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Occupational Therapy students' Concepts of Learning: Cross-Sectional and Longitudinal Associations With Deep, Strategic, and Surface Study Approaches

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ABSTRACT

This study aimed to gain knowledge about the cross-sectional and longitudinal associations between learning concepts and approaches to studying among occupational therapy students. A repeated cross-sectional design was combined with a longitudinal study design. Self-report questionnaires assessed sociodemographic variables, learning concepts, and approaches to studying (deep/strategic/surface). Linear regression analyses (*n* ranging between 109 and 193 in the analyses) showed that higher transforming concept ratings were consistently associated with higher ratings on the deep study approach, both cross-sectionally and longitudinally. Higher reproducing concept ratings were positively associated with higher strategic approach ratings in the second and third study years. In view of the results, students' understanding of what learning is impacts on their study attitudes and behaviors, which in turn is likely to influence learning outcomes and academic performance.

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Introduction

In higher education, the pursuit of optimal learning strategies continues to serve as an essential framework for attaining academic success and developing professional expertise (Hattie & Anderman, 2013; Vrugt & Oort, 2008). Attaining these objectives has significance for students across disciplines, including medicine (Aboregela et al., 2023; Hayat et al., 2020),

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physical therapy and occupational therapy (İlçin et al., 2018; Pucillo & Perez, 2023). For students in the health professions, the integration of academic understanding, practical abilities, and patient-centered care, demands a comprehensive approach to learning (Hodgetts et al., 2007; Turesson & Lindh Falk, 2023). Furthermore, the way students in these fields interact with educational ideas is crucial, not only for their educational progression, but also for the development and upkeep of competent and well-informed healthcare practitioners (Eichler & Keptner, 2023; Jones et al., 2023).

The 3P model developed by Biggs (1993) offers a comprehensive framework for understanding and enhancing the quality of learning in higher education. The model comprises three interrelated components: presage, which incorporates the learner's context, prior knowledge, and personal traits; process, which focuses on the learning activities and approaches adopted by the student; and product, which includes the assessment of learning outcomes (Biggs, 1993; Kanashiro et al., 2020). Prior studies have emphasized the significance of process factors, in particular students' learning approaches, for their ability to absorb, retain, and apply knowledge (Weinstein & Underwood, 2014). According to several authors, these approaches have been classified into three more or less distinct types (Entwistle, 2001; Gow & Kember, 1990; Zeegers, 2001). The deep approach to learning is distinguished by a deep level of engagement with the subject matter, including critical thinking, developing a personalized understanding, and the capacity to establish connections between new material and pre-existing knowledge (Biggs et al., 2001; Zeegers, 2001). On the other hand, the surface approach is characterized by rote memorization devoid of genuine understanding (Biggs et al., 2001; Howie & Bagnall, 2013). The strategic study approach occupies an intermediate position, incorporating several learning strategies that may be based on combinations of deep and surface approach behaviors, depending on the nature of the study materials. The strategic approach is characterized by well-developed organization and time management, with the aim of optimizing learning results (Kember, 1996; Kember et al., 1999). However, the three study approaches are not to be considered as entirely distinct from each other, as students often use a combination of attitudes and actions associated with different approaches (Entwistle, 2007).

As motivation generally denotes the individual's incentive for action—'the why behind the what'—it also drives and shapes study behaviors among students. Consistent with this view, study approaches have been linked with different types of learning motivation. For example, Entwistle found that students who were motivated by achievement exhibited stable personality traits such as self-confidence and determination (Entwistle, 2001). The presence of intrinsic motivation was shown to be associated with a

higher degree of autonomy and ability to think independently, which are aspects of the deep study approach. Conversely, being motivated by a fear of failure, an aspect of the surface study approach, was found to be associated with feelings of anxiety and a sense of restriction within the study program. Furthermore, students' approaches to studying were influenced by their educational and personal backgrounds (Entwistle, 2001; Liew et al. 2015; Trigwell et al., 2013). Nevertheless, the nature and context of the task also elicit tactics that are unique to that specific scenario. As suggested by several studies, descriptions of student learning should have a certain level of consistency, but also allow for some degree of variability across disciplines (Goss, 2022; Parpala et al., 2022).

