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The Academic Motivation Scale: Dimensionality, Reliability, and Construct Validity Among Vocational Students

Britt Karin Støen Utvær

Norwegian University of Science and Technology, Norway
(britt.karin.utvar@plu.ntnu.no)

Gørill Haugan

Norwegian University of Science and Technology, Norway

Abstract

Self-determination theory (SDT) distinguishes types of motivation according to types of self-regulation along a continuum of internalisation. Types of motivation vary in quality and outcomes and are frequently used in research as predictors of educational outcomes such as learning, performance, engagement, and persistence. The Academic Motivation Scale (AMS), which is based on the SDT, has not previously been evaluated in Norway. In response, by using correlation and confirmatory factor analysis, we examined the dimensionality, reliability, and construct validity of the AMS among vocational health and social care students. Our hypothesised 7-factor model demonstrated the best fit, while the AMS demonstrated good reliability and construct validity in the sample of students. However, some improvements remain necessary. In predicting the rate of school completion among students on vocational tracks, amotivation and identified regulation appeared to be more powerful as intrinsic motivational variables.

Keywords: self-determination theory, academic motivation scale, confirmatory factor analysis, vocational students, school completion

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Introduction

Of the challenges that vocational programmes in upper secondary schools face, a low rate of completion by students ranks among the most significant. In Norway, 25% of vocational students drop out of school within 5 years, whereas 58% complete their education and thereby achieving general study competence or a trade certificate of apprenticeship;[1] the remainder of students are still in school or have not passed their final examinations (Statistics Norway, 2016). Such a low rate of completion affects the lives of individuals as well as society in general, which greatly needs skilled workers with trade certificates of apprenticeship (Ministry of Education, 2012). At the same time, the problem also concerns the health and social care sector. Whereas thousands of new workers will be needed in healthcare during the coming decades, less than a quarter of students who enrol in health education at the upper secondary level are projected to achieve vocational qualifications (Ministry of Education, 2013). In particular, vocational programmes struggle to sustain the motivation of students, who find only minor relevance and meaning in learning both common core and vocational subjects (Dahlback, Hansen, Haaland & Sylte, 2011; Hiim, 2013), possibly due to their lack of identification with and interest in those subjects (Dahlback et al., 2011; Samdal & Smith, 2012). In response, identifying ways to foster and maintain students' interest and identification is thought to promote the relevance and meaning of subjects among students and thereby prevent their dropout.

Now a measure to promote such identification, relevance, and meaning among students (Dahlback et al., 2011; Ministry of Education, 2011; Wendelborg, Røe & Martinsen, 2014), a so-called vocational orientation in all subjects encompasses the subject matter, teaching methods, and vocabulary used in teaching different subjects, all of which should be made as relevant as possible to the profession an individual pursues (Ministry of Education, 2008). Vocationally oriented teaching aims to reduce student dropout by enhancing students' interest in and identification with both vocational and common core subjects (Hansen & Haaland, 2015; Wendelborg et al., 2014). To differentiate types of motivation instead of the overall amount of motivation, the Academic Motivation Scale (AMS) is a valuable instrument whose measurement distinguishes motivation originating in actual interest and identification from motivation originating in external control. Since the AMS therefore assesses issues crucial to motivation and dropout, this study sought to evaluate the dimensionality, reliability, and construct validity of the AMS among vocational students in Norway.

Types of motivation

The AMS is based on self-determination theory (SDT), a human motivation theory concentrating on individuals' motivation-related qualities and motives regulating their behaviour. More specifically, SDT focuses on how personal motives are integrated and regulated within the self, which can be made autonomous and highly functioning by way of sound regulation processes represented by autonomous types of motivation. However, because the interaction of an individual, his or her environment, and the current context are never ending, SDT focuses in particular on how the self internalises ideas, values, goals, and intentions under the influence of numerous embedded social contexts (Deci & Ryan, 2014).

In SDT, ways of conceiving internalisation and types of regulation have shifted, primarily from a differentiation of the intrinsic from the extrinsic motivation to one of autonomous from controlled motivation. Whereas external and introjected regulations are relatively controlled types of motivation, identified, integrated, and intrinsic regulations are autonomous types. Autonomous motivation is considered to be high-quality motivation, whereas controlled motivation is thought to be of low quality (Deci & Ryan, 2000, 2008). Figure 1 presents an overview of the internalisation continuum, along with the various types of motivation.

<table>
<tr><td>Amotivation</td><td colspan="4">Extrinsic motivation</td><td>Intrinsic motivation</td></tr>
<tr><td>Non Regulation</td><td>External Regulation</td><td>Introjected Regulation</td><td>Identified Regulation</td><td>Integrated Regulation</td><td>Intrinsic Regulation</td></tr>
<tr><td>Least self-determinated</td><td colspan="4">←→</td><td>Most self-determinated</td></tr>
<tr><td>Amotivation = lack of motivation</td><td colspan="2">Controlled motivation = low-quality motivation</td><td colspan="3">Autonomous motivation = high-quality motivation</td></tr>
</table>

Figure 1. The types of motivation and regulation within SDT.
Source: Adapted from Deci and Ryan (2008), and Ryan and Deci (2009).

Different types of motivation are understood as different ways in which a person regulates his or her driving forces: from being externally motivated to becoming internally and eventually autonomously driven to perform certain behaviours. SDT highlights types of motivation, or regulation, in terms other than by quantity, level, or amount, as well as differentiates types of behavioural regulation in terms of the degree to which they represent autonomous versus controlled functioning (Figure 1). Intrinsic motivation is the prototype of

autonomous motivation, whereas extrinsically motivated activity is often more controlled (Deci & Ryan, 2000, 2008; Ryan & Deci, 2000; Vansteenkiste, Lens & Deci, 2006). By extension, SDT maintains that knowing whether students' motivation is more autonomous or controlled is far more important for predicting their school-related outcomes, including meaning, relevance, and persistence, than the overall amount of motivation.

