Figure 2. «Preferences for different types of courses and teaching»: Screen plot showing Eigenvalues for each component (vertical axis), explained variance for each component (indicated on the graph), and cumulative explained variance for the components (indicated on the horizontal axis).

	Pattern matrix		Structure matrix		
Variables	Factor 1	Factor 2	Factor 1	Factor 2	Communalities
C5	**0.77**	0.12	**0.77**	0.12	0.61
C8	**0.71**	0.05	**0.71**	0.05	0.50
C1	**0.66**	0.01	**0.66**	-0.19	0.47
C4	**0.66**	-0.19	**0.66**	0.01	0.43
C6	-0.09	**0.67**	-0.09	**0.67**	0.46
C7	-0.13	**0.66**	-0.13	**0.66**	0.46
C2	0.08	**0.62**	0.08	**0.62**	0.39
C3	0.13	**0.59**	0.13	**0.59**	0.36
Eigenvalue	2.01	1.66			
Mean inter-item correlation	0.32	0.21			
Cronbach's alpha	0.60	0.51			
Explained variance	25.1 %	20.8 %			
Total explained variance	**45.9 %**				

Table 5
Factor structure of the Norwegian version of the "Preferences for different types of courses and teaching": factor loadings, communalities, Eigenvalue estimates, reliability estimates (mean inter-item correlation and Cronbach's alpha), and variance explained by the factors (n = 160).
Note. Results derived from Principal Component Analysis with a forced two-factor solution, using Direct Oblimin rotation with Kaiser Normalization.

type of course and teaching (r = 0.23, p < 0.01), but was unrelated to the «Transmitting information» type (r = 0.08, ns).

Discussion

Using PCA in combination with scree plot assessment and Parallel Analysis, two different factor solutions for the «Conceptions of learning» were found to be applicable. The measure can be treated as consisting of two factors – «Learning as understanding» and «Learning as reproducing knowledge» – in line with the theory proposed by Entwistle and colleagues (2006). One of the statements loaded on both factors, but was retained within the theoretically proposed factor. However, a one-factor solution appears to be an alternative structure: it renders more of the variance in the data unexplained, but the items load strongly on the underlying factor and the internal consistency of the items is good. For the «Preferences for different types of courses and teaching», the two-factor solution was uniformly confirmed across the three methods of assessment. The two resulting factors can be labeled «Supporting understanding» and «Transmitting information», as suggested from the theory. The internal consistency estimate for «Supporting understanding» was in the lower range, and should therefore be treated with some caution.

THE «CONCEPTIONS OF LEARNING» MEASURE

With regard to the «Conceptions of learning» measure, the assessment of Eigenvalues supported the proposed two-factor solution, and a substantial proportion of the variance in the data was explained by these two factors. The factor loadings were largely in agreement with the proposed model, except for item A5, which loaded strongly on both factors (see Table 1 for item content and Table 3 for factor loadings). At first glance, this result looks rather puzzling, as the item is concerned with «understanding new material for yourself». This content would logically reflect a concept of «Learning as understanding» (Entwistle et al., 2006), as the central term (understanding) is included in the item itself. It is somewhat harder to see how this item may be connected to the other factor; namely «Learning as reproducing knowledge». Unfortunately, there appears currently

to be no other research that can serve as a point of comparison in this matter (Entwistle, 2016). However, one can assume that this aspect of learning, understanding new material for yourself, is important for all students regardless of how they conceive what «learning» is generally about. If this is the case, the split factor loadings found for this item becomes more understandable. Measures of internal consistency are known to vary with sample size and number of items (Ponterotto & Ruckdeschel, 2007; Streiner & Norman, 2008). In this study, a sufficient, yet relatively small sample was used in the analysis, and both of the resulting factors from the «Conceptions of leaning» measure included three items only. Thus, the only moderate Cronbach's alpha values for the scales (both scales alpha = 0.61; see Table 3) were as expected.

Alternatively, a one-factor structure of the «Conceptions of learning» measure was suggested from the Parallel Analysis. All items in the measure loaded strongly on this factor (loadings 0.42-0.76), and internal consistency was good (alpha = 0.70). Item A1, however, had

1) the lowest factor loading of the six items,
2) a notably lower mean score (3.88) than the other items, ranging from 4.23 (A2) to 4.48 (A3), and
3) the internal consistency of the items would increase (from 0.70 to 0.72) by removing item A1.