In the context of occupational therapy education, several studies have investigated the study approaches adopted by students (Brown et al., 2017; Brown & Murdolo, 2016; Chapman et al., 2006; Gramstad et al., 2020; Mørk, Gramstad, et al., 2024; Richardson et al., 2005; Watson et al., 2006), and how these approaches are differently related to learning environment factors (Mørk et al., 2020; Mørk, et al., 2023; Sadlo & Richardson, 2003) and academic success (Bonsaksen et al., 2017; Bonsaksen et al., 2021; Mygland et al., 2023).

Students' adoption of study approaches takes place in the context of their specific education program and is therefore influenced by the curriculum organization and teaching strategies employed (Mørk et al., 2023). Hooper and coworkers found that occupational therapy programs have developed strategies at two curriculum levels, namely infrastructure and implementation, to assist the learning of professional knowledge among students. This refers to the way the profession is taught and learned (Hooper, 2010; Hooper et al., 2018). However, Hooper has also shown that the profession of occupational therapy can remain hidden and implied in traditional teaching-learning contexts (Hooper et al., 2020), which highlights the importance of effective teaching-learning strategies for students' integration of profession-specific knowledge and skills.

Fewer studies, however, have focused on the students' learning concepts—their understanding of what learning is (Bonsaksen, 2018; Eklund-Myrskog, 1998; Entwistle & Peterson, 2004; Vermunt & Vermetten, 2004)—as a possible precursor for their approach to studying. For example, understanding learning as transforming taught materials may be consistent with emphasizing personal involvement and meaning construction in learning, whereas understanding learning as reproducing knowledge would be consistent with Entwistle et al., 2013; Tait et al., 1998), memorization.

During the early development of the comprehensive *Approaches and Study Skills Inventory for Students* (relationships were revealed between the transforming learning concept, a preference for teaching that supports understanding, and the deep study approach (Entwistle, 2018). Conversely,

the reproducing learning concept was found to be related to a preference for teaching that transmits information, and to the surface study approach. Recent studies have only partially supported these results. One recent study with students from the USA found that higher ratings on the transforming learning concept were related to higher deep study approach ratings, whereas higher ratings on both the transforming and reproducing learning concepts were related to higher strategic approach ratings (Bonsaksen & Breen-Franklin, 2020). A prior investigation involving Norwegian students demonstrated that the components related to the transforming and reproducing learning concepts were more accurately interpreted as representing a unidimensional construct. Furthermore, it was found that higher ratings on the unidimensional scale were positively correlated with higher scores on the deep and strategic study approaches, while showing no association with ratings on the surface approach (Carstensen et al., 2018). In combination, the few available studies suggest that the relationships between students' learning concepts and their approaches to studying are under-researched, and that the underlying factor structure of learning concept assessments should be carefully considered (Bonsaksen & Breen-Franklin, 2020; Bonsaksen & Thørrisen, 2017).

In general, Korman's theory of self-consistency would suggest that behaviors are relatively harmonized with one's self-perceptions (Korman, 2012; Wu et al., 2018). That is, a person's view of who and what he is shapes his actions in the world. Similarly, changes in self-perceptions may lead to changes in behavior. For example, a study of employees using time-lagged data showed that workplace gossip led to changes in the employees' self-esteem, in turn leading to changes in their behaviors toward the organization and other employees (Wu et al., 2018). Applied to the current study, one would therefore assume that students' study behaviors are largely in sync with their views on learning. In general terms, we would hypothesize that students with higher ratings on 'learning as transforming' would have higher deep approach ratings. Conversely, students with higher ratings on 'learning as reproducing' would have higher surface approach ratings.