SDT differentiates types of behavioural regulation as well, including four types of extrinsic motivation: external regulation, introjected regulation, identified regulation, and integrated regulation (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000). All four types fall along a continuum of internalisation, meaning that they differ in terms of the degree to which the behavioural regulation is internalised with a person's sense of self and, in turn, the degree of autonomous behavioural regulation. First, external regulation is the least autonomous form of motivation, for it is initiated and regulated by external contingencies, including the promise of reward or punishment. For students in upper secondary school, such regulation might manifest in activities in which they can be praised by teachers or recognised by peers. Second, introjected regulation represents external regulation that is partially internalised in the self and stems from assumptions and feelings that people, including oneself, have to behave in certain ways. For example, students might behave in certain ways at school or in education programmes out of a sense of pressure and coercion instead of desire and choice. Third, identified regulation is based on the usefulness of an identified behaviour. For instance, students might identify with the value of an activity and willingly accept responsibility for regulating their behaviour in performing it. Fourth and lastly, the most autonomous form of extrinsic motivation is integrated regulation, in which students integrate their behaviour with other aspects of their core sense of self. In that sense, the behaviour is valued or viewed to be personally important and relevant for attaining self-selected goals. Together with intrinsic motivation and amotivation, those four types of external regulations can be placed along a continuum, ranging from amotivation (Figure 1), which implies a lack of intention and motivation, to intrinsic motivation, which signifies the strongest positive motivation possible (Deci & Ryan, 2008; Ryan & Deci, 2009).

SDT also suggests that different types of motivation relate to people's satisfaction with their sense of competence, relatedness, and autonomy, which are considered to be innate, basic psychological needs (Deci & Ryan, 2000). People need to feel that they freely choose their behaviour (i.e., autonomy), have close connections with others (i.e., relatedness), and are effective in the activities they undertake (i.e., competence). SDT stresses that internalisation and integration involve a process that functions more or less effectively depending on the degree to which a person experiences ambient support of or hindrances to those basic psychological needs. Similar to other natural

processes, however, internalisation does not occur automatically. As such, it is essential that students feel as though teachers support their basic psychological needs—for example, by providing them with choices, focusing on building relationships, and stipulating tasks toward mastery that are substantial enough to optimise natural regulation processes.

Autonomous types of motivation are thought to have stronger positive correlations with the satisfaction of needs than controlled types, whereas lack of motivation is thought to have more negatively correlations. In validating the AMS, we therefore expected students to experience the satisfaction of needs to affect both the type and strength of their motivation in upper secondary school.

Previous research (Vallerand, Fortier & Guay, 1997) has used types of motivation as separate (e.g., intrinsic motivation and identified regulation) or composite constructs (e.g., controlled motivation composite). Relative to controlled types of motivation, overarching, autonomous types are associated with numerous cognitive, affective, and behavioural outcomes, which are all considered to be positive for both individuals and society (Deci & Ryan, 2008, 2014; Guay, Ratelle & Chanal, 2008; Ryan & Deci, 2009, Vallerand & Bissonnette, 1992). Among students in high school and junior college, such positive outcomes include an experience of meaning and relevance in learning situations (Jang, 2008; Utvær, 2014; Vansteenkiste, Lens & Deci, 2006), an intention to complete a course of study (Alivernini & Lucidi, 2011; Hardre & Reeve, 2003; Otis, Grouzet & Pelletier, 2005), and persistence among high school and junior college students (Vallerand & Bissonnette, 1992; Vallerand et al., 1997). Conversely, amotivation has been associated with a range of negative outcomes (Deci & Ryan, 2000), including an intention to drop out (Hardre & Reeve, 2003) and actual dropout (Vallerand et al., 1997). Accordingly, we expected that autonomous instead of controlled types of motivation, as well as a lack of motivation, would relate positively to health and social care students' experiences of meaning in both academic and vocational subjects, their confidence with their choice of study programme, and their completion of upper secondary education.

The Academic Motivation Scale (AMS)

Vallerand et al. (1992, 1993) developed the AMS with seven subscales, including three types of intrinsic motivation (i.e., knowledge, accomplishment, and stimulation), three types of extrinsic motivation (i.e., identified, introjected, and external), and amotivation. Their research parsed Deci and Ryan's (1985, 2000) construct of intrinsic motivation into three unordered subscales: intrinsic motivation for knowledge, which assesses the desire to perform an activity for the pleasure and satisfaction experienced while learning; intrinsic motivation toward accomplishments, which assesses the desire to perform an activity for the pleasure and satisfaction experienced from accomplishment or creation; and

intrinsic motivation for stimulation, which measures the desire to perform an activity in order to experience stimulation. By contrast, there are three subscales of extrinsic motivation: identified regulation, which assesses the desire to perform activities in order to gain a sense of importance and personal value; introjected regulation, which assesses the experience of pressure and guilt; and extrinsic regulation, which measures whether students participate in activities to avoid negative consequences or achieve rewards. Lastly, amotivation assesses the experience of a lack of motivation.

Support for construct validity is determined by means of confirmatory factor analysis (CFA). A 7-factor solution has been replicated using samples from many different countries, including Canada (Guay, Morin, Litalien, Valiois & Vallerand, 2015; Vallerand et al., 1992), the United States (Fairchild, Horst, Finney & Barron, 2005), Italy (Alivernini & Lucidi, 2008), and Turkey (Can, 2015).

The AMS has demonstrated adequate to good reliability and validity in several studies among high-school students (Grouzet, Otis & Pelletier, 2006), college students (Can, 2015; Fairchild et al., 2005), and university students (Vallerand et al., 1992), which reported alpha values for the AMS ranging between .62–.86 (Vallerand et al., 1992), .70–.86 (Cokley, Bernard, Cunningham & Motoike, 2001), and .70–.90 (Fairchild et al., 2005).

Various studies have supported the proposed pattern of correlations among different types of motivation (Alivernini & Lucidi, 2008; Grouzet et al., 2006; Otis et al., 2005). In particular, intrinsic motivation and identified regulation have proven to be more highly and positively correlated with each other than with intrinsic motivation and external regulation. However, numerous studies have shown that the correlations between subscales do not fully support the scale's structure as proposed by SDT (Can, 2015; Cokley et al., 2001; Fairchild et al., 2005). Two recent studies have presented an overview of the literature regarding the reliability and the correlational pattern of AMS subscales (Can, 2015; Guay et al., 2015).

Altogether, vocational study programmes in upper secondary schools face several challenges concerning throughput, meaning, and relevance among students. To explain students' experiences with meaning in education, their confidence related to their choice of education, and their completion of school, the differentiation in motivational quality seems vital. SDT maintains that students' quality of motivation relates closely to the satisfaction of their basic psychological needs and, in turn, can explain school-related attitudes, emotions, and behaviour (Deci & Ryan, 2000, 2008). Although the AMS has been extensively examined, it has neither been previously validated in Norway nor evaluated in solely vocational programmes in upper secondary schools. In response, we tested the psychometric properties of the AMS in a sample of students attending a vocational programme in Norway.

