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Adolescent Students' Digital Engagement and Achievement Goal Orientation Profiles

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Abstract

The current study investigated how students' digital engagement (i.e., digital learning preference, wish for digital schoolwork, and schoolwork and sleep impairment related to Internet use) is related to their achievement goal orientation profiles from Grades 8 to 9. The sample included 1,482 Finnish students (15–16 years old, 53% female) from 26 schools. Students' digital engagement and achievement goal orientations were assessed with self-reported questionnaires. Latent profile and latent transition analyses were used to investigate goal orientation profiles, and the Bolck-Croon-Hagenaars approach and logistic regression were used to explore differences between the profiles with respect to digital engagement. Four groups with different achievement goal orientation profiles were identified: mastery-oriented (focused on learning and doing well in school); success-oriented (driven to succeed in school and outperform others); indifferent (had all achievement goals at average level); and avoidance-oriented (sought to avoid schoolwork). Most students tended to remain in a similar group over time. The results indicated that students with either average (indifferent) or high achievement goals (success-oriented) might wish for more digitally mediated schoolwork. Mastery-oriented students tended to have significantly lower schoolwork and sleep impairment related to Internet use than other students. The findings supported previous studies but also provided new insights into relationships between goal orientation profiles and digital engagement.

Keywords: digital engagement, achievement goal orientations, learning, adolescence, person-oriented approach

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1. Introduction

A significant portion of current students' environment is dominated by digital technologies, including technology-mediated learning opportunities (e.g., Papastergiou, 2009; Rodríguez-Aflecht et al., 2018) as well as distractions that may interrupt persistent learning (e.g., Carrier et al., 2015). The relationship between using digital tools in schools and students' academic achievement has attracted considerable attention in research, and the results indicate that some technology-mediated programs can support students' development if appropriately implemented (e.g., Archer et al., 2014; Little et al., 2018; Young et al., 2018). In addition, students could become more motivated by using digital tools for learning (Chen et al., 2016; Salmela-Aro et al., 2016; Shapley et al., 2011). Thus, investigating aspects of students' digital engagement together with their learning motivation could shed further light on how students cope in their learning environment.

The current study was conducted in Finland, where students generally have good access to digital technologies (OECD, 2015); however, the educational system still struggles to provide specific and efficient technology-mediated learning programs (Hakkarainen, 2009; Halonen et al., 2016). Moreover, several students engage in out-of-school educational activities via digital media and some want their schoolwork to include more technology-mediated learning opportunities (Hietajärvi et al., 2020). Thus, a gap might exist between students' out-of-school digital learning preferences and traditional schooling (Halonen et al., 2016), possibly leading to lower engagement in school (Hietajärvi et al., 2020). Yet adolescents primarily use digital media for socializing with peers (Li et al., 2017), and digital tools can distract them from learning. For example, multitasking (Carrier et al., 2015) and too frequent Internet use could be related to insufficient sleep time (Hale & Guan, 2015) and lower learning motivation (Anderson et al., 2017; Liu et al., 2017; Yang & Tung, 2007).

Studies have shown that a considerable number of students struggle with motivational and emotional issues in school (e.g., Salmela-Aro, 2017), and motivation to learn may decline, especially during adolescence (Eccles et al., 1993). The current study explores students' achievement goal orientations as indicators of learning motivation. Achievement goal orientations are an important part of self-regulated learning (Boekaerts & Niemivirta, 2000; Pintrich, 2000a), and students likely endorse different goals simultaneously. Numerous studies have investigated goal orientation profiles using a person-oriented approach (Bergman & Andersson, 2010) to identify distinct motivational profile patterns (for overviews, see Niemivirta et al., 2019; Wormington & Linnenbrink-Garcia, 2017). Investigating these profiles and distinct aspects of students' digital engagement might help better understand learning motivation in today's educational context. Accordingly, the current study aims to investigate students' digital learning preferences, wish for digital schoolwork, and schoolwork and sleep impairment related to Internet use together with their achievement goal orientation profiles longitudinally from Grades 8 to 9.

1.1 Digital Engagement

Digital tools can provide students with various learning opportunities and support their development as self-regulated learners. Social media and web-based communities, for example, can connect people with common learning goals and interests so they can enhance their skills and knowledge (i.e., connected learning; Barron, 2006; Ito et al., 2013; Kumpulainen & Sefton-Green, 2014). Connected learning via digital tools can also be related to adolescents' need to interact with their peers or adults (Eccles et al., 1993), indicating they might also prefer using more digital tools for schoolwork. Still, this type of interest-driven learning is identified as informal learning that occurs in out-of-school contexts (Barron, 2006; Kumpulainen & Sefton-Green, 2014), cultivating a possible gap between students' formal and informal learning, thereby affecting their school engagement (Halonen et al., 2016;

Hietajärvi et al., 2020; Salmela-Aro et al., 2016). Several studies have also investigated the possible detrimental effects of digital engagement on academic achievement (Adelantado-Renau et al., 2019) and sleep (Carter et al., 2016) which is often considered a mediating factor between digital engagement and academic outcomes (Adelantado-Renau et al., 2019). Similarly, the effects of digital screen time have been widely discussed (for reviews, see Adelantado-Renau et al., 2019; Appel et al., 2020; Carter et al., 2016; Hale & Guan, 2015). Screen time is a general concept that refers to the average time spent using smartphones, tablets or computers, or watching television (Hale & Guan, 2015; Przybylski, 2019). Empirical results do not indicate that too frequent screen time directly leads to lower achievement or insufficient sleep (Adelantado-Renau et al., 2019; Hale & Guan, 2015; Przybylski, 2019) and several researchers have emphasized that relationships between digital media use and well-being and behavior cannot be simply generalized. Screen time includes activities that can lead to various outcomes, making it important to account for distinct indicators to further understand relationships between digital media use and students' well-being (Hale & Guan, 2015; Huang, 2010; Orben & Przybylski, 2019a, 2019b; Przybylski, 2019). Accordingly, the current study investigates four types of digital engagement, conceptualizing digital learning preference and wish for digital schoolwork as learning supportive versus schoolwork and sleep impairment related to Internet use as detrimental.

Digital learning preference refers to students putting effort into using digital technologies at the edge of their competencies and enjoying using digital technologies on challenging problems across mainly informal contexts (Hakkarainen et al., 2000; Hietajärvi et al., 2020). Consequently, the wish for digital schoolwork indicates whether students would prefer using more digital tools in schoolwork (Halonen et al., 2016; Hietajärvi et al., 2020 Salmela-Aro et al., 2016). Stronger digital learning preferences and wish for digital schoolwork might lead to higher learning engagement (Halonen et al., 2016). However, if

students prefer digital tools for learning but have no such opportunities at school, they may experience a decrease in school engagement (Hietajärvi et al., 2020). Moreover, some students actively using online learning opportunities (i.e., being eager to learn) might still have lower academic outcomes in the formal schooling context (Hietajärvi et al., 2015).