All of the above suggest that A1 is an aspect of a learning concept that is similar to, but does not entirely fit together with the content comprised by, the other five items. Considering the six items as indicators of one underlying factor, we may see them as indicators of «The significance of learning». Thus, if this measure is used with a one-factor solution, the sum of the six items – or alternatively, the sum of the five items, omitting item A1 – may use the label «The significance of learning».

THE «PREFERENCES FOR DIFFERENT TYPES OF COURSES AND TEACHING» MEASURE

With regard to the «Preferences for different types of courses and teaching», the assessment of Eigenvalues supported the proposed 2-factor solution, and a substantial proportion of the data variance was explained by these two factors (see Table 5). However, the inspection of the scree plot suggested that a third factor might be appropriate to include, as illustrated in Figure 2. The third factor had an associated Eigenvalue of 0.96, marginally below the threshold value, and accounted for 12.0 prosent additional explained variance in the data. However, in light of the theoretical dichotomy of teaching styles underpinning this measure (Entwistle et al., 2006), in addition to a conservative assessment of Eigenvalues, the proposed 2-factor structure was retained. The very strong loadings on the two proposed factors, all in accordance with theory, was another reason for retaining the established factor structure. Cronbach's alpha for the two factors, however, were moderate («transmitting information») to low («supporting understanding»; see Table 5), which is likely owing to the aspects previously described: a relatively small sample size in combination with few items belonging to the resulting scales.

ASSOCIATIONS BETWEEN CONCEPTS OF LEARNING AND PREFERENCES FOR TEACHING

There was a strong and statistically significant association between the two derived concepts of learning: «Learning as understanding» and «Learning as reproducing knowledge». This result appears to somewhat contradict the underlying theoretical assumptions (Entwistle et al., 2006), i.e., that students have more or less clearly differentiated ways of conceptualizing learning. Given the positive association between the two different conceptions of learning in the present sample, this assumption does not seem to be entirely valid. To an extent, the «split loadings» shown for item A5 (see Table 3) serves to illustrate this point. With regard to the students' «Preferences for different types of courses and teaching», on the other hand, there was no association between the two resulting factors. This result means that the students could prefer one of the teaching types without the other being affected – an indication of independence between these two preferences.

The associations found between the students' conceptions of learning and preferences for teaching were very interesting. Those with higher scores on the preferred learning concept, «learning as understanding», also preferred courses and teaching that were «supporting understanding». Those with higher scores on the less preferred learning concept, «learning as reproducing knowledge», preferred both types of courses and teaching. Thus, there was a clearer preference for a certain type of courses and teaching among those who largely conceptualized learning as

gaining a personalized understanding of the study materials. The students who were more inclined to conceptualize learning as reproducing facts preferred both types of courses and teaching; essentially meaning that they had no clear preference with regard to the types of courses and teaching that would serve them best, or that they liked best. These results indicate a more differentiated evaluation of courses and teaching among those who tend to think of learning as understanding. On the other hand, those who tend to think of learning as reproducing knowledge appear to be less discriminating, and tend to seek a wider variety of types of courses and teaching.

Using the one-factor solution for the «Conceptions of learning», the sum score of the six items together was significantly associated with the teaching type «Supporting understanding», but not with the teaching type «Transmitting information». Using the tentative label «The significance of learning» for the learning concept sum score, this indicates that students making more learning efforts across different ways of conceptualizing learning have a preference for a «deep» type of teaching and assessment that supports the efforts they make in order to understand the study materials. This may be seen as somewhat extending the theorizing by Entwistle and coworkers (Entwistle et al., 2006): conceptualizing learning as understanding is logically related to a preference for teaching aimed at supporting understanding. However, a higher level of study efforts in general, be it oriented towards understanding or reproducing, similarly seems to be related to a preference for the «deep» teaching type oriented towards «supporting understanding». Thus, it appears the students who put in more effort, and who aim towards a better understanding, are more discriminating with regard to how the curriculum is taught and organized, compared to their counterparts.