Aims

Our aim was to examine the psychometric properties of the AMS in a vocational student population. The research question was twofold: How well does the original 28-item, 7-factor solution of the AMS fit the observed data, and how good are the reliability and construct validity of the AMS scale among vocational students? In accordance with the Standards for Education and Psychological Testing (American Educational Research Association, American Psychological Association & National Council on Measurement in Education, 1999; Goodwin & Leech, 2003), the research questions sought evidence related to the dimensionality, reliability, and construct validity of the AMS, all of which considered interrelated measurement properties. An investigation of the dimensionality, reliability, and construct validity of the AMS in the particular population should contribute further insights into the scale's stability and psychometric properties.

Dimensionality refers to the homogeneity of items included in a scale. When the measures are multidimensional (i.e., have more than one factor), items tap into more than one single dimension or factor (subscale). A construct's domain can be hypothesized to be unidimensional, multidimensional and/or a higher-order factor. A unidimensional factor structure is specified by (1) that each indicator loads on a single factor, and (2) the error terms are independent (Kline, 2011), whereas a multidimensional measurement is specified when any indicator loads on ≥ 2 factors or if its error term is assumed to covariate with that of another indicator (Netemeyer, Bearden & Sharma, 2003). However, a measure must also exhibit its theoretical dimensionality a priori and show evidence of reliability.

Reliability refers to the portion of measurement derived from permanent effects persisting from sample to sample. Psychometric literature identifies two broad types of reliability: test–retest reliability, which represents the correlation between a person's score on the same set of items at two points in time, and internal consistency, which signifies the interrelatedness among items or sets of items in the scale. Items forming a scale or subscale should show high levels of internal consistency (Netemeyer et al., 2003). As such, reliability can represent an instrument's consistence and relative lack of error. At the same time, Cronbach's alpha (α) and composite reliability (ρ_c) represent reliability coefficients that assess the internal consistency of items used in a study. Accordingly, dimensionality and reliability are necessary, but nevertheless insufficient conditions for construct validity.

Construct validity refers to how well a measure actually measures the construct it intends to measure and is the ultimate goal when developing an assessment instrument. Construct validity is based, among others, on the construct's relationships to other variables (i.e., convergent and discriminant validity) and content validity (Netemeyer et al., 2003). Since autonomous

motivation among vocational students is expected to correlate positively with the satisfaction of their basic needs, experiences with meaning in education, confidence related to their choice of study programme, and completion of school, all of which constructs were selected for assessing convergent validity by means of correlational analyses. According to SDT, the more self-regulated a behaviour, the greater its correlations with selected constructs.

Content validity refers to the degree to which a scale has an appropriate, relevant sample of items to represent the construct of interest—that is, whether the content of the specific construct is adequately represented by the items, meaning that the indicators measure all ideas in the theoretical definition (e.g., Waltz, Strickland & Lenz, 2005). However, a frequent challenge occurs when the wording of items is too similar—namely, the coefficient alpha, as well as the content validity and dimensionality, are artificially enhanced. Nevertheless, items worded too similarly increase the average correlation among items, which in effect increases the coefficient alpha, yet without adding substantively to the content validity of the measure. Although some similarity among items of a scale is needed to tap into the domain, several items that are mere rewordings of other items are redundant and contain very little new information about the construct (Clark & Watson, 1995). In that sense, theory, validity, reliability, and dimensionality are intertwined.

Given the above considerations, we tested two hypotheses:

- **Hypothesis 1 (H1):** The original 28-item, 7-factor structure of the AMS fits well with the observed data.
- **Hypothesis 2 (H2):** Autonomous motivation is positively correlated with the satisfaction of students' basic needs, their experiences with meaning in vocational education, confidence related to choice of education, and completion of school, whereas a lack of motivation is negatively correlated with those concepts.

Methods

Participants

Our sample included first-year students in a vocational programme for health and social care in an upper secondary school. All schools (n = 18) in a county in mid-Norway participated; five (55%) were urban schools, and 13 (45%) were rural. In all, the sample comprised 467 (92%) of the 510 students in the vocational programme.

Missing data were handled list-wise, and 403 students were ultimately included in analyses. Among them, 351 students were women (87%), 52 were men (13%), and their mean age was 16.8 years (SD 1.3). In terms of ethnic background, 369 students had one or two parents who were born and raised in

Norway (92%), 11 were immigrants from other Western countries (3%), and 23 students were immigrants from non-Western nations (6%).

Data collection

Students' motivations were assessed by means of the AMS, which formed part of a questionnaire comprising 133 items. A pilot study was carried out in spring 2009 (n = 64), whereas the survey itself was conducted during autumn 2009. Students completed the questionnaire during a typical 45-min class period; students absent from class that day received the survey from the teacher when they next attended class. Each survey included a prepaid postal envelope to be returned to the first author. All participants were volunteers, whose anonymity was guaranteed and who received no compensation. Data of students' progress in upper secondary school were collected throughout fall 2014, 5 years after their entry into upper secondary school.

The Norwegian version of the AMS designed for college students was translated from English into Norwegian and used in studies among university students (Olsen, 2006). The translation and its items were tested in the pilot study with the same population surveyed in this study. Briefly, students were asked to respond to the clarity and understandability of wordings used in class. Some questions were found to be difficult to consider, including 'For the intense feelings I experience when I am communicating my own ideas to others'. In the high-school version of the scale, that item has been replaced with 'Because I really like going to school'. In light of the pilot study, the college version of the AMS was replaced with the high-school version.

Measures

The high-school version of the AMS comprising 28 items was developed by Vallerand et al. (1992, 1993). As previously mentioned, the AMS comprises seven subscales that assess three types of intrinsic motivation (i.e., knowledge, accomplishment, and stimulation), three types of extrinsic motivation (i.e., identified, introjected, and external), and amotivation. Respondents were asked why they engage in various behaviours – for example, why they attend school – and were provided with a list of reasons representing different regulatory styles. Items addressed knowledge (IMK; e.g., 'Because I experience pleasure and satisfaction while learning new things'), accomplishment (IMA; e.g., 'For the pleasure I experience while surpassing myself in my studies'), stimulation (IMS; e.g., 'Because I really like going to school'), identified motivation (EMID; e.g., 'Because I think that a high-school education will help me better prepare for the career I have chosen'), introjected motivation (EMIN; e.g., 'Because I want to show myself that I can succeed in my studies'), external motivation (EME; e.g., 'In order to have a better salary later on'; and amotivation (AM; e.g., 'I can't see why I go to school and frankly, I couldn't care less'). Each type of

motivation included four items, all rated on a 7-point scale (1 = Does not correspond at all, 7 = Corresponds exactly). The instrument measurement is presented in Appendix 1.

