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Achievement Goal Orientation Profiles and the Experiences of Gymnasium Students with Digital Technologies in Education

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Abstract

Using a longitudinal person-oriented approach, this study aimed to examine the prevalence and stability of achievement goal profiles among gymnasium students (N = 794) in relation to their experiences with digital technologies in education. Achievement goal orientations and experiences with digital technologies in education (ICT use in learning and school-based activities, attitudes toward ICT use for educational purposes, flow experience while using ICT, and satisfaction with ICT implementation) were assessed by online questionnaire administered twice, seven months to one year apart. Results revealed four groups of students based on their achievement goal orientation profiles: mastery-oriented, success-oriented, avoidance-oriented and indifferent. In total, 77% of the students displayed identical profiles in both measurements suggesting a substantial stability in goal profiles. The transitions that were observed were mainly from more to less favourable profiles. The comparison of the goal orientation profiles indicated that the mastery-oriented and success-oriented students were generally more inclined towards digital technology for educational purposes, although the differences between the success-oriented and indifferent students were less pronounced at the second assessment point. The indifferent and avoidance-oriented students were less satisfied with ICT implementation. The findings build on previous work on the prevalence and stability of achievement goal profiles among high school students while also offering new insights into the relations between goal profiles and experiences with digital technologies in education.

Keywords: ICT in education, digital technology, high school students, achievement goal orientations, person-oriented approach

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Introduction

The implementation of digital technologies in education has been extensively researched over the past two decades. Even before COVID-19 pandemic, efforts were made to equip as many schools as possible with ICT (information and communication technology) infrastructure and to train teachers in the use of digital technologies for educational purposes. In Croatia, this goal was pursued through the e-Schools pilot project conducted by Croatian Academic and Research Network (CARNET), which aimed to establish a system for the development of digitally mature schools and to evaluate the use of ICT in the educational and operational processes of 10% of schools in Croatia (CARNET, n.d.). At the time of the implementation of the e-Schools pilot project, the results of international PISA survey (Markočić Dekanić et al., 2019) showed that almost all surveyed 15-year-old students in Croatia (94%) owned and used a computer and a cell phone with Internet access at home. The results also suggest that the availability of devices at home and at school does not necessarily imply a positive learning environment for students. However, students who used digital devices more frequently in certain school subjects performed better in all three literacy areas studied (reading, math, and science). Yet, one-third of students have never or almost never used apps or websites to learn using smartphones or computers.

Research conducted worldwide has shown that the use of digital technologies for educational purposes could increase student motivation and improve their achievement (Sailer, 2021). Still, the likelihood that innovation, including ICT, will be adopted, depends on compatibility or the „degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 1995, p. 15). The more the innovation is compatible with a person's current values, needs, and goals, the more likely it is to be adopted and successfully implemented. The Technology Acceptance Model (TAM model, Venkatesh & Davis, 2000) and its more recent versions (Venkatesh et al., 2003) has been widely used to understand and predict acceptance of various technologies. The models posit that intention to use technology is influenced mainly by attitudes towards technology (shaped by perceived usefulness and perceived ease of use of the technology). The present study seeks to explore students' experiences with digital technologies using several indicators that proved important within proposed framework.

In the educational context, different goals of individuals (primarily students) in achievement situations or the standards students use to judge their performance are referred to as achievement goal orientations (Ames, 1992). It can be argued that students with different goal orientations have different values and prefer different learning strategies and activities. Therefore, it could be assumed that achievement goal orientation could influence the attitudes toward digital technology and the likelihood of using different ICT activities for educational purposes. Although achievement goals have been extensively researched for more than 30 years, research examining the relationship between student achievement goals and ICT use has been surprisingly sparse. Several studies aimed in this direction (Mädamürk et al., 2021; McGloin et al., 2017; Orlando et al., 2018) showed that students with different achievement goals differ in their digital learning preferences (Mädamürk et al., 2021) and their technology use in the classroom (McGloin et al., 2017). Therefore, students' goal orientations should be taken into account when examining digital engagement in general and, in particular, their use of school-related digital activities. In this regard, it might be particularly useful to use a multiple-goal approach, as it has been shown that students can pursue multiple achievement goals simultaneously (Pintrich, 2000; Senko et al., 2011) and that achievement goal profiles can shape digital technology acceptance.

