

2020

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Recommended Citation

Bonsaksen, T., & Breen-Franklin, A. (2020). An Evaluation of the Factor Structure and Internal Consistency of the 'Conceptions of Learning' and 'Preferences for Teaching' Measures in American Occupational Therapy Students. *Journal of Occupational Therapy Education*, 4 (1). Retrieved from <https://encompass.eku.edu/jote/vol4/iss1/4>

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Abstract

When planning to use measurement scales in new samples and contexts, examining the scales' psychometric properties is an important initial step. This study examined the factor structure and internal consistency of two measures that are part of the *Approaches and Study Skills Inventory for Students (ASSIST)* – the *Conceptions of learning* and *Preferences for teaching and courses* – in a sample of American occupational therapy students. The students ($n = 115$) completed the measures and provided basic sociodemographic information. Scale structure was examined with Principal Components Analysis (PCA), while consistency between scale items was assessed with mean inter-item correlations. For the *Conceptions of learning* measure, one item was removed due to cross-loading between factors. The subsequent analysis revealed two factors, representing deep and surface conceptions of learning, on which the items – with one exception – loaded in line with theory. For the *Preferences for teaching and courses* measure, two factors were found, representing preferences denoted in theory as supporting understanding and transmitting information, respectively. The items showed good fit with the two theoretically proposed factors. The scales' mean inter-item correlations were satisfactory, ranging 0.27-0.36. One item on the *Conceptions of learning* measure appears to be problematic due to cross-loading, and another may be interpreted in a different way than originally proposed. After removing the problematic item, all scales showed satisfactory psychometric properties for assessing conceptions of learning and preferences for teaching.

Keywords

Factor analysis, higher education, occupational therapy, psychometrics, scale reliability, students

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Acknowledgements

The authors would like to express their gratitude to the students who volunteered to participate in the study.

**An Evaluation of the Factor Structure and Internal Consistency of the
'Conceptions of Learning' and 'Preferences for Teaching' Measures
in American Occupational Therapy Students**

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ABSTRACT

When planning to use measurement scales in new samples and contexts, examining the scales' psychometric properties is an important initial step. This study examined the factor structure and internal consistency of two measures that are part of the *Approaches and Study Skills Inventory for Students (ASSIST)* – the *Conceptions of learning* and *Preferences for teaching and courses* – in a sample of American occupational therapy students. The students ($n = 115$) completed the measures and provided basic sociodemographic information. Scale structure was examined with Principal Components Analysis (PCA), while consistency between scale items was assessed with mean inter-item correlations. For the *Conceptions of learning* measure, one item was removed due to cross-loading between factors. The subsequent analysis revealed two factors, representing deep and surface conceptions of learning, on which the items – with one exception – loaded in line with theory. For the *Preferences for teaching and courses* measure, two factors were found, representing preferences denoted in theory as supporting understanding and transmitting information, respectively. The items showed good fit with the two theoretically proposed factors. The scales' mean inter-item correlations were satisfactory, ranging 0.27-0.36. One item on the *Conceptions of learning* measure appears to be problematic due to cross-loading, and another may be interpreted in a different way than originally proposed. After removing the problematic item, all scales showed satisfactory psychometric properties for assessing conceptions of learning and preferences for teaching.

INTRODUCTION

Student learning in higher education is affected by a multitude of factors. While the quality of teaching is an important influence (Entwistle, 2018; Kreber, 2007), there seems to be general agreement that the students' own study behaviors are equally important for their learning – if not more important. What students do when they study, and how they go about doing it, is often referred to as their approach to studying. In Richardson's (2013) words, approaches to studying denote students' general orientation towards learning in academic situations, and these broad orientations have been categorized into three types: the deep, surface, and strategic approaches (Entwistle & Ramsden, 1983). Studying with a deep approach, the student aims at challenging and enhancing his or her personal understanding, by connecting the ideas introduced in lectures and in the study materials. On the other hand, studying with a surface approach the student aims at passing exams while making as little effort as possible. The strategic approach comprises time management and organizational behaviors and attitudes, while the aim is largely competitive and oriented towards achievement: the strategic student aims at the best possible grade, and organizes his or her study behaviors accordingly.