Autonomy, competence, and relatedness were measured by 12 items from the Basic Needs Scale, including three items for autonomy (e.g., 'I generally feel free to express my ideas and opinions'), three items for competence (e.g., 'I have been able to learn interesting new skills recently'), and five items for relatedness (e.g., 'People in my life care about me'). Responses were indicated on a 7-point scale (1 = Not true at all, 7 = Very true).

Meaningful education was measured by six items, one for each subject (i.e., Norwegian and English languages, mathematics, science, programme subjects, and in-depth study). The items were designed to obtain knowledge about students' experiences with meaningfulness in different subjects within the education programme. An example item is, 'How meaningful is your experience with your education in mathematics in relation to your choice of career?' Responses were made on a 7-point scale (1 = Not at all meaningful, 7 = Very meaningful).

To gauge confidence, three items were designed for this study to measure the degree to which students were confident about the study programme that they attended: 'I am sure that I have made the right choice for my study programme', 'My choice of programme is in accordance with my future life goals', and 'I am sure that I will complete this year of school'. All responses were made on a 7-point scale (1 = Does not correspond at all, 7 = Corresponds very much).

For completion of school, 5 years after collecting the questionnaire data, the Sør-Trøndelag County Authority provided information about the students' progress in upper secondary school. Completion of school was measured by a dichotomous variable; students completed the health and social care track, either with vocational competence (e.g., a trade certificate of apprenticeship) or general study competence (e.g., supplied with study competence), coded as 1 (n = 230, 57%).[2] All other students were coded as 0 (n = 173, 43%).

Statistical Analysis

Data were analysed with descriptive statistics using the Statistical Package for the Social Sciences version 22 (IBM, Armonk, NY, USA), while LISREL 8.8 (Jöreskog & Sörbom, 1995), a statistical approach dealing specifically with measurement models (Brown, 2006), was used for CFA. CFA represents a set of agreed-upon techniques to gauge the dimensionality of a scale (Netemeyer et al., 2003) and is designed to test hypotheses about a factor structure, as well as test the reliability of indicators representing the construct (Raykov & Marcoulides, 2006). A high loading of an item indicates that the factor and respective item have much in common; loadings greater than .32 are considered

to be poor, greater than .45 to be fair, greater than .55 to be good, greater than .63 to be very good, and greater than .71 to be excellent (Tabachnick & Fidell, 2001). Reliability involves the number of items and their loadings, explained variance of an item (R^2, or the square of a standardised factor loading), and internal consistence.

In assessing model fit, different descriptive fit indices and cutoff criteria were used as a rule of thumb (Schermelleh–Engel, Moosbrugger & Muller, 2003). Since standard errors were estimated under conditions of non-normality, the Satorra–Bentler scaled chi-square statistic was applied as a goodness-of-fit statistic, which is the correct asymptotic mean even under conditions of non-normality (Satorra & Bentler, 1994). In line with the rules of thumb of conventional cutoff criteria, chi-square (χ^2) and p values were used as indices of fit; a small χ^2 and non-significant p value indicated a good fit (Jöreskog & Sörbom, 1995). We also used the root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMS); values less than .05 indicated good fit, whereas values less than .08 were interpreted to be acceptable. We additionally applied a comparative fit index (CFI) and non-normed fit index (NNFI), with an acceptable fit at .95 and good fit at .97 and above, and a normed fit index (NFI), with an acceptable fit at .90 and good fit at .95.

Results

Descriptive Analysis

The means (M), standard deviations (SD), skewness, and kurtosis for the AMS are provided in Appendix 1, in addition to the mean score for each subscale. Among intrinsic motivation subscales, intrinsic motivation for knowledge achieved the highest mean score (5.17), whereas identified regulation achieved the highest mean score among extrinsic motivation subscales (6.05).

Inter-item correlations and correlations among the seven AMS subscales were positive, with middling to strong estimates, especially for items IMS1 and IMS2 (r = .79). The alpha levels for the different subscales of motivation indicated acceptable to good inter-item consistency, with Cronbach's alpha coefficients ranging between .71–.84 (Table 1). The Cronbach's alpha coefficient was .67 for autonomy, .69 for competence, .72 for relatedness, .77 for academic meaning, .76 for vocational meaning, and .73 for confidence. However, a substantial body of research has indicated that Cronbach's alpha cannot generally be relied upon as an estimator of reliability (Raykov, 2001). Therefore, Bagozzi and Yi's (1988) formula was used to estimate the composite reliability (ρ_c), for which a value of .60 or more is recommended. The composite reliability revealed values between .73–.86, which supported the reliability of the scale (Table 2).

Table 1. Different types of motivation in relation to selected measures: Cronbach's alpha, and correlations coefficient for Model-3 (Model-1 in parentheses).

Subscale	Number of items	Cronbach's alpha (α)	Autonomy	Competence	Relatedness	Academic meaning	Vocational meaning	Confidence	Complete the health and social care track
Knowledge	4 (4)	.84 (.84)	.30**	.47**	.33**	.48**	.31**	.49**	.05
Accomplishment	4 (4)	.78 (.78)	.28**	.38**	.31**	.38**	.15**	.27**	-.03
Stimulation	3 (4)	.71 (.78)	.19**	.34**	.23**	.39**	.15**	.29**	-.03
Identified	4 (4)	.81 (.81)	.40**	.44**	.41**	.34**	.34**	.54**	.13**
Introjected	4 (4)	.80 (.80)	.16**	.32**	.22**	.32**	.08	.25**	-.09
Extrinsic	4 (4)	.71 (.71)	.13**	.18**	.22**	.07	.08	.10*	.01
Amotivation	3 (4)	.85 (.84)	-.28**	-.26**	-.23**	-.22**	-.26*	-.55**	-.21**

Note. * = $p<.05$. ** = $p<.01$ *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Table 1 presents the Pearson's correlation matrix for the AMS and its seven subscales of motivation. Significant correlations in the predicted direction for autonomous motivation toward the satisfaction of students' basic needs, their experiences with meaning in vocational education, and confidence in the choice of educational programme were revealed. However, correlations between identified regulation and scales of autonomy, relatedness, vocational meaning, and confidence were stronger than for intrinsic motivation subscales. Concerning school completion, identified regulation was the only motivation subscale that showed a positive significant relationship. As hypothesised, the result showed a significant negative correlation between amotivation and the satisfaction of basic needs, confidence, and students' persistence. Based on the construct's relationships to other variables, construct validity was mostly supported.

Confirmatory Factor Analysis (CFA) – The original 7-factor model

The 7-factor model (Model 1) was tested first. Covariance among subscales was desirable, given previous findings that different types of motivation are correlated (e.g., Brown, 2006). The CFA revealed significant t values for all factor loadings ($p < .01$), ranging between .40–.88.