Achievement Goal Orientations

According to achievement goal theory, individuals engage in academic activities for a variety of reasons. Goals, aligned with students' values, guide students' thinking and behaviour through different learning situations or school assignments and determine how students approach these activities (Elliot & McGregor, 2001). Two main goal orientations have been most commonly referred to in achievement situations: mastery and performance goal orientation (Ames, 1992). The main difference between them is that the goal of students who are focused on mastery is to learn and develop competence, while the goals of students who are focused on performance is to achieve a positive evaluation of their competence, often through comparison with others (Ames, 1992). Compared to performance orientation, mastery orientation is more strongly related to flow experience (Ljubin-Golub, 2021) that refers to a state of intense focus and engagement where individuals find an activity so enjoyable that they willingly pursue it despite the costs (Csikszentmihalyi, 1990). Niemivirta (2002; Niemivirta et al., 2019) introduced the mastery-intrinsic and mastery-extrinsic orientation distinction. Mastery-intrinsic orientation refers to the original conceptualization of mastery goals, while mastery-extrinsic orientation refers to aspiration on getting good grades and succeeding in school, but without comparison with others. This conceptualization of achievement goals also includes performance approach and avoidance goal orientations, as well as work avoidance orientation.

Performance-avoidance goal orientation is aimed at avoiding judgments of incompetence (Elliot & McGregor, 2001), while work-avoidance orientation is endorsed by students whose goals are not aimed at attaining or demonstrating competence, but at avoiding effort and school challenges (Nicholls et al., 1985). Pursuing work avoidance goals was found to be associated with less engagement, lower grades, and greater negative affect (King & McInerney, 2014). Academic flow has been weakly positively associated with mastery-avoidance, had no association with performance-avoidance goals, and it has been negatively associated with work avoidance (Ljubin-Golub, 2021).

Early research on goal orientations mostly focused on the relations of particular goal orientations with different educational outcomes (Senko et al., 2011). Over the years, a focus has been shifted to include multiple goal orientations, as it has been demonstrated that people could endorse different goals simultaneously (Pintrich, 2000; Senko et al., 2011). Within this person-centred approach, students are classified into homogenous groups or profiles with similar goal orientation patterns. Such approach allows to capture students' motivational tendencies in a more profound way than variable-centred approach (Tuominen-Soini et al., 2011, 2012). Although meta-analysis of 24 studies (Wormington & Linnenbrink-Garcia, 2017) showed numerous different goal profile types, several studies on adolescents' goal orientation profiles that employed Niemivirta's five-dimensional conceptualization yielded similar four-profile solutions (Hietajärvi et al., 2015; Mädamürk et al., 2021; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012). Profiles were referred to as 1) mastery-oriented (high both mastery orientations and lower levels of both performance and work-avoidance orientations); 2) success-oriented (high both mastery and both performance orientations, lower work-avoidance orientation); 3) avoidance-oriented (low levels of both mastery orientations and performance-approach orientation, but somewhat higher performance-avoidance and high work-avoidance orientations); and 4) indifferent (similar, moderate levels of all goal orientations).

Mastery- and success-oriented profiles could be considered as adaptive since students with such achievement goal profile have similar effort expenditure and high academic success (Pintrich, 2000; Tuominen-Soini et al., 2011, 2012). However, some studies show that success-oriented students might be susceptible to certain maladaptive outcomes as they are preoccupied with possible failures in school (Tuominen-Soini et al., 2011), and thus might experience increased emotional exhaustion and higher sense of inadequacy as a student (Tuominen-Soini et al., 2012). Indifferent students represent an average student in both their motivation and academic achievement, while avoidance-oriented students have the least adaptive profile when considering different motivational and emotional aspects of school functioning (Hietajärvi et al., 2015; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012). Longitudinal studies have shown that these profiles were stably identified over time as most of the students were likely to remain in the same profile group (Mädamürk et al., 2021; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012).