Approaches to studying, often measured with the *Approaches and Study Skills Inventory for Students* (ASSIST; Tait, Entwistle, & McCune, 1998), have been found to be associated with academic outcomes among students. Ample research suggests that the deep and strategic approaches are related to better learning outcomes and exam grades, whereas worse outcomes are associated with surface approach behaviors (Diseth & Martinsen, 2003; May, Chung, Elliot, & Fisher, 2012; Richardson, Abraham, & Bond, 2012; Salamonson et al., 2013; Subasinghe & Wanniachchi, 2009; Ward, 2011). Consequently, teachers and educators have been encouraged to adapt their teaching, courses, and assessments. As a result, a range of different educational adaptations aiming to increase productive study behaviors have been developed and evaluated (Ballantine, Duff, & Larres, 2008; English, Lockett, & Mladenovic, 2004; Hall, Ramsay, & Raven, 2004). Specifically, a study of occupational therapy students found that using problem-based learning was associated with higher deep approach scores and lower surface approach scores (Sadlo & Richardson, 2003). The interpretation of the study was that occupational therapy students' learning may improve by emphasizing teaching methodologies that require the students' own activity and engagement.

However, while teaching and the broader learning environment influence student behaviors and subsequent learning outcomes, the students' own views on and attitudes toward learning and teaching may also be of importance. While recognizing the impact of the learning environment, Richardson (2011) noted that it does not adequately explain variations in students' approaches to studying and pointed towards the students' own conceptualizations of learning. This idea is in line with the assumptions underpinning the ASSIST instrument (Tait et al., 1998), and studies have found support for associating students' conceptualization of learning with their actual study behaviors (Dart et al., 2000; Van Rossum & Schenk, 1984). More recently, a study of occupational therapy students in Norway demonstrated that higher scores on a more broadly composed learning concept, encompassing indicators of the deep and surface views of

learning merged into one concept, were positively associated with both of the deep and strategic approaches to studying (Carstensen, Ødegaard, & Bonsaksen, 2018). Moreover, this study also found that a preference for courses and teaching oriented towards supporting understanding was associated with higher deep and strategic approach scores, while a preference for courses and teaching oriented towards transmitting information was associated with higher surface approach scores. In combination, and in line with theory (Entwistle, 1998; Entwistle & Tait, 1990; Tait et al., 1998), the research suggests a relatively consistent pattern of associations between students' conceptualizations of learning, their study approaches, and their preferences for teaching.

Part II of the ASSIST, the approaches to studying measure, has been extensively investigated in terms of measurement properties, and the deep, strategic, and surface dimensions have been well established across a range of settings (e.g., Bonsaksen et al., 2019; Byrne, Flood, & Willis, 2004; Diseth & Martinsen, 2003; Entwistle, Tait, & McCune, 2000; Kreber, 2003). However, the 'Conceptions of learning' and 'Preferences for teaching' measures, representing Parts I and III of the ASSIST, have been far less investigated (Bonsaksen & Thørrisen, 2017; Entwistle, personal communication, September 29, 2016). These parts of the ASSIST have only rarely been employed with occupational therapy students (Bonsaksen, 2018a, 2018b; Brown & Murdolo, 2016; Carstensen et al., 2018), and to our knowledge, never in the context of American occupational therapy education. Thus, the validity and reliability of the instrument in this context is not known. Before starting to use the instrument in research with American students, one should examine its measurement properties within the new context of American students at the master's and doctoral degree level.

Study Aim

The study aimed to assess the factor structure and internal consistency of two measures (Parts I and III of the ASSIST) used to assess conceptions of learning and preferences for teaching and courses in a sample of American occupational therapy students.

METHODS

Design and Study Context

A cross-sectional survey on learning and related aspects was conducted in an occupational therapy education program at a private university in Philadelphia, Pennsylvania. The data were collected in November-December 2018.