As students presumably use the Internet and digital media quite frequently in their everyday lives (Smahel et al., 2020), raising concerns in terms of its hypothesized detrimental outcomes (Adelantado-Renau et al., 2019; see also Orben, 2020), we also investigated schoolwork and sleep impairment related to Internet use. This conceptualization taps directly into self-reported Internet use that has either negatively affected respondents' learning behavior or is related to insufficient sleep time (Kubey et al., 2001). Too frequent Internet use can be related to several emotional and behavioral problems and distract learning (Dhir et al., 2015; Kubey et al., 2001; Yang & Tung, 2007; Zhang et al., 2018). However, Internet use's negative effect on academic achievement can be mediated through academic engagement (Zhang et al., 2018); using the Internet mostly for schoolwork makes it more likely to be positively related to academic performance (Kim et al., 2017). Still, we can expect adolescents to use the Internet mostly for leisure activities (Li et al., 2017); thus, the current study investigated how much participants have experienced Internet use distracting them from schoolwork (Kubey et al., 2001).

Too frequent screen time and its relation to sleep time has also been widely discussed (Hale & Guan, 2015; Przybylski, 2019). The current study asks students whether too frequent Internet use has led them to sleep less and feel tired during the day. Sleep impairment itself may negatively affect students' academic achievement (Wolfson & Carskadon, 2003) and learning motivation (Edens, 2006), but students who report problems with too frequent Internet use also tend to report lower academic achievement (Dhir, 2015). Boys in particular might have a higher tendency for excessive Internet use (Dhir, 2015; Kubey et al., 2001),

although they tend to report higher digital learning preferences and wish for digital schoolwork as well (Hietajärvi et al., 2020).

Students' digital engagement can be related to their socioeconomic status (SES); for example, students from higher SES families might have better access to the Internet (Livingstone & Helsper, 2007), and their parents might provide more support for their digital learning preferences (Barron et al., 2009). Although Finnish students have good access to digital technologies (OECD, 2015), a gap in access might still exist, thereby affecting interest in digital technologies among students from different SES families (i.e., digital divide).

1.2 Achievement Goal Orientations

Achievement goal orientations are part of self-regulated learning and are defined as persons' goals relevant to their learning aspirations (Ames, 1992; Boekaerts & Niemivirta, 2000; Dweck & Leggett, 1988; Pintrich, 2000a). Mastery (or task) goals are related to the need for competence and imply pursuing a deeper understanding of a topic under study. Performance (or ability) goals refer to demonstrating competence compared with others and thus relate to social interactions (Ames, 1992; Anderman & Maehr, 1994; Dweck & Leggett, 1988). More recent classifications of mastery and performance goals include an avoidance dimension; students more inclined toward performance-avoidance try to avoid situations that could imply that they are incompetent (Elliot & McGregor, 2001; Midgley & Urdan, 2001). Mastery-avoidance indicates that one is trying to avoid losing their skills, avoid misunderstanding, or forgetting the studied material (Elliot, 2005; Elliot & McGregor, 2001). However, the counterintuitive nature of the mastery-avoidance concept has raised some critiques of the concept and related empirical results (e.g., Bong, 2009; Carr & Marzouq, 2012; Ciani & Sheldon, 2010).

Mastery goals have also been separated into mastery-intrinsic and mastery-extrinsic goal orientations (Niemivirta, 2002). Mastery-intrinsic goals focus on learning and gaining

new knowledge (i.e., mastery-approach) whereas mastery-extrinsic goals concentrate on getting good grades and succeeding in school. In other words, students use extrinsic criteria to evaluate whether they have attained the given goal of mastering a subject (Niemivirta, 2002).

Aside to mastery and performance goals, work-avoidance has been discussed as an aspect of achievement goals. Whereas mastery- and performance-avoidance emphasize either not gaining or demonstrating enough skills or knowledge (Elliot & McGregor, 2001; Midgley & Urdan, 2001), work-avoidance is a type of academic alienation indicating that one wants to complete studies as easily as possible (Nicholls et al., 1985). Thus, work-avoidance indicates general effort put into learning.

1.3 Achievement Goal Orientation Profiles

The goal orientation research demonstrates that students can endorse different goals simultaneously, and the multiple goal approach (Harackiewicz et al., 1998; Pintrich, 2000a, 2000b) has gained substantial support over the years (Niemivirta et al., 2019; Wormington & Linnenbrink-Garcia, 2017). For example, Luo and colleagues (2011) used a common combination of a mastery-approach, performance-approach, and performance-avoidance to identify profiles. Their results implied that moderate mastery and performance-approach groups had the most adaptive learning behavior (e.g., higher persistence and lower test anxiety). However, combining high performance-approach goals with high performance-avoidance and low mastery goals led to difficulties in learning.

Several studies have investigated adolescents' achievement goal orientation profiles by combining mastery-intrinsic, mastery-extrinsic, performance-approach, performance-avoidance, and work-avoidance goals (e.g., Hietajärvi et al., 2015; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012). These studies have systematically identified a four-profile solution: high mastery-intrinsic and mastery-extrinsic goals together with lower levels

of performance-approach, and performance-avoidance, and work-avoidance (i.e., mastery-oriented); high mastery-intrinsic, mastery-extrinsic, performance-approach and -avoidance together with lower work-avoidance (success-oriented); low levels of mastery-intrinsic, mastery-extrinsic, and performance-approach, but somewhat higher performance-avoidance and elevated work-avoidance (avoidance-oriented); and similar, moderate levels of all different achievement goal orientations (indifferent).

Overall, mastery- and success-oriented students seem to be quite alike in their learning commitment and effort, and both profile types can be considered adaptive motivational profiles (Pintrich, 2000b; Tuominen-Soini et al., 2011, 2012). Still, students with the success-oriented profile might experience more fear of failure (Tuominen-Soini et al., 2011), exhaustion, a cynical and detached attitude toward school, and feelings of inadequacy as a student (i.e., school burnout; Salmela-Aro et al., 2009; Tuominen-Soini et al., 2012) due to their stronger emphasis on performance. Thus, the mastery-oriented profile might have some advantages over the success-oriented profile. Indifferent students represent an average student in both their motivation and academic achievement, but avoidance-oriented students seem to have the least adaptive profile when accounting for different motivational and emotional characteristics related to schoolwork (Hietajärvi et al., 2015; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012).

Longitudinal studies have shown both stability and change in achievement goal profiles. Some studies suggest that many students might change their motivational profile group over time (Schwinger et al., 2016; Schwinger & Wild, 2012). Other studies have reported fairly stable profiles (Jansen in de Wal et al., 2016; Lo et al., 2017; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012). Students' digital engagement could be related to their goal orientation stability or change. Thus, the current study investigates whether digital

engagement could play a role in either adaptive or maladaptive change in students' motivational aspirations over a one-year period.

1.4 Relationships between Students' Digital Engagement and Achievement Goal Orientations

To date, numerous studies have investigated relationships between use of digital tools for learning and students' achievement (e.g., Archer et al., 2014; Little et al., 2018; Young et al., 2018). Similarly, achievement goal orientation profiles in relation to other motivational characteristics, academic achievement, and overall well-being in school have been widely studied (see Niemivirta et al., 2019; Wormington & Linnenbrink-Garcia, 2017). However, less is known about the relationships between students' digital engagement and goal orientation profiles. Understanding these relationships could help further explain students' expectations for their learning environment and motivational aspirations.