For a comprehensive understanding of the interplay between learning concepts and the study approaches adopted by university students throughout their curriculum, consideration of the temporal dimension is required (Atkinson & Steward, 1997; Björklund & Svensson, 2006). Therefore, repeated cross-sectional analyses and, in particular, longitudinal studies are relevant for expanding the preliminary knowledge obtained from previous cross-sectional studies conducted at a single point in time (Bonsaksen & Breen-Franklin, 2023; Carstensen et al., 2018). The suggested study designs allow for the examination of study approaches and their relationships with learning concepts over an extended duration, exploring their evolutionary dynamics. As students' progress through their education

program, they may modify and enhance their learning strategies in response to novel obstacles and challenges (Mørk et al., 2024; Postareff et al., 2018; Ramsden, 1983). Factors of importance for students' approaches to studying, such as their learning concepts, may become more or less influential over time. Those with a consistent ability to predict study approaches on several occasions (cross-sectionally) and/or across time (longitudinally), may be considered particularly important for determining students' approaches to studying. Thus, the aim of this study was to gain knowledge about the cross-sectional and longitudinal associations between learning concepts and approaches to studying among occupational therapy students.

Methods and materials

Design

The study combined a repeated cross-sectional design with a longitudinal study design. The repeated cross-sectional design requires the selection of diverse individuals at multiple time points to investigate group-level changes over time, or track changes in associations between variables over time (Pan, 2021). Conversely, a longitudinal study design tracks the same individuals over time to analyze their individual pathways and changes (Schober & Vetter, 2018). Student surveys were conducted annually during the three-year study program. All programs were at the undergraduate (i.e. bachelor's degree) level. The data were collected between December 2017 and February 2018 (first year data), between December 2018 and February 2019 (second year data) and between December 2019 and February 2020 (third year data). Repeated cross-sectional analyses were conducted, with learning concepts being correlated with study approaches within each of the three study years. In addition, longitudinal analyses were used to assess whether learning concepts in the first study year were related to study approach measures in the second and third study year.

Sample

Occupational therapy students were sampled from each of the six education institutions providing this education program in Norway. An overview of similarities and differences between the occupational therapy curricula in these institutions has been provided elsewhere (Gramstad et al., 2020). All students who were enrolled in one of the occupational therapy education programs in the fall of 2017 were eligible for participation in the study. There were no exclusion criteria, and students were invited to participate in each study year, regardless of whether they had participated in the previous year.

All students were informed that participation was voluntary and that they could opt not to participate or withdraw their consent to participate at any time without stating a reason, and without any consequences. All information was treated as confidential, and no individuals can be identified from the published results of the study. The Norwegian Center for Research Data (national data protection agency) approved the study (October 12, 2017, project no. 55875).

In total, 263 students participated in the study by responding to the survey one or more times throughout their time in the three-year study program. To be included in this study's analyses, valid scores on the relevant variables was required. As a result, the sample sizes included in the analyses varied between 178 in the first year (58.4% of those eligible for participation), 163 in the second year (53.4% of those eligible for participation), and 191 (62.6% of those eligible for participation) in the third study year. A loss of participants was found in the longitudinal analyses, as these analyses required participants to have complete data at two time points (i.e. year 1 and year 2, or year 1 and year 3).

The characteristics of the participants included in each of the three study years are shown in Table 1. The mean age and the gender proportions were similar across the three study years, while the time spent on independent studying was somewhat lower among those participating in the third year. Descriptively, scores on the learning concept measures were relatively similar across study years, yet there were increased deep approach scores and reduced surface approach scores across time (averaged within study years).

Table 1. Characteristics of the sample in the first, second and third study years.

Variables	Study years		
	1 st study year (<i>n</i> = 178)	2 nd year (<i>n</i> = 163)	3 rd year (<i>n</i> = 191)
<i>Sociodemographic variables</i>	M (SD)	M (SD)	M (SD)
Age at enrollment (years)	22.9 (4.7)	22.3 (4.0)	22.7 (4.5)
Time spent on independent study (hours)	9.4 (7.1)	9.1 (6.8)	8.4 (6.7)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Female gender	142 (79.8)	131 (80.4)	147 (77.0)
Priority line of study	111 (62.4)	102 (62.6)	126 (66.0)
Prior higher education	78 (43.8)	64 (39.3)	78 (40.8)
<i>Learning concepts</i>	M (SD)	M (SD)	M (SD)
Learning as transforming	8.4 (1.2)	8.5 (1.2)	8.6 (1.2)
Learning as reproducing	8.5 (0.9)	8.4 (1.0)	8.3 (1.0)
<i>Approaches to studying</i>	M (SD)	M (SD)	M (SD)
Deep approach	56.7 (8.7)	57.3 (7.7)	57.5 (7.9)
Strategic approach	72.1 (10.2)	72.2 (9.7)	72.0 (9.1)
Surface approach	47.3 (9.2)	45.0 (8.5)	44.7 (9.6)