Tabachnick and Fidell (2001) considered loadings ≥0.55 to be good, which was the case for 27 of the 28 items. One loading might be considered as poor ($\lambda = .40$), namely for item EME1 ('Because I need at least a high-school degree to find a high-paying job later'). Ideally, the standardised factor loadings should be at least .70 (Hair, Black, Babin & Anderson, 2010), as was the case for 16 of the 28 items.

Together with the factor loadings, the square of a standardised factor loading (R^2) was used to assess the degree to which an item was a good measure of the factor and represented how much variation in an item was explained by the latent factor (Brown, 2006; Hair et al., 2010). In our study, R^2 values ranged between .16–.77. Kline (2011) has suggested that shared variance with a factor should be greater than .50, which 16 of the 28 items in Model 1 did not fulfil. Factor loadings, *t* values, and R^2 are presented in Table 2.

Table 2. Standardized Factor Loadings, t- Values, Squared Multiple Correlations (R^2), and Composite Reliability[1] (ρc) in the Measurement Model 1 and 3 (Model 1 in parenthesis).

Items	Lisrel standardized estimate	t-values	R^2
IMK1	0.73 (0.74)	15.99** (16.31**)	0.53 (0.54)
IMK2	0.76 (0.76)	18.29** (18.24**)	0.58 (0.58)
IMK3	0.77 (0.77)	18.35** (18.23**)	0.59 (0.59)
IMK4	0.75 (0.74)	16.22** (16.06**)	0.56 (0.55)
IMA1	0.61 (0.60)	12.95** (13.10**)	0.37 (0.38)
IMA2	0.77 (0.77)	16.64** (16.75**)	0.59 (0.60)
IMA3	0.58 (0.58)	11.75** (11.58**)	0.34 (0.33)
IMA4	0.78 (0.78)	18.73** (18.65**)	0.60 (0.60)
IMS1	0.57 (0.60)	12.92** (14.39**)	0.32 (0.36)
IMS2	---- (0.64)	---- (16.17**)	---- (0.41)
IMS3	0.70 (0.68)	16.49** (15.89**)	0.48 (0.46)
IMS4	0.79 (0.78)	19.52** (18.74**)	0.63 (0.60)
EMID1	0.69 (0.69)	9.91** (9.92**)	0.47 (0.47)
EMID2	0.69 (0.68)	10.20** (10.12**)	0.47 (0.47)
EMID3	0.74 (0.74)	12.71** (12.77**)	0.55 (0.55)
EMID4	0.76 (0.75)	15.65** (15.64**)	0.57 (0.57)
EMIN1	0.66 (0.67)	15.61** (15.70**)	0.44 (0.44)
EMIN2	0.73 (0.73)	16.71** (17.07**)	0.53 (0.54)
EMIN3	0.69 (0.69)	15.55** (15.47**)	0.48 (0.48)
EMIN4	0.78 (0.77)	17.60** (17.45**)	0.60 (0.60)
EME1	0.40 (0.40)	6.60** (6.65**)	0.16 (0.16)
EME2	0.66 (0.66)	11.01** (11.05**)	0.43 (0.43)
EME3	0.76 (0.75)	14.42** (14.38**)	0.57 (0.57)
EME4	0.74 (0.74)	13.03** (13.14**)	0.54 (0.55)
AM1	---- (0.57)	---- (6.98**)	---- (0.33)
AM2	0.70 (0.71)	8.76** (8.82**)	0.49 (0.50)
AM3	0.91 (0.88)	12.46** (12.33**)	0.82 (0.77)
AM4	0.85 (0.86)	10.50** (10.87**)	0.72 (0.74)
ρ_c IMK	.83 (.83)		
ρ_c IMA	.78 (.78)		
ρ_c IMS	.73 (.77)		
ρ_c EMID	.81 (.81)		
ρ_c EMIN	.81 (.81)		
ρ_c EME	.74 (.74)		
ρ_c AM	.86 (.85)		

Note. IMK = Intrinsic motivation for knowledge, IMA = Intrinsic motivation toward accomplishment, IMS = Intrinsic motivation for experience stimulation, EMID = Extrinsic motivation, identified regulation, EMIN = Extrinsic motivation, introjected regulation, EME = Extrinsic motivation, external regulation, and AM = Amotivation.

* p<.05, ** p<.01

[1] **Composite Reliability** $\rho c = \dfrac{\left(\sum \lambda\right)^2}{\left[\left(\sum \lambda\right)^2 + \sum\left(\theta\right)\right]}$

The correlation matrix for the factors (PHI) showed high correlations between the three intrinsic motivation factors (.71, .72, and .70). Somewhat surprisingly, introjected regulation displayed very strong correlations to all intrinsic motivation factors (.60, .68, and .61), and the strongest negative correlation was between identified regulation and amotivation (-.44), as shown in Table 3.

Table 3. Factor Correlations (Model-3).

		1	2	3	4	5	6	7
1	**Knowledge**	1						
2	**Accomplishment**	.71**	1					
3	**Stimulation**	.72**	.70**	1				
4	**Identified**	.63**	.46**	.37**	1			
5	**Introjected**	.60**	.68**	.61**	.47**	1		
6	**External**	.33**	.32**	.19**	.47**	.48**	1	
7	**Amotivation**	-.32**	-.15**	-.15**	-.44 **	-.12**	-.13**	1

Note. *p<.05.** p<.01. N=403

Dimensionality in Models 1 and 2

The original 7-factor, 28-item measurement model of the AMS (i.e., Model 1) was tested by means of CFA, which showed significant estimates ($p < .01$). Model 1 also demonstrated a modest fit with observed data: $\chi^2 = 976.44$, $p = .001$, df = 329, $\chi^2/df = 2.97$, RMSEA = .70, SRMR = .068, NFI = .95, NNFI = .96, CFI = .96 (Table 4). Since previous studies have indicated that the three intrinsic motivation factors have acted as a single construct of intrinsic motivation (e.g., Alivernini & Lucidi, 2008; Grouzet et al., 2006), a 5-factor solution of the AMS was tested and used to frame Model 2. Consequently, Model 2 comprised one factor measuring intrinsic motivation, the three original types of extrinsic motivation, and amotivation; it ultimately revealed a slightly worse fit, as Table 4 shows ($\chi^2 = 1{,}089.85$, $p = .001$, df = 340, $\chi^2/df = 3.21$, RMSEA = .074, SRMR = .075, NFI = .94, NNFI = .95, CFI = .96). The chi-difference test showed that Model 1 was significantly better than Model 2 (χ^2diff (-11) = -113.41 (976.44–1,089.85, 329–340); for the model to be significantly better, the change in χ^2 value had to exceed the critical value of the difference in degrees of freedom at the 5% level. Accordingly, the 7-factor structure was superior to the 5-factor model, which supported the original dimensionality of the AMS that comprised seven dimensions.