Previous studies have indicated that higher academic motivation may enhance the use of digital media for learning (Chang et al., 2019). Achievement goal orientations could also be related to how students utilize learning possibilities provided by digital media and tools (Orlando et al., 2018). For example, mastery-oriented students might be more engaged in learning new skills and gaining knowledge with the help of digital tools; performance-oriented students, in contrast, might merely aim to complete the task at hand (Orlando et al., 2018). Digital tools can also support students' need for autonomy and competence (i.e., connected learning; Barron, 2006; Ito et al., 2013; Kumpulainen & Sefton-Green, 2014), which becomes increasingly important during adolescence (Eccles et al., 1993).

Adolescents experience increased concern about their status related to their peers (Eccles et al., 1993), which can manifest in higher performance goals (Anderman et al., 2002). Students with a success-oriented profile (i.e., higher performance-approach and avoidance goals together with high mastery goals) could have some negative learning

experiences (e.g., fear of failure or exhaustion; Salmela-Aro et al., 2009; Tuominen-Soini et al., 2011, 2012). Thus, due to their stronger emphasis on academic achievement, success-oriented students might struggle with too frequent Internet use for academic purposes (Kim et al., 2017), which could also be related to sleep impairment.

Avoidance-oriented students might be less likely to use digital media for academic purposes than students with more adaptive goal orientation profiles (Hietajärvi et al., 2015). Moreover, students who tend to use the Internet for more general rather than academic purposes might have lower academic performance (Kim et al., 2017), but problematic Internet use might also be related to lower motivation to learn (Truzoli et al., 2019). Such relationships indicate that digital engagement might differ for students with distinct motivational profiles.

1.5 Finnish Education System

In Finland, where the current study was conducted, students enter compulsory, comprehensive education in the year when they turn seven and compulsory education lasts for nine years ("Finnish education in a nutshell," 2018). At comprehensive schools, most students follow the same general track guided by the Finnish Core Curriculum (OPS). Thus, the current study followed students during the last two years of their compulsory education before transitioning to secondary education.

After completing comprehensive education, students can choose to continue in general upper secondary education (high school), vocational upper secondary education, or to discontinue studying. Admission to upper secondary schools is mainly based on students' grades, and entering high school can be quite competitive; thus, final years in compulsory education can be stressful for students. Most students continue their studies after compulsory education; for example, in 2017, 53% continued to high school and 41% to vocational education immediately after comprehensive school (Official Statistics of Finland, 2018).

The transition to upper secondary education is a key educational transition in Finland and can be challenging for many students. Adjustment and disengagement issues during this crucial educational phase can have long-term consequences. Therefore, investigating digital engagement and achievement goal orientations during the final years of comprehensive school can provide further information on how to support students to better handle this critical period.

1.6 Aims and Hypotheses

The current study aims to investigate students' digital engagement and achievement goal orientation profiles longitudinally in Grades 8 to 9. We examine how students with different goal orientation profiles differ in their digital learning preference, wish for digital schoolwork, and schoolwork and sleep impairment related to Internet use. The main research questions and hypotheses are as follows.

First, what types of achievement goal orientation profiles can be identified in Grades 8 and 9 and will students remain in a similar profile through both assessment points? Based on previous studies (Hietajärvi et al., 2015; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012), we expect at least four groups with different achievement goal orientation profiles to emerge in both grades: mastery-oriented, success-oriented, avoidance-oriented, and indifferent (Hypothesis 1a). As goal orientation profiles tend to be rather stable in adolescence (Jansen in de Wal et al., 2016; Lo et al., 2017; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012), we also assume that most students remain in the same or a similar profile group through both assessment points (Hypothesis 1b).

Second, how do digital learning preference, wish for digital schoolwork, and schoolwork and sleep impairment related to Internet use differ between students with distinct goal orientation profiles at both time points and longitudinally? Based on the studies including motivational aspects of learning (Halonen et al., 2016; Hietajärvi et al., 2015), we

hypothesize that mastery- or success-oriented students have higher digital learning preferences and wish for digital schoolwork than other students (Hypothesis 2a). As previous studies have indicated that too frequent Internet use can be related to lower engagement and maladaptive learning behavior (Dhir et al., 2015; Kubey et al., 2001; Yang & Tung, 2007), we also hypothesize that avoidance-oriented students experience higher schoolwork impairment related to Internet use than students with more adaptive goal orientation profiles (Hypothesis 2b).

Third, how do grade point average (GPA), socioeconomic status (SES), and students' gender relate to digital engagement? In Finland, students have good access to digital technologies (OECD, 2015), so we do not expect a significant correlation between SES and digital learning preferences (Hypothesis 3a); however, we hypothesize (Hypothesis 3b) that schoolwork impairment related to Internet use is negatively related to GPA (Dhir et al., 2015).

2. Method

2.1 Sample and Procedure

The sample included 1,482 Finnish students from Grades 8 to 9 (age ~15 – 16 yrs., 53% female, 40% male, 7% other or not specified). The data were collected once in Grade 8 (N = 1215) and once in Grade 9 (N = 934). Of all participants, 667 (45%) students participated in the study at both assessment points. The participants filled in a self-report questionnaire; students' grades were drawn from the registry maintained by the Education Division of the City of Helsinki. Participation in the study was voluntary and informed consent forms were collected from the students and their parents. All teachers in the schools that were able to organize data collection administered the questionnaires during school hours. Because of the data collection procedure, the reasons for dropout may be due to either the schools' or the

teachers' inability to incorporate the data collection within their timeframe, the students being absent during the data collection or unwilling to respond.

2.2 Measures

Digital engagement. Four aspects of digital engagement were assessed. *Digital learning preference* (DLP; Hietajärvi et al., 2020; see also Halonen et al., 2017) was measured with four items that assessed having a preference towards learning and solving problems with digital technologies (e.g., "I'm happy to solve challenging problems related to digital technologies"). *Wish for digital schoolwork* (see Halonen et al., 2017; Hietajärvi et al., 2020; Salmela-Aro et al., 2016) was measured with three items that assessed whether students favor using digital technologies in schoolwork (e.g., "I'm more engaged in my schoolwork when I'm able to use digital technologies"). Students rated all items using a 5-point Likert-type scale ranging from 1 (Completely disagree) to 5 (Completely agree). *Schoolwork and sleep impairment related to Internet use* was measured using five items. Three assessed how often students think that their schoolwork suffers due to Internet use (e.g., "How often has your schoolwork been hurt because of the time you spend on Internet?"; see also Kubey et al., 2001) and two assessed how often students report feeling tired due to Internet use (e.g., "How often did you feel too tired to go to school the next day because you spent too much time on the Internet the previous night?"; see also Kubey et al., 2001). Students rated the items using a 5-point Likert-type scale ranging from 1 (Never) to 5 (Always).