Recruitment and Participants

Students were invited to participate in the study provided they were enrolled in the relevant occupational therapy education program, and 120 students gave their informed consent to participate. The students were master's and doctoral level students, representing first year professional students ($n = 61$, 50.8%) and second year professional students ($n = 59$, 49.2%). Of the 120 participants, 115 had valid scores on all employed variables in the current study, and these constituted the study sample.

Five students had missing values on one or more of the employed variables, and were therefore excluded from the analysis. Twenty-three students (20.0%) were aged 18-21 years; 76 students (66.1%) were aged 22-25 years, 13 students (11.3%) were aged 26-30 years, and three students (2.6%) were aged 31-35 years. There was a vast predominance of female students ($n = 106$, 92.2%) compared to male ($n = 9$, 7.8%).

Measures

In this study, the *Conceptions of learning* and *Preferences for teaching* measures, constituting Parts I and III of the ASSIST, were used (Entwistle, McCune, & Tait, 2006; Tait et al., 1998). The learning concept measure consists of six statements representing different conceptualizations of learning. Three statements relate to an instrumental approach to learning, reflecting a conception of learning as reproducing knowledge (items 1, 3 and 4; see Table 1). Three other statements relate to personal involvement and meaning construction, reflecting a conception of learning as understanding and personal development (items 2, 5 and 6; see Table 1). 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. Table 1 displays the item statements.

Table 1

Items of the 'Conceptions of learning' Measure

When you think about the term 'LEARNING', what does it mean to you? Consider each of these statements carefully, and rate them in terms of how close they are to your own way of thinking about it.

Item	Item statement
1	Making sure you remember things well
2	Developing as a person
3	Building up knowledge by acquiring facts and information
4	Being able to use the information you've acquired
5	Understanding new material for yourself
6	Seeing things in a new and more meaningful way

Note. Each item is rated 1-5, indicating very close (5), quite close (4), not so close (3), rather different (2), and very different (1).

The teaching preferences measure 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 (items 2, 3, 6 and 7), whereas four other statements reflect preference for teaching oriented towards transmitting information (items 1, 4, 5 and 8). 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'. Table 2 displays the item statements.

Table 2

Items of the 'Preferences for Teaching and Courses' Measure

Please indicate how you like or dislike the following:

Item	Item statement
1	Lecturers who tell us exactly what to put down in our notes
2	Lecturers who encourage us to think for ourselves and show us how they themselves think
3	Exams which allow me to show that I've thought about the course material for myself
4	Exams or tests which need only the material provided in our lecture notes
5	Courses in which it's made very clear just which books we have to read
6	Courses where we're encouraged to read around the subject a lot for ourselves
7	Books which challenge you and provide explanations which go beyond the lectures
8	Books which give you definite facts and information which can easily be learned

Note. Each item is rated 1-5, indicating definitely like (5), like to some extent (4), unsure (3), dislike to some extent (2), and definitely dislike (1).

A Norwegian version of the two scales, as developed by Diseth (2001), was examined in a previous factor-analytic study (Bonsaksen & Thørrisen, 2017). The analysis of the *conceptions* measure questioned the theoretically proposed two-factor solution, and suggested that a one-factor solution might be preferred. Moreover, one item showed split loadings; i.e., it loaded on both of the extracted factors. On the other hand, the *preferences* measure demonstrated a clear two-factor structure with no split loadings (Bonsaksen & Thørrisen, 2017).

Data Analysis

All data were entered into and analyzed with the computer program IBM SPSS version 24 (IBM Corporation, 2016). With the purpose of assessing latent factors in the measures, exploratory Principal Component Analysis (PCA) was used. 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). Factor extraction was determined by Kaiser's criterion, stating that factors with eigenvalues (λ) larger than 1 should be extracted, in combination with visual inspection of the scree-plots. Moreover, each factor should account for at least 10% of the data variance. As the factors were expected to be interrelated, the Direct Oblimin rotation method was used in order to obtain a clearer structure matrix.