Table 4. Goodness-of-fit measures for Model-1, Model-2, and Model-3.

Fit Measure	**Model-1** 7-factor 28 variables	**Model-2** 5-factor 28 variables	**Model-3** 7-factor 26 variables
χ2 ***Satorra Bentler***	976.44	1089.85	662.98
p-value	<0.001	<0.001	<0.001
$\frac{x^2}{df}$ ***Satorra Bentler***	2.97 df=329	3.21 df=340	2.38 df=278
RMSEA	0.070	0.074	0.059
p-value ***(close fit test)***	0.001	0.001	0.007
SRMR	0.068	0.075	0.060
NFI	0.95	0.94	0.96
NNFI	0.96	0.95	0.97
CFI	0.96	0.96	0.98

Note. **Model-1** = 7-factor-model comprising all 28 items. **Model-2** = 5-factor model all 28 items, the three factors of intrinsic motivation are included in one factor. **Model-3** = 7-factor-model comprising 26 items; IMS1 and AM1 are dismissed. RMSEA=Root Mean Square Error of Approximation. SRMR = Standardized Root Mean Square Residual. NFI = Normed Fit Index. NNFI = Nonnormed Fit Index. CFI = The Comparative Fit Index.

Although Model 1 revealed an acceptable fit, it did not demonstrate a good one. Therefore, we scrutinised the modification indices (MI), expected change, and standardised residuals (SR), which showed an exceptionally high MI for error variance (TD) for IMS1 and IMS2 (223.59), IMA2 and EMIN2 (36.42), IMA1 and IMA2 (25.01), and EME3 and EMID3 (22.58). The first pair of items concerned the experience of enjoying attending school (IMS1), as well as that attending school was a great experience (IMS2). Furthermore, the pleasure of surpassing oneself in personal accomplishments (IMA2) seemed to be theoretically close to the feeling of being important when successfully coping at school (EMIN2), as well as the pleasure experienced by surpassing oneself in studies (IMA1). Lastly, the items EME3 and EMID3 represent motivations for attending school; being able to have a good life later on (EME3) and to make a better choice concerning career orientation (EMID3) seemed closely interrelated. Accordingly, correlating error terms between those pairs of variables seems theoretically sound. A nested version of Model 1 that includes those four correlated errors was estimated to show a strongly improved fit: $\chi^2 = 685.91$, p = .001, df = 325, $\chi^2/df = 2.11$, RMSEA = .053, SRMR = .067, NFI = .98, NNFI = .98, CFI = .98. However, correlated error terms should be treated with caution, and

we did not represent them in this model. Instead, we performed an additional evaluation to search for particularly troublesome items.

Model 3: A better fitting model

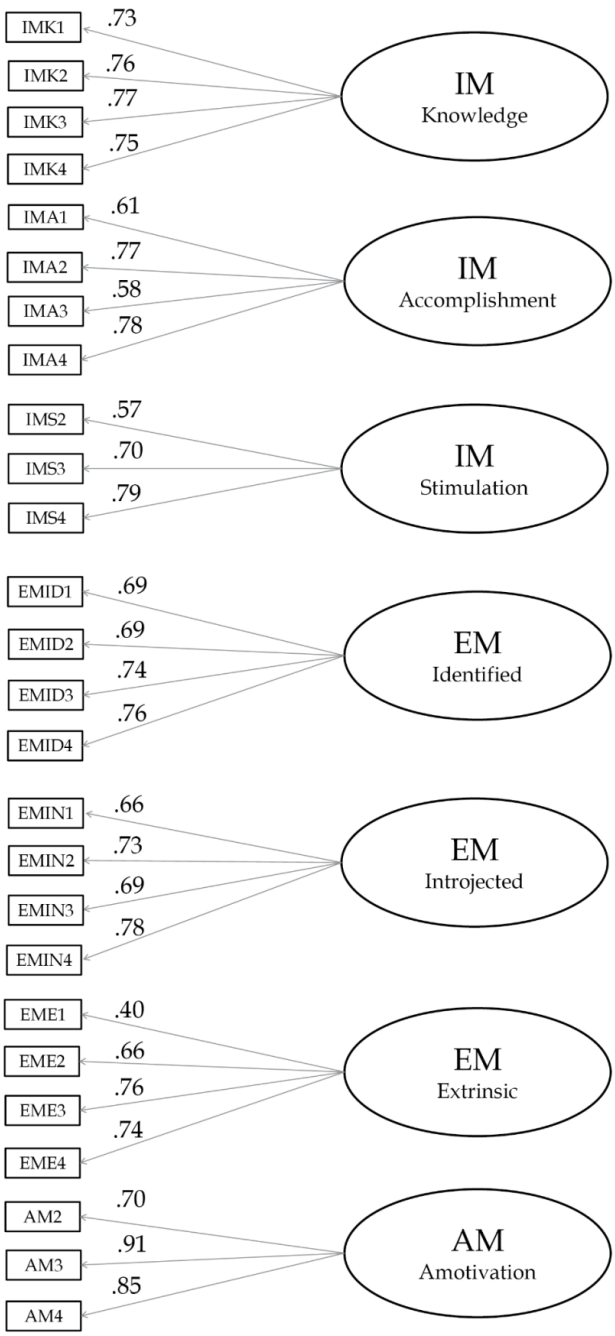

Figure 2. The 26 Items Factor Model (Model 3).

A further investigation of the standardised residuals revealed that items IMS1 and IMS2 shared variance, with an extremely positive standardised residual of 27.84. Moreover, particularly high standardised residuals emerged between EMIN3 and EMIN4 (RS = 6.83), IMS3 and IMS4 (SR = 6.18), IMS3 and IMK4 (RS = -5.96), IMS2 and AM1 (RS = -5.70), and IMS4 and IMA4 (SR = 5.26), as well as numerous significant residuals ranging from -2.73 to 5.00. Additionally, EMID1 revealed considerably high MIs for the subscales of external regulation (MI = 96.25) and amotivation (MI = 20.81). The variables IMS2 and AM1 were therefore removed, and Model 1 with 26 items was re-estimated. It was dubbed Model 3 and exposed a better fit with the present data: $\chi^2 = 662.98$, $p = .001$, $df = 278$, $\chi^2/df = 2.38$, RMSEA = .059, SRMR = .060, NFI = .96, NNFI = .97, CFI = .98 (Table 4). Embodying the best fit, Model 3 is shown in Figure 2. The chi-difference test indicated that Model 3 was significantly better than Model 1 (χ^2_{diff} (51) = 313.46 (976.44–662.98, 329–278).