Achievement goal orientations. Five achievement goal orientations were assessed with the instrument by Niemivirta (2002; see also Niemivirta et al., 2019). Each of the goal orientations was assessed with three statements and students rated all items using a 7-point Likert-type scale ranging from 1 (Not true at all) to 7 (Very true). The scale for mastery-intrinsic orientation assessed students' focus on learning, understanding and gaining

competence (e.g., “To acquire new knowledge is an important goal for me in school”). The scale for mastery-extrinsic orientation assessed students’ aspiration to get good grades and succeed in school (e.g., “It is important to me that I get good grades”). The scale for performance-approach orientation assessed students’ focus on relative ability and judgments of competence (e.g., “An important goal for me in school is to do better than other students”). The scale for performance-avoidance orientation assessed the avoidance of demonstrating normative incompetence (e.g., “I try to avoid situations in which I might fail or make a mistake”). Finally, the scale for work-avoidance orientation assessed students’ desire to avoid achievement situations and to minimize the effort and time spent on studying (e.g., “I try to get away with as little effort as possible in my school work”).

Grade point average (GPA) was assessed using register-based yearly grade point averages across course grades in Mathematics, Finnish, Biology, and Physics. The grades were drawn from the registry maintained by the Education Division of the City of Helsinki.

Socioeconomic status (SES) was self-reported by the students by answering the question “How would you rate your family’s financial situation?” using a 5-point Likert-type scale ranging from 1 (Bad) to 5 (Good).

2.3 Data Analysis

The Mplus statistical package (Version 8.4; Muthén & Muthén, 1998–2017) and IBM SPSS Statistics 25 were used for the analyses. Nearly half of students (45%) participated in the study at both time points. We used Little’s MCAR test (Little, 1988) to test whether the data missing completely at random (MCAR) but the results did not confirm MCAR (χ^2 (1147) = 1286.11, p = .002); thus, we assumed that the data was missing at random (MAR). Full information maximum likelihood (FIML) approach was used to estimate MI, LPA, LTA, and logistic regression models, as well the correlations between the variables. FIML relies on the MAR assumption; thus, it is robust to the presence of differences between participants

related to attrition on all variables included in the model which comprise the constructs themselves at the preceding time point (Enders, 2010; Graham, 2009, 2012; Newman, 2014). Importantly, FIML has performed well even with very high rates of missing data (e.g., Enders, 2010; Graham, 2009, 2012; Larsen, 2011; Shin et al., 2009; Zaninotto & Sacker, 2017).

We also specified a longitudinal measurement invariance (MI) model with the questionnaire data. All autocorrelations were allowed and all the models fitted the data well (see Appendix Table A.1). Model fit was evaluated by the chi-square, the Comparative Fit index (CFI, with a cutoff value of > .90), the Tucker Lewis index (TLI, cutoff value of > .90), the Root Mean Square Error of Approximation (RMSEA, cutoff value of < .08), and the Standardized Root Mean Square Residual (SRMR, cutoff value of < .08). Strict invariance models had good model fit for the five factors of achievement goal orientations, two factors of digital learning preference and wish for digital schoolwork, and two factors of schoolwork and sleep impairment related to internet use. Descriptive statistics, internal reliabilities (Cronbach's α) of the measures and bivariate correlations are presented in Appendix Tables A.3 and A.4.

Our first research aim was to examine how many and what kinds of profile groups can be identified on the basis of the five achievement goal orientations; and whether or not students tend to remain in a similar group between Grades 8 to 9. To achieve this aim, we applied latent profile analyses (LPA) and latent transition analyses (LTA) as mixture complex models with students' class as a cluster variable. The LPA analyses were conducted with the same set of variables both at Grade 8 and Grade 9. The LPA models were tested with different numbers of groups (2–5) to identify the most probable number of groups. The model fit indices, number of students to be assigned to a group, and theoretical justification together with the interpretability of the solution of the groups were taken into account when choosing

the number of groups (Bauer & Curran, 2003; Muthén, 2003). Latent transition probabilities (LTPs) were used to assess the stability of the achievement goal orientation groups. The fit of the model was evaluated by the Bayesian Information Criterion (BIC), the Adjusted Bayesian Information Criterion (aBIC), the Lo-Mendell Rubin Adjusted Likelihood Ratio Test (ALMRT), and the Vuong-Lo-Mendell-Rubin Likelihood Ratio Test (VLMRT). Lower BIC and aBIC values indicate a better model, and significant ALMRT and VLMRT values suggest the choice of a higher number of latent groups. Entropy was used to evaluate the classification quality, i.e. higher Entropy values indicating clearer classification (Muthén, 2003).

Our second aim concerned the extent to which the profile groups in Grades 8 and 9 would differ with respect to their digital engagement. This aim was examined by applying the Bolck-Croon-Hagenaars approach (BCH; Bolck et al., 2004; Asparouhov & Muthén, 2018; Bakk & Vermunt, 2016) to identify statistically significant differences between the mean scores. BCH method is applied as a last step in latent profile analysis and it allows to evaluate the means of continuous auxiliary variables across profile groups. BCH method is preferred since it uses weighted multiple group analysis where the profile groups of the latent profile analysis are already known and the auxiliary variables (i.e., digital engagement scores) do not affect the profile solution. In practice, using the BCH method for the comparison of means across the latent profiles takes into account also the classification uncertainty related to the latent profile memberships. As well, the BCH method performs well even if the variance of the auxiliary variable differs substantially across classes (Asparouhov & Muthén, 2018). We also examined with logistic regression whether digital engagement in Grade 8 is related to adaptive or maladaptive change in the most probable achievement goal orientation profile group.

To answer the third research question, we controlled relations to GPA, SES with correlations and gender imbalance with t-tests and chi-square tests.

3. Results

3.1 Achievement Goal Orientation Profiles

To answer the first research question, we used LPA to identify the possible number of groups in both grades and based on the results of LPA models (see Appendix Table A.2) we carried out LTA to investigate the stability and change of goal orientation profiles. The groups were similar in both grades (see Appendix Table A.5). Mastery-oriented students (18% of students in grade 8 and 17% in Grade 9) had high mastery-intrinsic and mastery-extrinsic goals, but lower performance-approach, performance-avoidance, and work-avoidance. Success-oriented students (39% and 35%) had the highest performance-approach, but also quite high mastery-intrinsic, mastery-extrinsic, performance-avoidance and somewhat lower work-avoidance. Indifferent students (34% and 41%) had slightly lower than average mastery-intrinsic and -extrinsic goals, and closer to average performance-approach and -avoidance goals, and work-avoidance. The smallest group of students were identified as avoidance-oriented (9% and 7%) having very low mastery-intrinsic and mastery-extrinsic goals, quite low performance-approach, but higher performance-avoidance and work-avoidance when compared with their mastery goals. Overall, the profiles also indicated that students tend to rate mastery-intrinsic and mastery-extrinsic goals at similar level.