IMPLICATIONS

This study implies that the proposed factor structure of the «Conceptions of learning» and «Preferences for different types of courses and teaching» measures are appropriate to use. However, an alternative one-factor solution may be applied to the «Conceptions of learning» measure, depending on the purpose of its use. If the one-factor solution is preferred, the resulting scale may be labeled «The significance of learning», and a score can be obtained by summing the six relevant items. A five-item scale, omitting item A1, may also be explored for this purpose. As the resulting scales consist of very few items, scale consistency was found to be moderate, and in the lower range particularly for the «Teaching as supporting understanding» scale. The resulting scales are short and easy to administer, and they may prove useful for obtaining a quick glimpse into the students' learning concepts and their preferences for types of courses and teaching. However, the scales' potential usefulness and applicability in occupational therapy education settings are questions to be explored in future research.

The associations between the students' conceptions of learning and their preferences for teaching may have more direct applications for educational practice in occupational therapy. Students who tended to see learning as reproducing knowledge, and thus had less ability to discriminate between different types of teaching, may benefit from examining their learning conception in view of the targeted learning objectives across the curriculum. If learning objectives are directed towards reflection and discussion, reproducing facts may be insufficient to meet the standards. In such cases, students may need to reconsider their views on what learning is, and also the types of input and support they seek from their teachers and mentors. Teachers may need to take an active role in this process. On the other hand, students who tended to see learning as understanding appeared to have a clearer opinion concerning what teachers and mentors can do to support their learning. Thus, these students may benefit from having opportunities to discuss the teaching methodology with those who provide it. By doing so, they may influence the teacher's mode of teaching, and thereby influence their own learning process in a positive direction.

METHODOLOGICAL CONSIDERATIONS

The study is limited by a relatively small sample. Generally, large samples are better than small ones (Pedhazur & Schmelkin, 1991), but there is no agreement as to what constitutes a large sample. Some authors (e.g., Comrey, 1978) have proposed that samples consisting of more than 200 participants may be characterized as large. Nunnally (1978), on the other hand, suggested that there should be at least ten times as many participants as variables.

The present sample consisted of 160 participants and PCA was applied on six and eight variables, respectively, and was thus deemed appropriate.

In addition, the sample was one of convenience, recruited from one higher education institution only, and consisting of students from only one university. These are all factors that may limit the generalizability of the study results. The moderate to low measures of internal consistency indicate that scale scores should be used with some caution, in particular for the «Supporting understanding» scale.

Factor analysis constitutes a highly serviceable approach to studying the internal structure of a set of indicators (Pedhazur & Schmelkin, 1991). In this study, PCA was employed as the method of dimension reduction. Although it may be argued that PCA and factor analysis constitute somewhat different techniques, they do share basic similarities. According to Guadagnoli and Velicer (1988), PCA is indeed a psychometrically sound technique and its solutions tend to differ little from those generated from other factor-analytic approaches.

CONCLUSION

The two ASSIST measures examined in this study – the «Conceptions of learning» and the «Preferences for different types of courses and teaching» – were each found to consist of two latent factors, as suggested from theory. However, an alternative one-factor solution appeared also to be applicable for the «Conceptions of learning» measure. Based on data from this sample of occupational therapy students, conceptions of learning can be meaningfully differentiated into a deep concept (learning as understanding) and a surface concept (learning as reproducing knowledge), or – if using the one-factor solution – it can be used as a way of measuring «the significance of learning» across a range of aspects. The preferences for courses and teaching can be meaningfully differentiated into teaching as «supporting understanding» and as «transmitting information». The resulting scales may prove useful for occupational therapy educators who want a quick guide to their students' ways of conceptualizing learning, and to the ways by which they perceive different types of courses, teaching, and related aspects of the curriculum.

ACKNOWLEDGEMENTS

The authors thank Assistant Professor Brian Ellingham at Oslo and Akershus University College of Applied Sciences for his proofreading of the manuscript.

References

Baeten, M., Kyndt, E., Struyven, K., & Dochy, F. (2010). Using student-centered learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness. *Educational Research Review*, 5(3), 243-260. doi:http://dx.doi.org/10.1016/j.edurev.2010.06.001

Ballantine, J. A., Duff, A., & Larres, P. M. (2008). Accounting and business students' approaches to learning: A longitudinal study. *Journal of Accounting Education,* 26(4), 188-201. doi:10.1016/j.jaccedu.2009.03.001

Bartlett, M. S. (1954). A note on multiplying factors for various chi square approximations. *Journal of the Royal Statistical Society,* 16(2), 296-298.