Experiences with Digital Technologies in Students with Different Goal Orientations

Achievement goal orientation profiles have been extensively studied in relation to various aspects of motivation, academic achievement, and overall well-being in school (Niemivirta et al., 2019; Wormington & Linnenbrink-Garcia, 2017). However, studies exploring the relationship between goal orientation profiles and the use of digital technologies have been scarce (Hietajärvi et al., 2015; Mädamürk et al., 2021).

When considering the use of technology in education, Kolb (2017) points out that effective integration of technology should involve 1) students' active and meaningful engagement that enhances comprehension, 2) enhancement of learning, in a way that technology tools help students to achieve learning goals, and 3) extension that refers to the ways technology could support connecting classroom learning and everyday lives, as well as developing useful soft skills.

Such integration of technology would be best suited for mastery-oriented students. Indeed, mastery orientation predicted digital competence in a large sample of 7th grade students (Hatlevik et al., 2015). Also, Ni and Cheung (2023) found that learning (mastery) goal orientation had an indirect effect on high school students' intention to continue using intelligent learning systems through the mediating effects of perceived ease of use and usefulness. Students with performance orientation might use technology not to gain further understanding but to complete the task at hand to demonstrate their competence (Orlando et al., 2018). Students with work-avoidance orientation might avoid the use of digital technology for educational purposes, as they avoid any task requiring academic engagement.

Research exploring the use of digital technologies in different goal orientation groups showed that students with avoidant goal orientations use digital technologies to the least extent for academic activities and they are more likely to use social media intensively (especially girls) and engage in more intense gaming (especially boys). More adaptive motivational orientations (mastery and success oriented) were associated with higher ICT-skills and use of digital technologies for academic purposes (Hietajärvi et al., 2015).

More recently, Mädamürk et al. (2021) revealed that digital learning preference was the highest for the success-oriented students in Grade 8, 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. Success-oriented students also displayed the highest wish for digital schoolwork. Contrary to expectations, mastery-oriented students did not differ from avoidance-oriented students in both digital learning preference and wish for digital schoolwork. These results show that achievement goal orientation profiles might differ in their attitudes toward use of technology for educational purposes and that success-oriented students might endorse the most positive attitudes.

Some studies explored whether the implementation of digital technologies in the educational settings could change student goals, in a way that students become more mastery-oriented. Research conducted on upper elementary school students (Hsieh et al., 2008) showed that levels of performance orientation (both approaching and avoiding tendency) decreased when students were exposed to a technologically enriched learning environment. Asplund (2014) showed that students who tend to have avoidance orientations benefit the most from the use of mobile devices in teaching. However, some studies on university students indicated that learning with technology (i.e., desktop virtual reality) increased the perceived ease of use and usefulness, but also lowered mastery goal orientation and increased surface learning (Luo & Du, 2022). These results suggest that relationship between achievement goal profiles and technology use in educational settings is complex.

Despite the current availability of educational technologies, students are, in general, more likely to have maladaptive than adaptive change in their goal orientation profiles over time (Mädamürk et al, 2021; Tuominen et al., 2020). This implies that they transition from profiles characterized by more favourable goal orientations (e.g., mastery and success-oriented) to profiles defined by less favourable goal orientations (e.g., indifferent and avoidance-oriented). High prevalence of indifferent students also suggests, as Hietajärvi et al. (2015) noticed, that learning environments and practices should be designed in such a way that they are more suited for today's adolescents.

The Present Study

In Croatia, the e-Schools project led to widespread integration of digital technologies into education, aiming to establish digitally mature schools through the provision of essential digital infrastructure and the implementation of teacher training. The project aimed to contribute to the development of digitally competent students who are prepared for continued education and success in a competitive job market. Within this broader context, current study focuses on gymnasiums, general upper secondary schools (grammar schools) that comprise almost 50% of high school programs in Croatia (Ministry of Science and Education, n.d.). Gymnasiums are very competitive schools and have high enrolment requirements. Gymnasium programs conclude with the compulsory state matriculation exam, but do not provide a professional qualification like the vocational programs. Students are expected to pursue higher education after completing the curriculum. Therefore, gymnasium students form a fairly homogeneous sample in terms of their prior academic achievement and goals. Understanding the gymnasium students' goal orientation provides insight into their motivational tendencies and readiness for higher education and allows teachers to tailor instructional strategies and learning experiences.