The six statements in the *conceptions* measure 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, a two-factor solution would be expected. Similarly, the eight statements in the *preferences* measure are proposed to reflect two types of preferences: four statements indicating a preference for teaching as 'supporting understanding', and four other statements indicating a preference for teaching as 'transmitting information'. Thus, theory would suggest a two-factor solution. In addition to eigenvalues, 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, and high loadings on more than one factor was considered cross-loading.

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 as an indicator of scale consistency (Ponterotto & Ruckdeschel, 2007; Streiner & Norman, 2008). However, scales with very few items may be unable to produce satisfactory α 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). Thus, the internal consistency of the scales detected from the PCA was examined with mean inter-item correlation coefficients.

Ethics

The Institutional Review Board at the University of the Sciences, Philadelphia, approved of the study being conducted and gave it 'exempt' status. The participants were informed that completing and returning the questionnaires was voluntary; that confidentiality would be maintained throughout the project; that participation in the study was voluntary; and that there would be no negative consequences from opting not to participate in the study. No person-identifying information was collected; thus, the anonymity of the participants was ensured.

RESULTS

The Conceptions of Learning Measure

When conducting the exploratory PCA, the KMO value was 0.70 and Bartlett's test of sphericity was statistically significant ($p < 0.001$), indicating that the data were appropriate for factor analysis. Two factors had eigenvalues above the threshold level of 1, and both factors accounted for more than 10% of the data variance. Together, the two extracted factors explained 57.4% of the total data variance. The items' communalities, provided the extraction of two factors, were between 0.49 (item # 4) and 0.63 (item # 3). Table 3 displays the factor structure resulting from the initial PCA, with factor loadings sorted by size. Most items loaded on the two factors in line with theory. However, item # 4 loaded on Factor 1 (deep concept), in contrast to theory. In addition, item # 5 cross-loaded with high loadings on both factors.

Table 3

Initial Factor Structure of the 'Conceptions of Learning' Measure (n = 115)

Item #	Factor 1 (deep concept)	Factor 2 (surface concept)	Communalities
6	0.78	0.06	0.61
2	0.71	-0.10	0.54
4	0.70	0.19	0.49
5	0.67	0.47	0.60
3	0.17	0.79	0.63
1	0.03	0.75	0.57
Eigenvalue	2.18	1.27	
Explained variance	36.3%	21.1%	
Total explained variance	57.4%		

Note. Results derived from exploratory Principal Component Analysis, using Direct Oblimin rotation with Kaiser Normalization. Factor loadings are taken from the structure matrix. Loadings > 0.40 are in **bold** type.

Following the initial analysis, we decided to remove the cross-loading item #5, while retaining item # 4. Repeating the PCA with item # 5 removed, the KMO value (0.62) was somewhat reduced. Bartlett's test of sphericity was statistically significant ($p < 0.001$). Two factors had eigenvalues exceeding 1, both factors accounted for more than 10% of the data variance, and the factors together explained 60.2% of the total data variance. The items' communalities were between 0.56 (item # 4) and 0.63 (items # 1 and # 3). Table 4 displays the items' factor structure, with factor loadings sorted by size. Again, item # 4 loaded on Factor 1 (deep concept), in contrast to theory. Otherwise, all items loaded on the factors in line with theory. The mean inter-item correlations were 0.36 for the items on Factor 1 (deep concept), and 0.27 for the items on Factor 2 (surface concept). The two factors correlated 0.09, essentially indicating no association.

Table 4

Factor Structure of the Modified 'Conceptions of Learning' Measure (n = 115)

Item #	Factor 1 (deep concept)	Factor 2 (surface concept)	Communalities
6	0.78	0.06	0.61
2	0.75	-0.06	0.58
4	0.73	0.24	0.56
3	0.13	0.79	0.63
1	0.02	0.79	0.63
Eigenvalue	1.76	1.25	
Mean inter-item correlations	0.36	0.27	
Explained variance	35.2%	25.0%	
Total explained variance	60.2%		

Note. Results derived from exploratory Principal Component Analysis, using Direct Oblimin rotation with Kaiser Normalization. Factor loadings are taken from the structure matrix. Loadings > 0.40 are in **bold** type.