Discussion

This study's research question sought evidence related to the dimensionality, reliability, and construct validity of the AMS among students attending a vocational health and social care program. To the authors' knowledge, the psychometric properties of the AMS have not previously been examined in Norway, nor within a vocational student population. In examining construct validity, two hypotheses (H1 and H2) were tested, both supported by data demonstrating that autonomous types of motivation correlated significantly and positively with the satisfaction of basic needs, experiences with meaning in vocational education, and confidence. However, only the autonomous type of motivation, termed identified regulation, positively correlated with school completion 5 years later, whereas lack of motivation negatively correlated with all concepts included in the study. Accordingly, results supported SDT and the AMS. Nevertheless, the correlations did not necessarily indicate that intrinsic motivation variables represented a higher quality of motivation than identified regulation.

Dimensionality

The first research question concerned how well the original 7-factor model of the AMS fit the observed data. Concerning dimensionality, the 7-factor model (Model 1) showed a significantly better fit than the 5-factor one (Model 2). The chi-square difference test showed that the 7-factor structure was statistically superior to the 5-factor model. Results also lend support to Vallerand et al.'s (1992) findings, which suggested a 7-dimensional structure of the AMS concept comprising three components of intrinsic motivation, three components of

extrinsic motivation, and amotivation. The knowledge dimension showed relatively high correlations with accomplishment and stimulation (r = .71, r = .72, respectively), whereas the correlation between accomplishment and stimulation was r = .70. Generally, when different concepts reveal inter-correlations of values around .70, it is not questioned whether they actually represent different concepts or measure the same phenomenon. Accordingly, our study supports the idea that intrinsic motivation contains three dimensions, as proposed by Vallerand et al. (1992, 1993).

Reliability

The second research question aimed to examine the reliability and construct validity of the AMS in a vocational student population. Reliability was supported by items in each factor with highly significant standardised factor loadings, preferably greater than .70 (Brown, 2006; Hair et al., 2010; Kline, 2011). The square of a standardised factor loading represents how much variation in an item is explained by the latent variable (i.e., the factor) and is termed extracted variance (Hair et al., 2010). Since loadings were less than .70, they can still be considered to be significant, though more of the variance in the measure is error variance than explained variance. As the factor loadings for Model 3 show, 17 of the 26 items loaded .70 or higher in Model 3. Although reliability was therefore not fully supported, all loadings except those from EME1 showed fair to good values ranging between .57–.91. However, Cronbach's alpha and composite reliability revealed good values, which indicated good internal consistency, since values greater than .70 are good (Hair et al., 2010).

Construct validity

Construct validity refers to accuracy of measurement, which reflects the extent to which a set of measured indicators actually reflects the theoretical latent construct that those items are designed to measure (Fayers & Machin, 2007). Construct validity was further supported by significant positive correlations with the satisfaction of vocational students' basic needs, their experiences with meaning in vocational education, and their confidence, whereas a lack of motivation was negatively correlated with all scales involved in the study. The three dimensions of intrinsic motivation (i.e., knowledge, accomplishment, and stimulation) were significantly and highly intercorrelated.

However, opposed to what SDT proposes, the phi-matrices revealed that the introjected regulation subscale was highly correlated with the intrinsic motivation subscales, thereby indicating that the extrinsic type of motivation has much in common with the intrinsic motivation subscales. That finding is in accordance with the results of previous studies (Can, 2015; Cokley et al., 2001, Fairchild et al., 2005). Therefore, our study partially supports the proposed pattern of correlations of the AMS, which imply that proximal motivations,

(e.g., intrinsic motivation and identified regulation) are more highly and positively correlated with each other than with the distal ones (e.g., intrinsic motivation and external regulation). Thus, results partly support one of SDT's central postulates: that the energy underlying a given behaviour varies in terms of quality.

Items IMS1 and IMS2, belonging to the stimulation subscale, were highly correlated. They represented wordings 'I really like going to school' (IMS1) and 'To me, school is fun' (IMS2). When adolescents find school to be fun, it is very likely that they also like going to school. It is theoretically reasonable that those items correlate and reveal a very strong inter-item correlation. Very closely worded, they achieve an extremely high MI (223.6) and several significant residuals, especially for IMS2. Therefore, item IMS2 was excluded. Item AM1 was strongly and negatively correlated to the pair IMS1 and IMS2, which caused a poor model fit. AM1 represents the wording, 'Honestly, I don't know. I really feel that I'm wasting my time in school'. Accordingly, it is plausible that the experience of school as fun and something to be enjoyed is negatively associated with the experience of wasting one's time in school. Furthermore, as the reliability shows, dismissing AM1 also revealed a better composite reliability and Cronbach's alpha and thus strengthened reliability.

Strengths and Limitations

The AMS has not previously been validated in Norway, nor solely among students in vocational programmes. A major strength of this study was its suitable sample size and high response rate among students who were all attending school in one county in mid-Norway. However, some limitations should be considered. For one, the sample was strongly gendered (87% girls), which is a clear limitation, particularly for generalisability. Nevertheless, the sample portrays the gender distribution in health and social care vocational programmes in upper secondary schools in Norway (Vibe, Brandt & Hovdhaugen, 2011). Plus, the AMS has shown good longitudinal cross-gender factorial invariance (Can, 2015; Grouzet et al., 2006). Another limitation was exclusive reliance on self-reports from students aged 15.7–24.5 years – an overwhelming 92% were 16 years old – which could suggest self-report bias (Rothman, 2002). Self-report requires participants to exhibit a level of cognitive maturity by which they can reflect upon and understand concepts of motivation and basic needs. Second, it could have been challenging for the participants to evaluate and report reliably on feelings and complaints through self-report (e.g., social desirability). The questionnaire was tested with a pilot study and corrected, though no back-translation took place. Previous studies have revealed differences between students in general studies and those in vocational programmes, as well as among different vocational programmes (Blondal, Jonasson & Tannhauser, 2011; Markussen, Sandberg, Lødding &

Frøseth, 2008; Mikiewicz, 2011). Since our sample was relatively homogenous, further examination of the AMS in other student populations in Norway would be beneficial.