Note. Table content is mean and standard deviations for continuous variables, and frequency and proportions for categorical variables.

Measures

Background variables

As part of the questionnaire being used, data were collected on age (in years), gender (male or female), time spent on independent studying (average number of hours during a typical week), educational priority (whether occupational therapy was the first priority choice of education at the time of enrollment, or not), and prior higher education experience (whether one had prior experience from higher education at the time of enrollment, or not).

Conceptions of learning and approaches to studying

In this study, the *Approaches to studying* scales and the *Conceptions of learning* scales, both taken from the *Approaches and Study Skills Inventory for Students* (Entwistle et al., 2013; Tait et al., 1998), were used. The *Conceptions of learning* measure consists of six statements representing two different learning concepts. Three statements relate to an instrumental approach to learning, reflecting a conception of learning as reproducing knowledge, while three other statements relate to personal involvement and meaning construction, reflecting a conception of learning as transforming. Students were 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.

Previous factor-analytic studies have revealed problems with cross-loadings in the *Conceptions of learning* measure (i.e. items loading substantially on both scales), and in response, researchers have suggested (Bonsaksen & Thørrisen, 2017) and used a one-factor solution (Carstensen et al., 2018) or have removed problematic items from the scales (Bonsaksen & Breen-Franklin, 2020; Bonsaksen & Breen-Franklin, 2023). Therefore, for this study, we conducted an exploratory Principal Components Analysis (PCA) with Oblimin rotation to ensure that the employed *Conceptions of learning* scales had a factor structure that was aligned with our intended use. We found that among the six items, one item (#5) cross-loaded and another (#4) was considered to be an ambiguous indicator of the learning as reproducing concept, as theoretically proposed (Entwistle et al., 2013; Tait et al., 1998). After removal of these two problematic items, the remaining four items were considered theoretically aligned with the proposed underlying concepts, as also demonstrated by their factor loadings. The two components (learning as transforming and learning as reproducing) accounted for 61.1% of the data variance. An overview of the items and scales is displayed in Table 2. The internal consistencies of the ‘conceptions of learning’ scales were assessed with mean inter-item correlations, as only

Table 2. The *Conceptions of learning* measure used with the first-year sample: Items, factor loadings, and scales.

When you think about the term 'learning', what does it mean to you?	Factor 1	Factor 2	Scale
2. Developing as a person	0.83	-0.05	Learning as transforming
6. Seeing things in a different and more meaningful way	0.82	0.16	
3. Building up knowledge by acquiring facts and information	0.05	0.76	Learning as reproducing
1. Making sure you remember things well	0.05	0.70	

Note. Factor loadings are extracted from the structure matrix.

two items were included on each scale (Ponterotto & Ruckdeschel, 2007; Streiner, 2003). Normally, mean inter-item correlation coefficients of 0.20 or higher is required to indicate substantial consistency between items (Briggs & Cheek, 1986). The 'learning as transforming' scale showed a mean inter-item correlation of 0.34 in all of the three study years, while the corresponding coefficient for the 'learning as reproducing' scale ranged between 0.07 and 0.09 during the three years.