As expected (H1b), latent transition probabilities (see Table 1) indicated that students tended to remain in the same or similar group through both time points. Most of the students in the mastery-oriented, success-oriented, and indifferent groups in Grade 8 were likely to remain in a similar group in Grade 9 (*LTP* = .68 – .72). Avoidance-oriented students, however, were also likely to move to the indifferent group in Grade 9 (*LTP* = .53) and, as well, success-oriented students (*LTP* = .27). Based on the most probable profile group, we

created a variable indicating whether a student is in a same group in both time points or do they change the group into more or less adaptive profile group. Overall, 80% of the students were likely to remain in the same group based on their most likely group membership (14% of students as stably mastery-oriented, 33% success-oriented, 32% indifferent, and 1% avoidance-oriented), 9% of students were likely to have an adaptive change (i.e., from avoidance-oriented to indifferent or success-oriented or mastery-oriented; from indifferent to success-oriented or mastery-oriented; from success-oriented to mastery-oriented) and 11% were likely to have a maladaptive change (i.e., from mastery-oriented to success-oriented, indifferent or avoidance-oriented; from success-oriented to indifferent or avoidance-oriented; from indifferent to avoidance-oriented).

3.2 Differences in Digital Engagement

To answer the second research question, differences between the students in distinct achievement goal orientation groups in digital learning preference, wish for digital schoolwork, and schoolwork and sleep impairment related to Internet use were analyzed using the BCH method (see Tables 2 and 3). Digital learning preference in Grade 8 was the highest for the success-oriented students but all the other groups had a similarly average score. In Grade 9, success-oriented students had higher digital learning preferences only in comparison to indifferent and avoidance-oriented students. Interestingly, the results indicated that mastery-oriented students remained with an average score since they did not differ from all the other groups.

Wish for digital schoolwork was the highest for the success-oriented students in Grade 8 and still higher than for the mastery-oriented students and avoidance-oriented students in Grade 9. Surprisingly, both digital learning preference and wish for digital schoolwork were quite similar for mastery- and avoidance-oriented students in both grades although we expected that mastery-oriented students would have similar results with success-oriented students (H2a).

However, only wish for digital schoolwork in Grade 8 negatively predicted maladaptive change in the most probable goal orientation profile group (see Table 3).

Schoolwork impairment related to Internet use was the lowest for the mastery-oriented students in both grades. We hypothesized (H2b) that avoidance-oriented students experience higher schoolwork impairment related to Internet use than students with more adaptive goal orientation profiles; however, all three profile groups (except for mastery-oriented) had similarly average scores in schoolwork impairment related to Internet use.

The results concerning sleep impairment related to Internet use indicated that mastery-oriented students also had the lowest average score in Grade 8 compared to others, but in Grade 9 the results were slightly different. Accordingly, mastery- and avoidance-oriented students had a quite similarly low average score in sleep impairment. Success-oriented and indifferent students still had statistically significantly higher sleep impairment than the mastery-oriented students in Grade 9.

3.3 The Role of GPA, SES and Gender

Contrary to our hypothesis (H3a), SES was related to digital learning preference (r = .12, p = .00) in Grade 9 but also to schoolwork impairment related to Internet use in Grade 8 (r = -.11, p = .00). As expected (H3b), schoolwork impairment related to Internet use was negatively related to GPA in both grades (r = -.31 and -.23, p = .00) but also sleep impairment related to Internet use was negatively related to GPA in Grade 8 (r = -.17, p = .00). As for gender differences, boys tended to have higher average scores in digital learning preferences than girls (d = 0.86 in Grade 8 and 0.68 in Grade 9). boys tended to have significantly higher wish for digital schoolwork than girls (d = 0.63 and 0.61). However, there were no gender differences in schoolwork and sleep impairment related to Internet use.

We also controlled for GPA, SES and gender balance in the goal orientation groups (see Appendix Tables A.3 and A.4). The results indicated that mastery- and success-oriented

students had similarly high GPA and SES, and avoidance-oriented students had the lowest GPA and the lowest SES in both grades. The chi-square test using the most likely group membership and reported gender (male or female) indicated that in Grade 8 there were significantly more girls in the mastery-oriented and indifferent group [$\chi^2(3, N = 1278) = 37.86, p = .00$], the same proportional differences were in Grade 9 [$\chi^2(3, N = 1278) = 31.01, p = .00$].

4. Discussion

The current study investigated students' digital engagement in relation to their achievement goal orientation profiles in Grades 8 to 9. The types and stability of the achievement goal orientation groups of the current study were in accordance with previous empirical findings. However, some interesting and novel results emerged concerning students' digital engagement in different profiles.

4.1 Achievement Goal Orientation Profiles

Four achievement goal orientation profiles were identified, similarly to previous findings (Hietajärvi et al., 2015; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012). Mastery-oriented students (17%–18%) were driven to gain new knowledge, succeed in school, and get good grades. They had a lower tendency than others to prove their competence, a low concern about failing in front of others, and lower work-avoidance. Thus, they were willing to put effort into their schoolwork, as indicated by their high GPAs.

Success-oriented students (35%–39%) had quite high goals to learn and succeed in school, and their GPAs were high; thus, they seemed similar to mastery-oriented students in their learning commitment (Bong, 2009; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012), yet they were more performance driven. The success-oriented group was one of the largest groups in the current study, showing that many adolescents are more inclined to performance goals (Anderman et al., 2002).

Although the success-oriented group was quite stable over time, several success-oriented students were still likely to move to the indifferent group in Grade 9 with lower learning goals. Grade 9 is the final year of comprehensive school in Finland, so such a transition into a slightly less-engaged motivational group might be concerning. Success-oriented students might be more vulnerable due to a higher fear of failure (Hietajärvi et al., 2015; Tuominen-Soini et al., 2011) or anxiety (Bong, 2009), and they could lower their goals when facing challenges. Overall decline in motivation during adolescence has been previously noted as well (Eccles et al., 1993).

Indifferent students (34%–41%) had close to average scores in all five achievement goal orientations. This group tended to be quite stable over time; however, about 13% of students from other groups in Grade 8 were likely to move into the indifferent group, making it the largest group in Grade 9. This type of achievement goal orientation profile can be characterized as a typical student who acknowledges the importance of studying, but is not very dedicated into achieving learning goals (Tuominen-Soini et al., 2011).

Avoidance-oriented students (7%–9%) reported low mastery goals but a higher goal to put as little effort as possible into schoolwork. The avoidance-oriented group was not as stable as other groups; several avoidance-oriented students from Grade 8 were likely to move into the indifferent group in Grade 9. Such a transition into a slightly more motivated group might be due to the upcoming end of comprehensive school in Grade 9. Still, avoidance-oriented students have been described as the least adaptive due to their low motivation toward schoolwork and lower emotional well-being (Hietajärvi et al., 2015; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012). In the current study, they also tended to have low GPAs.

The profiles also indicated that students tend to rate mastery-intrinsic and mastery-extrinsic goals at similar levels even though mastery-intrinsic orientation is based on intrinsic criteria (e.g., feelings of understanding) and mastery-extrinsic is grounded on successfully

meeting extrinsic assessment criteria (e.g., grades). Still, we can assume that by the end of comprehensive school students grades and understanding of learnt material are tightly related. One needs to understand the material to meet the extrinsic goal. As well, in the Finnish education context, comprehensive school GPA has an important role regarding students' academic future. Thus, even if students would like to concentrate mainly on mastery-intrinsic goals it is reasonable to also meet the extrinsic criteria to have wider range of options for their future.