In addition, we assessed the AMS at an ordinal level by using a 7-point Likert scale. As such, the variables were treated as if metric even if they were not. That conflict is quite common with scales including a 5-point rating or more. Nevertheless, it is important to ensure that nonmetric data are used appropriately in statistical techniques (Carifio & Perla, 2007; Hair et al., 2010) and to be aware that that represents a limitation.

Conclusion

This study's results provide further evidence to support the 7-dimensional factor structure of the AMS. Reliability was supported by good values for Cronbach's alpha and composite reliability, and moreover, the construct validity was good. However, the results also show that items IMS1 and IMS2, which represent stimulation, need to be reworded in order to achieve better reliability among vocational students. Moreover, the study revealed a high number of significant residuals, thereby indicating that several items share error variances both within and between subscales of the AMS. The study also demonstrated highly significant associations between students' experiences with the satisfaction of basic needs and different types of motivation; such satisfaction showed positive correlations with autonomous motivation and negative correlations with amotivation. Consequently, supporting students' satisfaction of basic needs seems critical to promoting identification, hindering amotivation, and thereby preventing school dropout.

Since dropout is a major challenge among vocational students in the Western world, access to a reliable measure of students' motivation can be highly useful. Identified regulation had the only significant correlation with completion of school other than amotivation, which supports the idea that identification is a high-quality type of motivation for vocational students.

Endnotes

[1] In Norway, it is common to measure students' dropout and achievement rates of competence 5 years after their entry into upper secondary school (Utdannings-direktoratet, 2012).

[2] Students achieve competence and thus complete school, as measured 5 years after their entry into upper secondary school. Vocational programmes are primarily built upon a 2+2 model, in which a student first completes 2 years of schooling, followed by 2 years of apprenticeship in a work environment. Another option in vocational education is a 3-year, school-based route directed toward securing an occupation. A

third option for students who have started a vocational programme is to switch to an additional general course during a supplementary year, which is possible after they complete 2 years in a vocational programme (Utdanningsdirektoratet, 2012).

Notes on contributors

Britt Karin Støen Utvær, PhD, RN, Associate Professor, NTNU Norwegian University of Science and Technology, Faculty of Social Sciences and Technology Management, Program for teacher education. Her research program focuses on dropout, school persistence, and different kinds of motivation and aspirations among students within vocational education and training programs.

Gørill Haugan PhD, RN, Associate Professor, NTNU Norwegian University of Science and Technology, Faculty of Social and Health Science, Center for Health Promotion Research, Department of Nursing. Her research program focuses on students' aspirations, motivation, and learning, sense of coherence, resilience, life satisfaction and school stress, along with spirituality and health promotion on the health care system, contributing to patients' well-being and quality of life.

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APPENDIX

Measurement Instrument, Academic Motivation Scale (AMS) Mean Score, Standard Deviation, Skewness, and Kurtosis (N=403, 28 items).

	Items	M	SD	Skewness	Kurtosis
IMK1	Because I experience pleasure and satisfaction while learning new things	5.15	1.49	-0.59**	0.00
IMK2	For the pleasure I experience when I discover new things never seen before	4.71	1.54	-0.24	-0.51**
IMK3	For the pleasure that I experience in broadening my knowledge about subjects which appeal to me	5.23	1.51	-0.65**	-0.25
IMK4	Because my studies allow me to continue to learn about many things that interest me	5.59	1.49	-1.02**	0.51
IMA1	For the pleasure I experience while surpassing myself in my studies	4.46	1.87	-0.39**	-0.79**
IMA2	For the pleasure that I experience while I am surpassing myself in one of my personal accomplishments	5.09	1.59	-0.60**	-0.27
IMA3	For the satisfaction I feel when I am in the process of accomplishing difficult academic activities	3.17	1.63	0.23*	-0.70**
IMA4	Because high school allows me to experience apersonal satisfaction in my quest for excellence in my studies	4.22	1.69	-0.18	-0.57**
IMS1	Because I really like going to school	3.39	1.78	0.17	-1.00**
IMS2	Because for me, school is fun	3.44	1.78	0.16	-0.99**
IMS3	For the pleasure that I experience when I am taken by discussions with interesting teachers	3.65	1.80	0.10	-0.86**
IMS4	For the 'high' feeling that I experience while reading about various interesting subjects.	4.28	1.72	-0.25*	-0.61**
EMID1	Because I think that a high-school education will help me better prepare for the career I have chosen	6.22	1.17	-1.73**	3.02**
EMID2	Because eventually it will enable me to enter the job market in a field that I like	6.18	1.21	-1.61**	2.47**
EMID3	Because this will help me make a better choice regarding my career orientation	5.88	1.27	-1.26**	1.44**

EMID4	Because I want to show myself that I can succeed in my studies	5.93	1.20	-0.98**	0.54
EMIN1	To prove to myself that I am capable of completing my high-school degree	4.86	1.95	-0.59**	-0.78**
EMIN2	Because of the fact that when I succeed in school I feel important	4.75	1.71	-0.45**	-0.60**
EMIN3	To show myself that I am an intelligent person	3.93	1.77	-0.13	-0.83**
EMIN4	Because I want to show myself that I can succeed in my studies	5.14	1.69	-0.80**	0.01
EME1	Because I need at least a high-school degree in order to find a high-paying job later on.	5.63	1.87	-1.28**	0.51
EME2	In order to obtain a more prestigious job later on	5.78	1.51	-1. 35**	1.32**
EME3	Because I want to have 'the good life' later on	5.68	1.45	-1.07**	0.60*
EME4	In order to have a better salary later on	5.81	1.35	-1.17**	0.95**
AM1	Honestly, I don't know; I really feel that I am wasting my time in school	1.73	1.24	1.82**	2.84**
AM2	I once had good reasons for going to school; however, now I wonder whether I should continue	1.73	1.41	2.19**	4.26**
AM3	I can't see why I go to school and frankly, I couldn't care less	1.52	1.28	2.58**	6.20**
AM4	I don't know; I can't understand what I am doing in school	1.52	1.18	2.54**	6.25**
	Subscales mean scores				
IMK (Knowledge)		5.17	1.24	-0.50**	-0.10
IMA (Accomplishment)		4.23	1.32	-0.28	-0.31
IMS (Stimulation)		3.69	1.38	-0.01	-0.67**
EMID (Identified regulation)		6.05	0.97	-1.42**	2.99**
EMIN (Introjected regulation)		4.67	1.42	-0.37*	-0.50**
EME (Extrinsic regulation)		5.72	1.14	-1.11**	1.25**
AM (Amotivation)		1.64	1.05	2.19**	4.96**

Note. *p<.05. ** p<.01.