Approaches to Studying denote types of attitudes, motives, and behaviors that students can have, and the deep, strategic and surface approaches were measured using the *Approaches and Study Skills Inventory for Students* (ASSIST; Entwistle et al., 2013; Tait et al., 1998) in a previously validated Norwegian translation (Diseth, 2001). There are 52 statements in the instrument, and the respondent rates his or her level of agreement to each of them (1 = disagree, 2 = disagree somewhat, 3 = unsure, 4 = agree somewhat, 5 = agree). Example statements are: "When I'm reading an article or book, I try to find out for myself exactly what the author means" (deep approach); "I organize my study time carefully to make the best use of it" (strategic approach); and "I often have trouble in making sense of the things I have to remember" (surface approach).

In the current sample of occupational therapy students, the theoretically proposed three-factor structure was confirmed (DaLomba et al., 2020), as it also was in a previous cross-cultural study of undergraduate occupational therapy students (Bonsaksen et al., 2019). Three main scales were used, representing the deep (16 items), strategic (20 items), and surface (16 items) approaches to studying. Scale scores were calculated by adding scores on the items belonging to the scale. The internal consistency (Cronbach's coefficient α) between the deep approach scale items was 0.71, 0.79, and 0.81 in the first, second, and third study year, respectively. The corresponding coefficients for the strategic approach scale items were 0.84, 0.74 and 0.79, and for the surface approach scale items 0.76, 0.77, and 0.81, indicating good reliability of the study approach scales.

Data analysis

The data were analyzed with the SPSS software, version 26 (IBM Corporation, 2019). Missing data were handled with case-wise deletion (analysis by analysis). Continuous data were analyzed descriptively with means and standard deviations, while categorical data were examined with frequencies and percentages. Associations with ratings on the study approach variables were examined with linear regression analysis. For each study year, separate analyses were performed using each of the three study approach variables as dependent variables. Independent variables were entered in two subsequent blocks: 1) sociodemographic control variables (age, gender, time spent on independent study during the relevant year, priority line of education, and prior higher education experience); and 2) the scales measuring learning as transforming and learning as reproducing, as measured in the first study year.

In the longitudinal analyses, we explored whether learning concepts in the first study year were associated with study approach ratings in the subsequent study years. Thus, separate analyses were conducted for study years two and three, using each of the study approach measures in study years two and three as dependent variables. Independent variables were entered in two blocks: 1) sociodemographic control variables (age, gender, average time on independent study during a typical week, priority line of study, and prior higher education experience); and 2) the transforming and reproducing learning concepts as measured in the first study year.

Effect sizes related to the associations were reported as standardized beta weights (β), interpreted in line with Cohen (1992): β about 0.10 is small effect, about 0.30 is medium effect, and about 0.50 is large effect. The multiple r^2 was reported as a measure of the amount of variance in the dependent variables accounted for by the independent variables in each of the models. Statistical significance was set at $p < 0.05$.

Assumptions underpinning linear regressions were assessed prior to analysis. Linear relationships between the learning concepts and each of the three study approach scales were assessed and confirmed by visually inspecting the scatterplots. Multicollinearity was assessed with the variance inflation factor (VIF), and across analyses, all VIFs fell at or below 1.16, well below the standard threshold of 5. Autocorrelation was assessed with the Durbin-Watson statistic, which was about the ideal value of 2 across analyses, ranging between 1.85 and 2.16. In most cases, the standardized residuals fell within the recommended [-3, 3] interval (Field, 2013), with the exception of two analyses where greater variability was shown. Based on visual inspection of the P-P plots, the regression slopes were found to fit the data well across the spectrum of scores (homoscedasticity). The scatterplots of the predicted values plotted against the standardized

residuals approximated a normal distribution of residuals, with no patterns revealed.

Results

Cross-sectional associations between learning concepts and approaches to studying

All reported results from the regression analyses are adjusted by the students' age, gender, time on independent study, educational priority, and prior experience from higher education. The results from the within-year analyses are displayed in Table 3. In the first study year ($n=178$), higher scores on transforming concept were related to higher scores on the deep ($\beta=0.37$, $p<0.001$) and strategic approaches to studying ($\beta=0.16$, $p<0.05$). Scores on the reproducing concept were not significantly related to any approach measure. In the second study year ($n=162$), higher scores on transforming learning concept were related to higher scores on the deep approach ($\beta=0.33$, $p<0.001$), whereas higher scores on reproducing learning concept were associated with higher scores on the strategic approach to studying ($\beta=0.22$, $p<0.01$). In the third study year ($n=193$), higher scores on transforming concept were related to higher scores on the deep approach ($\beta=0.35$, $p<0.001$), higher scores on the strategic approach

Table 3. Cross-sectional associations with study approach scores in the first, second and third study years.