4.2 Digital Learning Preferences and Wish for Digital Schoolwork in Different Goal Orientation Groups

Digital learning preference tended to be especially high for the success-oriented group, who were rather keen to solve challenging tasks using digital tools. Success-oriented students also tended to have high wish for digital schoolwork, implying they might experience a gap between their learning preferences and schoolwork assignments (Halonen et al., 2016). Meanwhile, other groups were quite similar in their digital learning preferences, which was somewhat surprising as mastery-oriented students generally show high overall school engagement (Bong, 2009; Schwinger et al., 2016; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012) and report Internet-based academic participation (e.g., using Internet for schoolwork), similar to success-oriented and indifferent students (Hietajärvi et al., 2015). The current study's results indicated that mastery-oriented students did not seem to be particularly interested in using more digital tools in their schoolwork and perhaps were already content with the current situation.

Wish for digital schoolwork tended to be higher for indifferent students than mastery-oriented students in both grades. Although not highly invested in learning, they would apparently like to have more digital tools included in schoolwork (as would success-oriented

students). Including more digitally mediated schoolwork in the curriculum might support the development of their motivational goals.

Interestingly, avoidance-oriented students had similar digital learning preferences and wish for digital schoolwork as the mastery-oriented students; however, these two groups differ in their learning goals, so the reasons for these similarly low scores are likely different. Avoidance-oriented students might be less interested in learning overall and, thus, not be as eager to use digital tools for schoolwork. Mastery-oriented students, however, are highly engaged and perhaps tend to be content with their current learning environment.

Digital learning preference was also negatively related to students' SES in Grade 9 indicating that students from lower SES families might have less support for advancing their digital skills (Barron et al., 2009). Digital learning preference and wish for digital schoolwork were not related to students' GPA, indicating that digital engagement is not directly related to academic achievement. However, the differences between goal orientation profile groups indicated that students with either average (indifferent group) or high achievement goals (success-oriented group) might wish for more digitally mediated schoolwork because they believe such learning could be motivating. Students with lower achievement goals might not be more motivated by digital technologies in school as their wish to do schoolwork is not that high. Moreover, students with lower wish for digital schoolwork were likely to have a maladaptive change in their achievement goal profile, indicating a decline in their motivation to learn. Although using digital tools for learning in school might be motivating for students (Chen et al., 2016; Salmela-Aro et al., 2016; Shapley et al., 2011), it does not necessarily apply for all students.

4.3 Schoolwork and Sleep Impairment Related to Internet Use in Different Goal Orientation Groups

An inclination toward mastery is related to higher well-being (Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012); similarly, in the current study, mastery-oriented students reported low schoolwork and sleep impairment related to Internet use. However, only about one fifth of students tended to have a mastery-oriented profile. The result is a little worrisome when the highly adaptive nature of this profile is taken into account. The students in the current study were facing an important educational transition from comprehensive to secondary school, which could be exceedingly challenging for students with less adaptive profiles. Thus, the development of mastery goal orientations should be more supported in schools.

Success-oriented students reported somewhat higher schoolwork and sleep impairment related to Internet use than mastery-oriented students. Schoolwork impairment related to Internet use was also negatively related to GPA in general, but the results imply that some highly motivated students with high GPAs still report distinct levels of schoolwork impairment. Moreover, success-oriented students, who had good learning outcomes, reported similar schoolwork and sleep impairment related to Internet use as avoidance-oriented students, who had lower GPAs. Thus, schoolwork impairment might have a different meaning for different students. For example, success-oriented students might experience negative emotional challenges in school (Bong, 2009; Tuominen-Soini et al., 2012) and be more critical toward their learning outcomes whereas indifferent or avoidance-oriented students might report more adequate schoolwork impairment related to their lower GPAs.

Interestingly, sleep impairment was similarly low for mastery- and avoidance-oriented students; however, they had different achievement goals, schoolwork impairment related to Internet use, and GPAs. For mastery-oriented students, low sleep impairment fits well with their overall adaptive profile, indicating that their schoolwork and sleep probably do not suffer from excessive Internet use. Avoidance-oriented students with their somewhat

dispassionate attitude toward learning might overall feel less concern about sleep impairment and Internet use related to schoolwork and, thus, report low scores.

4.4 Limitations

The current study has some important limitations. First, only 45% of students participated in the study at both time points, which could affect the results; still, we can assume that the data were missing at random, and we used FIML to handle missing data. Second, students answered self-reported questionnaires; their answers may have been affected by social desirability (Tan & Hall, 2005) and subjective interpretations of the statements and Likert-type answers (Karabenick et al., 2007). Internet use and sleep impairment were self-reported and not controlled via more accurate measures; thus, students with different Internet use frequency and sleep time might still report similar scores and vice versa. Finally, latent profiles, transitions, and differences in profiles do not imply causal relationships, meaning that the results should be interpreted cautiously.

4.5 Conclusions and Future Directions

The current study provided novel results concerning students' digital engagement and achievement goal profiles. The results indicated that students with either average or high achievement goals might wish for more digital schoolwork; however, students in the least adaptive motivational profile (avoidance-oriented) are probably quite impassionate about digitally mediated learning. Thus, digitally mediated learning itself cannot be considered directly motivating for students, and students' motivational profiles should also be considered when implementing more digital tools into schoolwork.

Schoolwork impairment related to Internet use was negatively correlated to GPA, but the person-oriented analysis results indicated that some highly motivated students with high GPAs also reported too frequent Internet use and schoolwork impairment. Thus, the study

demonstrated the value of person-oriented research, but further studies are needed to investigate the reasons and explanations behind these results.

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Table 1

Latent Transition Probabilities from Grades 8 to 9

	Grade 9			
Grade 8	Mastery-oriented (17%)	Success-oriented (35%)	Indifferent (41%)	Avoidance-oriented (7%)
Mastery-oriented (18%)	.69	.12	.16	.03
Success-oriented (39%)	.04	.68	.27	.02
Indifferent (34%)	.02	.15	.72	.11
Avoidance-oriented (9%)	.08	.00	.53	.39

Table 2

Mean Differences in Digital Engagement, GPA, and SES between the Latent Goal Orientation Profiles in Grades 8 and 9

Measure	1. Mastery-oriented		2. Success-oriented		3. Indifferent		4. Avoidance-oriented		χ^2	*p*	Summary of significant differences
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*			
Grade 8											
Digital learning preference	2.64	0.10	3.02	0.08	2.73	0.07	2.63	0.14	13.38	.00	2 > 1, 3, 4
Wish for digital schoolwork	2.69	0.10	3.30	0.08	3.09	0.07	2.88	0.17	21.68	.00	2 > 3, 4, 1 3 > 1
Schoolwork impairment related to Internet use	1.41	0.04	1.96	0.05	2.12	0.06	2.19	0.12	127.92	.00	2, 3, 4 > 1
Sleep impairment related to Internet use	1.56	0.06	2.18	0.06	2.14	0.06	2.18	0.12	79.21	.00	2, 3, 4 > 1
GPA	8.62	0.07	8.47	0.07	7.82	0.07	7.42	0.13	187.00	.00	1, 2 > 3 > 4
SES	4.16	0.09	4.06	0.06	3.83	0.06	3.52	0.15	19.18	.00	1, 2 > 3, 4