The Preferences for Teaching and Courses Measure

When conducting the PCA with the *preferences* measure, the KMO value was 0.70 and Bartlett's test of sphericity was statistically significant ($p < 0.001$). Two factors had eigenvalues exceeding 1, both factors accounted for more than 10% of the data variance, and 51.5% of the total data variance was explained by the factors together. The items' communalities were between 0.32 (item # 3) and 0.70 (item # 7). Table 5 displays the items' factor structure, with factor loadings sorted by size. No cross-loading between factors emerged, and all items loaded on the two factors in line with theory. The mean inter-item correlations were 0.33 for the items on Factor 1 (preference towards teaching that supports understanding), and 0.35 for the items on Factor 2 (preference towards teaching that transmits information). The two factors correlated 0.33, indicating a moderate association.

Table 5

Factor Structure of the 'Preferences for Teaching and Courses' Measure (n = 115)

Item #	Factor 1 (Supporting understanding)	Factor 2 (Transmitting information)	Communalities
7	-0.84	-0.26	0.70
6	-0.76	-0.14	0.59
2	-0.62	-0.33	0.40
3	-0.56	-0.26	0.32
5	0.10	0.80	0.68
1	0.37	0.73	0.55
4	0.38	0.66	0.46
8	0.22	0.65	0.42
Eigenvalue	2.78	1.34	
Mean inter-item correlations	0.33	0.35	
Explained variance	34.8%	16.7%	
Total explained variance	51.5%		

Note. Results derived from exploratory Principal Component Analysis, using Direct Oblimin rotation with Kaiser Normalization. Factor loadings are taken from the structure matrix. Loadings > 0.40 are in **bold** type.

DISCUSSION

The study aimed to investigate the factor structure and internal consistency of two measures (Parts I and III of the ASSIST) – related to conceptions of learning, and preferences for teaching and courses – when employed with a sample of American occupational therapy students. After the removal of one cross-loading item, the *concept* measure functioned largely in line with the theoretical assumptions. Notably, however, one item showed factor loadings directly in contrast to theory. For the *preferences* measure, all items functioned as expected. Measures of internal consistency for all resulting scales were satisfactory.

The Learning Conceptions Scales

With the publication of the ASSIST, the *Conceptions* measure was presented as 'underdeveloped' (Tait et al., 1998), which has been reiterated in later studies (Brown & Murdolo, 2016). Nonetheless, in view of Richardson's comments (2011) and evidence of associations between learning concepts and approaches to studying (Carstensen et al., 2018), we believe this measure's properties and value for understanding more about student behaviors in higher education should be explored in research. Item # 5, which was found to cross-load between the two extracted factors, cross-loaded between factors also in the recent study with Norwegian occupational therapy students (Bonsaksen & Thørrisen, 2017). Although the item was retained in the Norwegian study, the consistency between the findings suggest that the item is problematic. The problem might relate to its content, as arriving at 'new understanding' may be considered an appropriate learning outcome for all students, regardless of their views on what learning is. Alternatively, the ending of the phrase 'for yourself' may constitute problems. While some students might interpret this part of the phrase as significant to the meaning of the full sentence, other might not – or they might be unsure about its meaning. When removing item #5 from the measure, the communalities of the items somewhat increased, as did the proportion of the variance accounted for by the two extracted factors (see Tables 3 and 4). Thus, removing this item improved the measure in several respects.