Our study builds on and extends rather scarce previous research on the relationships between high school students' goal orientation profiles and their experiences with digital technology in education by capturing these relations beyond a single time point.

We directed our attention to multiple indicators to cover a wider spectrum of experiences with digital technology in education, which have proven significant within TAM models. We assessed the reported use of technology, as acceptance outcome variables are primarily depicted by usage intentions and reported use. Furthermore, in line with the conclusions by Scherer & Teo (2019), several other variables are gaining attention within TAM models (e.g., satisfaction with the technology), prompting us to examine satisfaction with technology and perceived flow. Additionally, attitudes toward technology use in education were assessed as a key explanatory variable in TAM model (Scherer & Teo, 2019).

Specifically, present study addressed the following research questions: 1) what kinds of achievement goal profiles can be identified among gymnasium students, 2) how stable these profiles are, i.e. do students change their profile membership during the e-Schools pilot project, and 3) how students with different achievement goal orientation profiles differ with respect to experiences with digital technologies in education and whether the initial experiences with digital technologies predicted maladaptive/adaptive change in goal orientation profiles.

It is hypothesized that similar goal orientation profiles could be identified as in previous studies conducted in other countries: mastery-oriented, success-oriented, avoidance-oriented, and indifferent (Niemivirta et al., 2019) and that the profiles are rather similar over time. It is also expected that most students will remain in the same profile group across both assessment time points, and that a smaller percentage of students will transition to a different group.

Based on the reviewed literature, we expect the more adaptive (mastery- and success-oriented) profile groups to have more favourable experiences with digital technologies in education. In addition, it is hypothesized that more positive experiences with digital technology at the beginning of the pilot project will predict adaptive transitions between profiles over time (e.g., from avoidance-oriented to indifferent, success-oriented, or mastery-oriented).

Method

Participants and Procedure

The data used in this study were collected through online questionnaires as part of a broader evaluation study of the project "e-Schools: Establishing a System for the Developing Digitally Mature Schools (Pilot Project)", supported by the CARNET. The 151 schools were selected by CARNET to be representative of schools in Croatia based on the type and size of school, and digital development, but for the purpose of this study, only gymnasiums were selected. All the gymnasiums that participated in the pilot project were included in the study, which represents approximately 11% of all gymnasiums in Croatia. Only first and second graders participated in the study as the e-Schools pilot project focused on those high-school grades. Second grade students were assessed first time in late spring of the first grade, and second time approximately one year later. To ensure longitudinal following, first grade students were assessed at the beginning of the first grade (autumn) and second time at the same assessment point as second year students. From each school, students were randomly selected, and the number of selected students depended on the school size. In the present study, 794 students (M_{age} = 15.30, SD_{age} = 0.42, 67% girls) participated in both measurement points. At the beginning of the questionnaire administration students were apprised in writing of the voluntary nature of their participation and assured of confidentiality. Personal data underwent conventional anonymization procedures and were securely stored. The students completed the questionnaires within the school premises during regular school hours, under the supervision of school psychologist or pedagogue.

Measures

Goal orientations were assessed with the instrument by Niemivirta (2002; Niemivirta et al., 2019). Each of the goal orientations was assessed with three items that were translated from English to Croatian language. Students rated all items using a 7-point Likert-type scale ranging from 1 (*not true at all*) to 7 (*completely true*). The scales assessed five orientations referring to students' general orientations to learning and studying: mastery-intrinsic (e.g., "To acquire new knowledge is an important goal for me in school"), mastery-extrinsic (e.g., "It is important for me to get good grades"), performance-approach (e.g., "An important goal for me in school is to do better than the other students"), performance-avoidance (e.g., "I try to avoid situations in which I may fail or make mistakes"), and avoidance (referring to work-avoidance; e.g., "I try to get away with as little effort as possible in my school work"). Composite scores were derived for each scale by averaging the scale sum scores, with a higher score denoting higher corresponding goal orientation.