Variables	1 st study year ($n=178$)			2 nd study year ($n=162$)			3 rd study year ($n=193$)		
	Deep	Strategic	Surface	Deep	Strategic	Surface	Deep	Strategic	Surface
<i>Sociodemographic variables</i>									
Age at enrollment	0.09	-0.01	-0.12	0.14	-0.08	-0.19*	0.23**	-0.08	-0.13
Female gender	-0.07	0.20**	0.05	-0.06	0.15	0.09	-0.04	0.10	0.01
Time spent on independent study	0.03	0.20**	0.10	0.12	0.26**	0.02	0.13	0.18*	0.07
Priority line of study	0.05	0.10	-0.19*	0.00	-0.01	-0.15	-0.01	0.08	-0.19**
Prior higher education	0.14	0.03	-0.07	0.14	0.05	0.03	0.09	-0.02	-0.03
Explained variance	5.9%	9.2%**	7.8%*	11.3%**	11.0%**	6.3%	15.8%***	7.2%*	6.9%*
<i>Learning concepts</i>									
Transforming	0.37***	0.16*	-0.13	0.33***	0.10	-0.09	0.35***	0.17*	-0.17*
Reproducing	0.10	0.13	0.03	0.09	0.22**	0.14	0.02	0.21**	-0.06
R ² change	15.2%***	4.2%*	1.7%	11.9%***	6.7%**	2.2%	11.6%***	7.6%***	3.3%*
Explained variance	21.1%***	13.4%***	9.5%*	23.2%***	17.7%***	8.5%	27.5%***	14.8%***	10.1%***

Note. Table content is standardized beta weights adjusted for all included variables.

* $p<0.05$.

** $p<0.01$.

*** $p<0.001$.

($\beta=0.17$, $p<0.05$), and with lower scores on the surface approach scale ($\beta=-0.17$, $p<0.05$). Higher scores on reproducing concept were associated with higher scores on the strategic approach to studying ($\beta=0.21$, $p<0.01$).

In the different study years, the learning concept variables accounted for 11.6%-15.2% of the variance in deep approach ratings, 4.2%-7.6% of the variance in strategic approach ratings, and 1.7%-3.3% of the variance in surface approach ratings.

Longitudinal associations between learning concepts and approaches to studying

Table 4 displays the results from the longitudinal associations between scores on the learning concepts in the first study year and the students' approaches to studying in the second ($n=109$) and third ($n=123$) years of study, respectively. Higher first-year ratings on transforming concept were associated with higher ratings on the deep approach to studying, both in the second year ($\beta=0.27$, $p<0.01$) and in the third year ($\beta=0.27$, $p<0.01$). Higher first-year ratings on reproducing concept were related to higher ratings on the strategic study approach in the third study year ($\beta=0.23$, $p<0.01$). No other associations with first-year learning concepts were statistically significant.

In the different study years, the learning concept variables accounted for 7.7%-9.9% of the variance in deep approach ratings, 4.6%-7.1% of the variance in strategic approach ratings, and 1.3%-3.2% of the variance in surface approach ratings.

Table 4. Longitudinal associations between first-year learning concepts and subsequent study approach scores.