Bonsaksen, T., Kvarsnes, H., & Dahl, M. (2016). Who wants to go to occupational therapy school? Characteristics of Norwegian occupational therapy students. *Scandinavian Journal of Occupational Therapy,* 23(4), 297-303. doi:10.3109/11038128.2015.1105293

Bonsaksen, T., Thørrisen, M. M., & Sadeghi, T. (2017). Occupational therapy students in Norway: Do their approaches to studying vary by year in the program? (in press). *Open Journal of Occupational Therapy*.

Brodersen, L. D. (2007). *Approaches to studying and study tactics of baccalaureate nursing students* (Doctoral thesis). United States: University of Northern Iowa, IA.

Brown, T., Fong, K., Bonsaksen, T., Tan, H. L., Murdolo, Y., Cruz-Gonzales, P., & Lim, H.B. (2016). Approaches to learning among occupational therapy undergraduate students: A cross-cultural study (early online). *Scandinavian Journal of Occupational Therapy,* doi: 10.1080/11038128.2016.1229811

Brown, T., & Murdolo, Y. (2016). Approaches to study across four year-levels of undergraduate occupational therapy students: Similar or different? *British Journal of Occupational Therapy,* (early online). doi:10.1177/0308022616662482

Byrne, M., Flood, B., & Willis, P. (2004). Validation of the approaches and study skills inventory for students (ASSIST) using accounting students in USA and Ireland: A research note. *Accounting Education,* 13(4), 449-459. doi:10.1080/0963928042000306792

Diseth, Å. (2001). Validation of Norwegian version of the Approaches and Study Skills Inventory for Students (ASSIST): Application of structural equation modelling. *Scandinavian Journal of Educational Research*, 45(4), 381-394. doi:10.1080/0031380120096789

Diseth, Å., & Martinsen, Ø. (2003). Approaches to learning, cognitive style, and motives as predictors of academic achievement. *Educational Psychology,* 23(2), 195-207. doi: 10.1080/01443410303225

English, L., Luckett, P., & Mladenovic, R. (2004). Encouraging a deep approach to learning through curriculum design. *Accounting Education,* 13(4), 461-488. doi:10.1080/0963928042000306828