Grade 9											
Digital learning preference	2.73	0.16	2.96	0.08	2.66	0.07	2.36	0.16	15.52	.00	2 > 3, 4
Wish for digital schoolwork	2.57	0.13	2.94	0.08	2.92	0.09	2.37	0.20	12.37	.01	2, 3 > 1, 4
Schoolwork impairment	1.55	0.08	2.01	0.06	2.25	0.06	2.19	0.20	45.17	.00	2, 3, 4 > 1
related to Internet use											3 > 2
Sleep impairment related to	2.00	0.10	2.29	0.07	2.30	0.07	2.02	0.15	8.41	.04	2, 3 > 1
Internet use											3 > 4
GPA	8.61	0.13	8.77	0.09	8.05	0.10	7.40	0.17	102.48	.00	1, 2 > 3 > 4
SES	4.15	0.11	3.98	0.06	3.97	0.07	3.37	0.19	15.19	.00	1, 2, 3 > 4

Note. Numbers in the last column indicate difference between achievement goal orientation profile groups based on the BCH method.

Table 3

Predictors of Adaptive and Maladaptive Change in Goal Orientations

Grade 8 predictor	Adaptive change				Maladaptive change			
	B	*SE B*	*OR*	*SE OR*	*B*	*SE B*	*OR*	*SE OR*
Digital learning preference	-0.07	0.12	0.94	0.12	0.21	0.11	1.23	0.13
Wish for digital schoolwork	-0.11	0.12	0.90	0.10	-0.23*	0.09	0.80*	0.07
Schoolwork impairment related to Internet use	0.20	0.16	1.22	0.20	0.23	0.15	1.25	0.18
Sleep impairment related to Internet use	0.03	0.14	1.03	0.15	-0.15	0.13	0.86	0.12
GPA	-0.23*	0.10	0.79*	0.08	-0.05	0.10	0.96	0.10
SES	-0.18	0.12	0.84	0.10	0.30*	0.13	1.35*	0.17

Note. B = unstandardized coefficient, *SE* = standard error, *OR* = odds ratio. The reference group is the stable goal orientation group.

*$p < .05$

Appendix A

Table A.1

Fit Indices of the Measurement Invariance Models

Measure	Fit indices										
	χ^2	*df*	*scf*	*p*	$\Delta\chi^2$	*df*	*p*	*RMSEA*	*CFI*	*TLI*	*SRMR*
Achievement goal orientations											
Configural invariance	1296.21	345	1.23	< .01				.04	.93	.91	.07
Metric invariance	1331.07	360	1.22	< .01	29.87	15	< .01	.04	.93	.91	.07
Scalar invariance	1408.55	375	1.21	< .01	82.93	15	< .01	.04	.92	.91	.07
Strict invariance	1418.68	390	1.24	< .01	27.55	15	< .05	.04	.92	.92	.07
Digital engagement											
Configural invariance	259.73	64	1.17	< .01				.05	.98	.97	.03
Metric invariance	276.62	71	1.14	< .01	13.24	7	> .05	.04	.98	.97	.04
Scalar invariance	322.47	78	1.13	< .01	47.68	7	< .01	.05	.97	.97	.04
Strict invariance	317.19	85	1.19	< .01	7.03	7	> .05	.04	.97	.97	.04

Schoolwork and sleep impairment related to Internet use										
Configural invariance	72.36	24	1.26	< .01			.04	.99	.99	.02
Metric invariance	85.49	29	1.22	< .01	12.77	5	< .05	.04	.99	.98	.04
Scalar invariance	111.55	34	1.19	< .01	28.00	5	< .01	.04	.98	.98	.04
Strict invariance	111.34	39	1.21	< .01	1.47	5	> .05	.04	.98	.98	.04

Table A.2

Fit Indices for Latent Profile Analysis for 2–5 Latent Profiles Groups in Grades 8 and 9

Number of profiles	Log-likelihood	Para-meters	*BIC*	*aBIC*	*VLMRT p*	*ALMRT p*	Entropy	group 1 (%)	group 2 (%)	group 3 (%)	group 4 (%)	group 5 (%)
Grade 8 (N = 1087)												
Two groups	-9537.08	16	19186.02	19135.20	.00	.00	.79	29	71			
Three groups	-9315.15	22	18784.10	18714.23	.00	.00	.86	8	34	58		
Four groups	-9125.06	28	18445.88	18356.94	.18	.19	.81	8	19	34	39	
Five groups	-9035.25	34	18308.20	18200.21	.04	.04	.81	6	16	26	26	26
Grade 9 (N = 807)												
Two groups	-6924.94	16	13956.97	13906.16	.00	.00	.75	38	62			
Three groups	-6802.39	22	13752.04	13682.18	.00	.00	.84	56	6	38		
Four groups	-6674.29	28	13536.00	13447.08	.01	.01	.80	7	38	38	17	
Five groups	-6611.490	34	13450.55	13342.58	.14	.15	.79	6	18	31	19	26

Note. BIC = Bayesian information criterion; *aBIC* = Adjusted Bayesian information criterion; *VLMRT* = Vuong-Lo-Mendell-Rubin Likelihood Ratio test; *ALMRT* = Lo-Mendell-Rubin adjusted likelihood ratio test.

Table A.3

Descriptive Statistics and Internal Reliabilities (Cronbach's α) of the Measures

Measure	Range	Grade 8						Grade 9					
		α	General M (SD)	Female M (SD)	Male M (SD)	*t*	*d*	α	General M (SD)	Female M (SD)	Male M (SD)	*t*	*d*
Mastery-intrinsic	1 – 7	.89	4.71 (1.47)	4.84 (1.43)	4.64 (1.46)	2.201*	0.14	.88	4.76 (1.41)	4.89 (1.36)	4.55 (1.43)	3.41**	0.24
Mastery-extrinsic	1 – 7	.91	5.42 (1.46)	5.65 (1.37)	5.20 (1.47)	5.22**	0.32	.90	5.24 (1.45)	5.40 (1.39)	5.00 (1.49)	3.82**	0.27
Performance-approach	1 – 7	.78	4.08 (1.55)	4.02 (1.54)	4.22 (1.55)	2.10*	0.13	.78	4.05 (1.48)	4.05 (1.45)	4.05 (1.51)	0.05	0.00
Performance-avoidance	1 – 7	.86	3.98 (1.69)	4.02 (1.72)	3.94 (1.64)	0.73	0.05	.87	4.13 (1.54)	4.22 (1.58)	3.98 (1.47)	2.15*	0.16
Work-avoidance	1 – 7	.74	4.25 (1.44)	4.21 (1.45)	4.32 (1.41)	1.23	0.08	.74	4.34 (1.42)	4.24 (1.41)	4.47 (1.40)	2.28*	0.16
Digital learning preference	1 – 5	.91	2.83 (1.13)	2.44 (0.99)	3.34 (1.09)	14.37**	0.86	.90	2.76 (1.09)	2.45 (0.94)	3.17 (1.14)	10.20**	0.68
Wish for digital schoolwork	1 – 5	.93	3.07 (1.24)	2.75 (1.18)	3.5 (1.19)	10.41**	0.63	.93	2.83 (1.19)	2.54 (1.10)	3.24 (1.18)	8.97**	0.61