Variables	2 nd study year ($n=109$)			3 rd study year ($n=123$)		
	Deep	Strategic	Surface	Deep	Strategic	Surface
<i>Sociodemographic variables</i>						
Age at enrollment	0.13	-0.09	-0.12	0.21*	-0.11	-0.12
Female gender	0.05	0.14	0.07	0.06	0.11	0.03
Time spent on independent study	0.12	0.18	0.02	0.14	0.20*	0.04
Priority line of study	-0.05	-0.05	-0.21*	-0.07	0.04	-0.14
Prior higher education	0.20*	0.12	-0.01	0.18*	-0.00	-0.05
Explained variance	10.3%*	8.4%	6.9%	11.5%*	8.4%	4.4%
<i>Learning concepts</i>						
Transforming	0.31**	0.18	-0.16	0.27**	0.12	-0.10
Reproducing	0.06	0.11	0.11	0.04	0.23**	-0.05
R ² change	9.9%**	4.6%	3.2%	7.7%**	7.1%*	1.3%
Explained variance	20.2%**	13.0%*	10.2%***	19.3%**	15.5%**	5.7%

Note. Table content is standardized beta weights adjusted for all included variables.

* $p<0.05$.

** $p<0.01$.

*** $p<0.001$.

Discussion

The purpose of this study was to acquire understanding about the cross-sectional and longitudinal associations between learning concepts and approaches to studying among occupational therapy students. The cross-sectional analyses showed significant and positive correlations between the transforming learning concept and a deep approach to studying, which remained throughout all study years. This is well aligned with self-consistency theory (Korman, 2012), suggesting that one's view of what learning is, and the view of oneself as a learner, plays a significant role in determining one's study behaviors. In more practical terms, and with implications for teaching and student supervision, the result also highlights the role of promoting a transforming learning concept among students to facilitate their adoption of deep learning strategies. However, as noted in several recent studies, a deep approach to studying is no guarantee for being rewarded with good grades—in and of itself, a deep study approach may be unrelated to grades (Herrmann et al., 2017) or even related to poorer grades (Bonsaksen & Breen-Franklin 2020)

While we found that the transforming concept ratings were significantly and positively related to strategic approach ratings in two of the study years, the same associations were found for the reproducing learning concept. In view of the many studies pointing to the strategic approach as one route to good academic outcomes (Bonsaksen et al., 2021; Breen-Franklin & Bonsaksen et al., 2021; Diseth & Martinsen, 2003; Mygland et al., 2023; Ward, 2011), it is intriguing to note that both types of learning concepts seem to contribute to determining students' strategic approach levels. Apparently, supporting students in their efforts to use the strategic study approach and thereby succeed academically might include their adoption of a multi-faceted learning concept (Bonsaksen & Thørrisen, 2017), comprising elements of personal growth but also of systematically adding to, and maintaining access to, one's knowledge base. During the first year of study, there was no statistically significant correlation between the reproducing concept and the strategic study approach. Nevertheless, when students advanced through the second and third years of their studies, a correlation between the reproducing concept and the strategic approach became evident, indicating that students undergo a process of adaptation such that their strategic study approach is gradually more aligned with a reproducing learning concept. In a similar vein, the results derived from the longitudinal analyses also showed that the associations between the students' reproducing learning concept and their study approaches evolved as the students progressed with their studies. This exemplifies the fluidity of students' approaches to learning as they evolve over time (Asikainen & Gijbels, 2017). However, while evolving associations with study approaches were found for the reproducing learning concept,

the transforming learning concept's association with study approaches was very consistent, both cross-sectionally and longitudinally.

The longitudinal analysis demonstrated that higher initial ratings on the transforming concept during the first year were indicative of subsequent higher ratings on the deep study approach in both the second and third years. This highlights the enduring impact of students' early transforming learning concept on their inclination to use the deep study approach during the later stages of their studies. It appears that students who have a transforming learning concept at the outset of their academic pathway are more inclined to sustain a deep approach to their studies throughout their educational pursuits, suggesting a substantial degree of stability in the relationship between the transforming learning concept and the deep approach to studying. While we are unaware of directly comparable studies, earlier studies from the same research project found that associations between learning environment factors and study approaches varied across time (Mørk et al., 2020; Mørk et al., 2023). One interpretation may be that, while associations between perceived environmental factors and own study behaviors may fluctuate over time, associations between entirely individual phenomena, such as learning concepts and study approaches, exhibit a greater degree of stability. Stable associations between self-perceptions and behaviors would be in line with self-consistency theory (Korman, 2012), proposing that people tend to model their behaviors on how they see themselves.