Entwistle, N. (1998). Motivation and approaches to learning. In S. Brown,

G. Thompson, & S. Armstrong (Eds.), *Motivating Students* (pp. 15-24). London: Routledge.
Entwistle, N. (2016). Personal e-mail correspondence, 29. september 2016.
Entwistle, N. & McCune, V. (2004). The conceptual base of study strategy inventories. *Educational Psychology Review*, 16(4), 325-345. doi: 10.1007/s10648-004-0003-0
Entwistle, N., McCune, V., & Tait, H. (2006). ASSIST: *Approaches and Study Skills Inventory for Students.* Edinburgh: University of Edinburgh.
Entwistle, N., & Ramsden, P. (1983). *Understanding student learning*. London: Croom Helm.
Entwistle, N., & Tait, H. (1990). Approaches to learning, evaluations of teaching and preferences for contrasting academic environments. *Higher Education*, 19(2), 169-194.
Entwistle, N., Tait, H., & McCune, V. (2000). Patterns of response to an approaches to studying inventory across contrasting groups and contexts. *European Journal of Psychology of Education,* 15(1), 33-48. doi:10.1007/bf03173165
Guadagnoli, E., & Velicer, W. F. (1988). Relation to sample size to the stability of component patterns. *Psychological Bulletin*, 102(2), 265-275. doi:10.1037/0033-2909.103.2.265
Hall, M., Ramsay, A., & Raven, J. (2004). Changing the learning environment to promote deep learning approaches in first-year accounting students. *Accounting Education,* 13(4), 489-505. doi:10.1080/0963928042000306837
Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30(2), 179-185. doi:10.1007/BF02289447
IBM Corporation. (2015). SPSS for Windows, version 23. Armonk, NY: IBM Corp.
Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31-36. doi:10.1007/BF02291817
Kielhofner, G. (2006). *Research in occupational therapy: Methods of inquiry for enhancing practice.* Philadelphia, PE: F. A. Davis Company.
Kreber, C. (2003). The Relationship between Students' Course Perception and their Approaches to Studying in Undergraduate Science Courses: A Canadian experience. *Higher Education Research & Development*, 22(1), 57-75. doi:10.1080/0729436032000058623
Lizzio, A., Wilson, K., & Simons, R. (2002). University Students' Perceptions of the Learning Environment and Academic Outcomes: Implications for theory and practice. *Studies in Higher Education*, 27(1), 27-52. doi:10.1080/03075070120099359
May, W., Chung, E.K., Elliot, D., & Fisher, D. (2012). The relationship between medical students' learning approaches and performance on summative high-stakes clinical performance examination. *Medical Teacher,* 34(4), 236-241. doi:10.3109/0142159X.2012.652995
Pettersen, R. (2010). Validation of Approaches to Studying Inventories in a Norwegian Context: In Search of "Quick-and Easy" and Short Versions of the ASI. *Scandinavian Journal of Educational Research*, 54(3), 239-261. doi: 10.1080/00313831003764511
Ponterotto, J. G., & Ruckdeschel, D. (2007). An overview of coefficient alpha and a reliability matrix for estimating adequacy of internal consistency coefficients with psychological research measures. *Perceptual and Motor Skills*, 105(3 Part I), 997-1014. doi:10.2466/pms.105.3.997-1014
Ramsden, P. (1991). A performance indicator of teaching quality in higher education: The Course Experience Questionnaire. *Studies in Higher Education*, 16(2), 129-150. doi:10.1080/03075079112331382944
Richardson, J. T. E. (2010). Perceived Academic Quality and Approaches to Studying in Higher Education: Evidence from Danish Students of Occupational Therapy. *Scandinavian Journal of Educational Research*, 54(2), 189-203. doi:10.1080/00313831003637972
Richardson, J. T. E. (2013). Approaches to studying across the adult life span: Evidence from distance education. *Learning and Individual Differences,* 26(4), 74–80. doi:10.1016/j.lindif.2013.04.012
Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin,* 138(2), 353-387. doi:10.1037/a0026838
Sadlo, G., & Richardson, J. T. E. (2003). Approaches to Studying and Perceptions of the Academic Environment in Students Following Problem-Based and Subject-Based Curricula. *Higher Education Research & Development,* 22(3), 253-274. doi:10.1080/0729436032000145130
Salamonson, Y., Weaver, R., Chang, S., Koch, J., Bhathal, R., Khoo, C., & Wilson, I. (2013). Learning approaches as predictors of academic performance in first year health and science students. *Nurse Education Today*, 33(7), 729-733. doi:10.1016/j.nedt.2013.01.013
Streiner, D. L., & Norman, G. R. (2008). *Health measurement scales - a practical guide to their development and use* (4 ed.). Oxford: Oxford University Press.
Subasinghe, S. D. L. P., & Wanniachchi, D. N. (2009). Approach to learning and the academic performance of a group of medical students – any correlation? *Student Medical Journal*, 3(1), 5-10.
Sun, H., & Richardson, J. T. E. (2016). Students' perceptions of the academic environment and approaches to studying in British postgraduate business education. *Assessment & Evaluation in Higher Education*, 41(3), 384-399. doi:10.1080/02602938.2015.1017755
Tait, H., Entwistle, N. J., & McCune, V. (1998). ASSIST: a reconceptualisation of the Approaches to Studying Inventory. In C. Rust (Ed.), *Improving students as learners*. Oxford: Oxford Brookes University.
Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Education,* 37(1), 57-70. doi:10.1023/A:1003548313194
Ward, P. J. (2011). Influence of study approaches on academic outcomes during pre-clinical medical education. *Medical Teacher,* 33(12), e651-e662. doi:10.3109/0142159X.2011.610843
Zwick, W.R., & Velicer, W.F. (1986). Comparison of five rules for determining the number of components to retain. *Psychological Bulletin*, 99(3), 432-442. doi: 10.1037/0033-2909.99.3.432