The reported ICT use was assessed using the scale on ICT-enabled activities related to learning (Centar za primijenjenu psihologiju, 2017). It consisted of 8 items assessing the frequency of various activities related to the students' use of digital technologies for school tasks and purposes (e.g., "I look for content to help me write homework, reports, or reading notes"). Students responded on a 4-point Likert-type scale (1 - *never*, 2 - *several times a month*, 3 - *several times a week*, 4 - *daily*).

Attitudes towards ICT use were assessed using two six-item scales: perceived benefits (e.g., "By using digital technologies, students concentrate better on what they are learning) and risks (e.g., "ICT in classroom distract students from the learning material") of ICT use for learning purposes. Students responded on a 5-point Likert-type scale from 1 (*completely disagree*) to 5 (*completely agree*).

Flow during ICT use was assessed using five-item scale. Three items from Absorption subscale (e.g., "I'm engrossed when I work with ICT") and two items from Enjoyment subscale (e.g., "I like working with ICT more than other people do") of Flow ICT questionnaire (Rodríguez-Sánchez et al., 2008) were translated and some of them slightly adapted. Students responded on a 5-point Likert-type scale from 1 (*completely disagree*) to 5 (*completely agree*).

For each of the four scales assessing experience with digital technologies, a composite score was computed by averaging the sum scores of the respective scale. A higher score indicated a more pronounced corresponding construct.

Finally, students rated their satisfaction with the way technology is used in lessons at their school on a 5-point Likert-type scale ranging from 1 (*not true at all*) to 5 (*completely true*). Satisfaction ratings were collected only at the second measurement point.

Data Analyses

First, confirmatory factor analyses (CFAs) were conducted separately for the two time points to verify the structural validity of goal orientation measures. Furthermore, longitudinal CFAs were performed to test the measurement invariance of goal orientation measures over time. Models that imposed accumulating equality restrictions on model parameters were tested and compared. Adequacy of model fit was assessed by comparative fit index (CFI), root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) using the following cut-off values: CFI > .90, RMSEA < .06 and SRMR < .08 (Browne & Cudeck, 1992; Hu & Bentler, 1999). In model comparisons, measurement invariance was evaluated by two criteria: χ^2-difference tests, and ΔCFI < .01 paired with ΔRMSEA < .015 and ΔSRMR < .030 (for metric invariance) or ΔSRMR < .015 (for scalar or strict invariance) (Chen, 2007).

To identify students with similar patterns of achievement goal orientation, latent profile analyses (LPA) were estimated separately at each time point using the composite scores of achievement goal orientation scales. Six classes were added stepwise to explore the most optimal data fit in terms of number of classes. In line with the existing recommendations (Masyn, 2013), the following statistical criteria were used to select the optimal time-specific solution: Akaike information criterion (AIC), Bayesian information criterion (BIC), Vuong-Lo-Mendell-Rubin (VLMR) likelihood ratio test, and Lo-Mendell-Rubin (LMR) adjusted likelihood ratio test. A better fit to the data is indicated by a model with lower AIC and BIC values, while *p*-values of the VLMR and LMR tests less than .05 indicate that the estimated model is preferable over the reduced model. The classification quality (entropy value > .70), meaningfulness and interpretability of the latent classes, and the size of the smallest group were also considered for choosing the best-fitting model. Furthermore, students' grade level was modelled as covariate of latent profile membership in LPAs conducted at both Time 1 and Time 2, using the auxiliary BCH command within the BCH manual approach in Mplus (Asparouhov & Muthén, 2021).

A two-wave latent transition analysis (LTA) as a longitudinal extension of LPA modelling latent profile memberships and possible transitions was used to examine the stabilities and transitions between goal orientation profiles over time. Model selection was informed by the results of cross-sectional LPAs.