Limitations

The study has several limitations. First, participants self-selected to participate in the study. Hence, it is possible that a selection bias exists and that the sample is not an accurate representation of the whole population, which would affect the results. Moreover, there is a potential for reporting bias, since participants may provide answers that are biased or incomplete. In particular, the longitudinal analyses performed in this study required complete data on at least two assessments (i.e. assessments 1 and 2, or assessments 1 and 3), which resulted in a loss of participants in these analyses. The exclusion of participants with missing data is a potential source of bias (van Ginkel et al., 2020). We also note that the participants in each of the longitudinal analyses were (partly) different from the participants in the other. Thus, several participants contributed to the data underpinning both analyses, whereas others contributed data to one of them only, suggesting that the design is 'pseudo-longitudinal'. Moreover, the use of repeated cross-sectional data with some participants, but not all, being assessed more than once, may preferably be labeled an 'unbalanced design' with inherent problems with autocorrelation (Lebo & Weber, 2015), and where missing data can be difficult to correct by modern imputation methods (Honaker & King, 2010).

Specifically, we checked for sample bias by examining any differences between participants included in longitudinal analyses and participants included in cross-sectional analyses only. While no significant sociodemographic differences were found, participants who were included in one or both longitudinal analyses had higher ratings on the strategic approach scale in the first (Cohen's $d=0.38$, $p=0.02$) and second study year ($d=0.28$, $p=0.04$), while they had lower ratings on the surface approach scale in the third study year ($d=0.35$, $p=0.02$). Thus, students with more productive study behaviors were somewhat more inclined to participate in the annual surveys in a consistent manner, as also shown in a previous study (DaLomba et al., 2021). We acknowledge the missing data problems inherent in these designs, and the problems in assessing the ways they may have impacted on the study results.

The learning concept scales were composed by only two items each and differed from the scales used in previous studies (Bonsaksen & Breen-Franklin, 2020; Bonsaksen & Breen-Franklin, 2023; Bonsaksen & Thørrisen, 2017), indicating that comparisons between studies should be made with caution. Indeed, while the items constituting the 'learning as transforming' scale loaded substantially on the common latent factor and were quite strongly intrinsically related, the items constituting the 'learning as reproducing' scale were only weakly related to each other. However, the items were connected by their strong relationship to the common latent factor. Nonetheless, the low internal consistency measures need to be considered in the interpretation of results pertaining to this scale. Finally, the limited sample of participants, consisting only of undergraduate students from one country, also limit the generalizability of the findings.

Implications to education

The study highlights the significance of adaptability in learning approaches, especially in studies conducted over an extended period. A thorough comprehension of how concepts of learning correspond to various study styles may help guide the development of curricula, teaching methods and evaluation procedures. By fostering efficient study habits, students can enhance their academic performance and overall learning experience. This entails fostering critical thinking, integrating multidisciplinary knowledge, and supporting active learning techniques. Clear learning objectives, a variety of teaching strategies, and the promotion of self-regulated learning should all be included in instruction.

Based on the results of this study, it appears that faculty in the occupational therapy programs should not restrict teaching content to the disciplinary and professional knowledge and skills required for sound practice. Rather, given that student learning is largely contingent on the students' own efforts, it seems that teaching should also explicitly address the students' own process of learning. This study suggests that students' understanding of

‘what learning is’ has direct bearings on their study behaviors, in the present and also in the future. Thus, addressing this question openly with the students in any appropriate forum may open up new possibilities for students’ adoption of productive study behaviors and improved learning outcomes. Finally, assessment of students’ study methods, constructive criticism in line with learning goals, and long-term support to track development and provide remedial guidance should all be part of the assessment process. Occupational therapy programs can better prepare students for professional practice and foster good learning habits by putting these ideas into practice.

Conclusion

The results of the study underscore the diversity and intricacy of the relationships between learning concepts and study approaches among undergraduate occupational therapy students in Norway. While the relationship between a transforming learning concept and the deep study approach was very consistent over time, the relationship between the reproducing concept and the strategic approach appeared to evolve during the study process.

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