Schoolwork impairment related to Internet use	1 – 5	.85	1.94 (0.88)	1.89 (0.84)	1.94 (0.85)	1.08	0.06	.87	2.05 (0.94)	2.00 (0.90)	2.08 (0.96)	1.26	0.09
Sleep impairment related to Internet use	1 – 5	.79	2.06 (0.95)	2.09 (0.96)	1.98 (0.89)	1.86	0.12	.83	2.22 (1.04)	2.26 (1.06)	2.15 (1.00)	1.51	0.10
GPA	5 – 10		8.14 (1.06)	8.39 (0.99)	7.91 (1.03)	8.26**	0.48		8.18 (1.12)	8.44 (1.05)	7.98 (1.09)	7.47**	0.43
SES	1 – 5		3.96 (0.98)	3.89 (1.00)	4.11 (0.90)	3.62**	0.23		3.96 (1.00)	3.88 (1.02)	4.09 (0.94)	2.83**	0.21

**$p < .01$

*$p < .05$

Table A.4

Bivariate Correlations between the Measures (N = 1482)

	N	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
1. Mastery-intrinsic G8	1134	-																				
2. Mastery-extrinsic G8	1134	.68*	-																			
3. Performance-approach G8	1136	.41*	.51*	-																		
4. Performance-avoidance G8	1134	.22*	.28*	.53*	-																	
5. Work-avoidance G8	1134	-.01	.14*	.25*	.35*	-																
6. Digital learning preference G8	1201	.19*	.08*	.18*	.09*	.05	-															
7. Wish for digital schoolwork G8	1198	.06	.03	.15*	.12*	.12*	.57*	-														
8. Schoolwork impairment related to Internet use G8	1201	-.19*	-.21*	.03	.17*	.30*	.03	.14*	-													
9. Sleep impairment related to Internet use G8	1200	-.12*	-.10*	.08*	.16*	.23*	.01	.11*	.67*													
10. GPA G8	1273	.23*	.40*	.18*	.01	-.07*	.01	-.08*	-.31*	-.17*	-											
11. SES G8	1103	.19*	.19*	.11*	-.03	-.05	.09*	.09*	-.11*	-.09*	.06	-										
12. Mastery-intrinsic G9	821	.53*	.39*	.15*	.09*	-.06	.10*	-.06	-.12*	-.04	.26*	.07	-									
13. Mastery-extrinsic G9	823	.41*	.54*	.26*	.12*	.03	.07	.05	-.17*	-.08*	.42*	.17*	.64*	-								
14. Performance-approach G9	825	.22*	.30*	.50*	.27*	.11*	.16*	.10*	.06	.07*	.26*	.04	.36*	.53*	-							
15. Performance-avoidance G9	821	.07	.12*	.27*	.52*	.19*	.04	.08*	.21*	.18*	.09*	-.09*	.20*	.24*	.49*	-						
16. Work-avoidance G9	817	-.17*	-.03	.06	.14*	.51*	.02	.10*	.24*	.17*	-.01	-.08*	-.10*	.06	.16*	.26*	-					

17. Digital learning preference G9	927	.15*	.06	.14*	.06	.05	.60*	.42*	.01	.01	.03	.10*	.14*	.14*	.16*	.07	.04	-		
18. Wish for digital schoolwork G9	925	.04	-.02	.07	.08*	.07	.43*	.57*	.13*	.07	-.10*	.10*	-.00	.06	.12*	.09*	.13*	.64*	-	
19. Schoolwork impairment related to internet use G9	919	-.11*	-.19*	.01	.11*	.20*	.06	.18*	.54*	.38*	-.21*	-.09*	-.17*	-.18*	.03	.16*	.32*	.10*	.19*	-
20. Sleep impairment related to internet use G9	915	-.05	-.08*	.01	.08*	.12*	.02	.13*	.41*	.47*	-.04	-.09*	-.02	-.03	.07*	.11*	.23*	.09*	.14*	.68*
21. GPA G9	1288	.22*	.41*	.20*	.01	-.06	.03	-.05	-.29*	-.15*	.93*	.09*	.28*	.47*	.28*	.09*	-.05	.07	-.07	-.23*
22. SES G9	765	.08	.10*	.04	-.06	-.07	.04	.12*	-.02	-.02	.00	.66*	.08*	.14*	.05	-.06	-.08*	.12*	.09*	-.03

*$p < .01$

Table A.5

Mean Differences in Achievement Goal Orientations between the Most Probable Goal Orientation Profile Group in Grades 8 and 9

Measure	Mastery-oriented			Success-oriented			Indifferent			Avoidance-oriented			*df*	*F*	*p*	η^2
	Range	*M*	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range	*M*	*SD*				
Grade 8																
Mastery-intrinsic	2.33 - 7	5.72	1.06	1.33 - 7	5.45	1.15	1 - 7	4.03	0.84	1 - 7	2.36	1.14	3, 1081	357.62	.00	.50
Mastery-extrinsic	4.67 - 7	6.36_a	0.59	4.67 - 7	6.47_a	0.59	2.67 - 7	4.58	0.73	1 - 4.67	2.42	0.94	3, 1081	1297.60	.00	.78
Performance-approach	1 - 5.33	2.78	1.11	3 - 7	5.48	0.90	1 - 6	3.74	0.91	1 - 4.67	1.98	0.81	3, 1083	625.95	.00	.63
Performance-avoidance	1 - 7	2.73_a	1.44	1 - 7	5.02	1.52	1 - 7	3.88	1.18	1 - 7	2.52_a	1.45	3, 1081	168.56	.00	.31
Work-avoidance	1 - 7	3.54_a	1.40	1 - 7	4.66	1.43	1.67 - 7	4.38	1.07	1 - 7	3.34_a	1.81	3, 1081	46.55	.00	.11
Grade 9																
Mastery-intrinsic	3 - 7	5.88	1.01	1 - 7	5.53	1.05	1 - 7	4.10	0.90	1 - 4.33	2.34	0.87	3, 797	290.58	.00	.52
Mastery-extrinsic	4 - 7	6.16	0.73	5 - 7	6.38	0.63	1.67 - 7	4.45	0.87	1 - 3.67	2.31	0.83	3, 799	668.86	.00	.72
Performance-approach	1 - 5.33	2.81	1.07	2.67 - 7	5.50	0.91	1 - 6.67	3.73	0.88	1 - 4	1.99	0.82	3, 801	421.39	.00	.61
Performance-avoidance	1 - 7	2.82_a	1.41	1 - 7	5.10	1.39	1 - 7	4.08	1.08	1 - 7	2.79_a	1.50	3, 797	120.63	.00	.31
Work-avoidance	1 - 7	3.73_a	1.41	1 - 7	4.60_b	1.50	1 - 7	4.43_b	1.11	1 - 7	3.88_{ab}	1.97	3, 794	14.82	.00	.05

Note. The goal orientation group is based on the most likely group membership. The means within a row sharing the same subscripts are not significantly different at the $p < .05$ level (with Games–Howell correction)