In both analyses, item # 4 loaded on the deep concept scale, in contrast to theory (Tait et al., 1998). The surface learning concept was originally described as an instrumental view of learning, considering it a means to achieve other ends. In contrast, the deep learning concept was described as a process of broadening and enhancing one's personal understanding. In line with the ideas expressed in the Structured Observation of Learning Outcomes (SOLO; Biggs & Tang, 2007), however, the unexpected loading may make sense. According to the SOLO taxonomy, using knowledge (application) requires the ability to relate concepts to each other, as well as to generalize them such that they can become applicable to new areas. Therefore, item # 4 ('Being able to use the information you've acquired') can be viewed as indicating a conception of learning that is compatible with the advanced stages of the SOLO structure. Taking into consideration that the American students were students at the master's and doctoral levels, their level of maturity may indicate that they were prone to associate application of knowledge with a deep learning concept, and with items reflecting 'developing as a person' (item # 2) and 'seeing things in a new and more meaningful way' (item # 6).

The Preferences for Teaching Scales

For the *Preferences* measure, no items cross-loaded and all items loaded on the scales as expected from theory and prior research (Bonsaksen & Thørrisen, 2017; Entwistle et al., 2000; Tait et al., 1998). Thus, the results for these scales are easily interpretable. The study provides further evidence that the scales have good psychometric properties and may be used to assess preferences for teaching and courses among American postgraduate occupational therapy students. In due time, and following the lines from previous research (Carstensen et al., 2018; Entwistle et al., 2000), further research with American students may combine the three aspects of the ASSIST in exploring

associations between learning concepts, preferences for teaching and courses, and students' own approaches to studying. Future studies may also explore the extent to which the learning conceptions, preferences for teaching, and study approaches change during the course of a study program.

Study Limitations

The study employed a relatively small convenience sample from one university only. With regards to the sample size, a ten-to-one ratio between participants and items are generally suggested for multivariate analyses (Nunnally, 1978). In the current study, the ratio exceeded this recommendation. On the other hand, the convenience sampling, and the sampling of participants from one university only, constitute limitations concerned with the ability to generalize the study results. To obtain a factor structure free from cross-loading items, one item was removed from the *Conceptions* measure. In addition, another item loaded not as expected from theory (Entwistle et al., 2000; Entwistle et al., 2006; Tait et al., 1998) and previous research (Bonsaksen & Thørrisen, 2017). These modifications related to the *Conceptions* scales constitute challenges with comparing the findings with previous results, and indicate that careful interpretation of the results is required.

The extracted factors accounted for modest proportions (51.5% - 60.2%) of the data variance. This indicates that substantial aspects of the instrument items are not captured by the latent variables. Although it is preferred to be able to explain more of the variance with the extracted factors, factor analysis always involves a trade-off between reducing the number of variables (i.e., when extracting factors based on the items) and seeking to explain the variations in the data with the retained factors (Field, 2009). With regard to the internal consistency of the scales, the mean correlations between the scale items exceeded the commonly applied threshold value of 0.20 (Briggs & Cheek, 1986), but were in the lower range (Field, 2009). Thus, the internal consistency of the scales may be unstable.

Over 85% of the sample was under the age of 25 years, and more than 90% were women. The restricted demographic composition of the sample limits the external validity of the study. A 'social desirability bias' may have affected the results (Bowling, 2009), in spite of collecting data anonymously from students. This would be the case if the participants responded in ways that they believed were desirable, or compliant with relevant norms. However, the extent to which this was a reality is not known.

CONCLUSION

This study aimed to examine the factor structure and internal consistency of two measures taken from the ASSIST; namely the *Conceptions of learning* and the *Preferences for courses and teaching*. The structure of the *Conceptions* measure improved after the removal of one problematic item, and one item loaded unexpectedly. Otherwise, the resulting scales functioned as theoretically proposed and with satisfactory internal consistency between items. In conclusion, the scales appear to be relevant for assessing conceptions of learning and preferences for courses and teaching among American occupational therapy students. In an education context, they

may be used as a reflection exercise to start a discussion between students and educators about their understanding of what learning and teaching entail. They may also be used to modify or verify students' expectations related to what will happen during an educational course, and what will be expected of students as well as educators. In future research, particularly with reference to the American context, studies may investigate the degree to which learning conceptions and preferences for teaching are associated with students' approaches to studying and subsequent outcomes. Longitudinal studies are needed to examine how students change in these respects or remain stable across time.

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