Finally, a series of analysis of covariance (ANCOVA) with students' grade level as covariate were performed to examine the differences in the experiences with digital technologies in education between students with distinct goal orientation profiles at Time 1 and Time 2. Logistic regression was used to examine whether the experiences with digital technologies in education at Time 1 predicted maladaptive/ adaptive change in the most probable goal orientation profile group.

The statistical analyses were conducted using Mplus Statistics Software Version 8.10 (Muthén & Muthén, 1998–2023) and IBM SPSS Statistics Version 21.

Results

Preliminary Analyses

CFAs results showed that the measurement model had a good fit at Time 1, χ^2 (80, N = 794) = 308.86, $p < .001$, CFI = .93, RMSEA = .060, SRMR = .058 and at Time 2, χ^2 (80, N = 794) = 374.31, $p < .001$, CFI = .93, RMSEA = .068, SRMR = .058, thus verifying the hypothesized factorial structure of goal orientation measures. Longitudinal CFAs indicated satisfactory measurement invariance over time, implying that comparable constructs of goal orientations were measured at both time points (see Appendix Table A1).

Descriptive statistics and internal consistencies for all variables are presented in Table 1.

Table 1

Descriptive Statistics and Internal Consistencies for All Variables

Variable	Range	Time 1			Time 2		
		M	*SD*	α	*M*	*SD*	α
Mastery-intrinsic orientation	1 - 7	5.88	0.96	.77	5.47	1.11	.82
Mastery-extrinsic orientation	1 - 7	5.91	0.98	.76	5.59	1.15	.83
Performance-approach orientation	1 - 7	4.28	1.32	.66	4.26	1.36	.70
Performance-avoidance orientation	1 - 7	4.83	1.35	.67	4.51	1.38	.70
Avoidance orientation	1 - 7	3.40	1.40	.66	3.84	1.37	.69
ICT use	1 - 4	2.30	0.47	.74	2.36	0.50	.76
Perceived benefits of ICT use	1 - 5	3.44	0.55	.73	3.33	0.59	.76
Perceived risks of ICT use	1 - 5	2.90	0.61	.75	2.95	0.65	.77
Flow during ICT use	1 - 5	2.58	0.74	.80	2.56	0.80	.85
ICT implementation satisfaction	1 - 5	-	-	-	3.29	1.06	-

Note. α = Cronbach's alpha.

Achievement Goal Orientation Profiles

The results of the time-specific LPAs are reported in Table 2. The results for Time 2 provided support for the four-class solution. Although BIC value, *p*VLMR and *p*LMR suggested better fit for five-class solution for the Time 1 data, adding a fifth profile only resulted in the arbitrary division of one of the existing profiles into smaller similar profiles, differing only in their level of achievement goals. Therefore, the four-profile solution was retained at both time points. The entropy value for the four-profile solutions was .72 for Time 1 and .69 for Time 2 suggesting satisfactory level of classification accuracy.

Table 2

Fit Indices for Latent Profile Analyses for Time 1 and Time 2

k	AIC	BIC	p_{VLMR}	p_{LMR}	Entropy	Group sizes
	Time 1					
1	11286.372	11333.143	-	-	-	794
2	10752.984	10851.202	.0000	.0000	.63	274, 520
3	10585.424	10735.091	.0342	.0358	.65	252, 190, 352
4	10442.148	10643.263	.0043	.0045	.72	169, 210, 363, 52
5	10380.017	10632.579	.0137	.0145	.69	46, 166, 233, 302, 47
6	10334.531	10638.542	.2018	.2067	.70	68, 53, 247, 199, 45, 182
	Time 2					
1	11286.372	11333.143	-	-	-	794
2	10831.917	10930.135	.0000	.0000	.62	345, 449
3	10638.384	10788.050	.0326	.0340	.70	231, 131, 432
4	10493.121	10694.235	.0382	.0396	.69	174, 273, 264, 83
5	10447.606	10700.169	.1996	.2041	.70	139, 278, 101, 71, 205
6	10431.875	10735.885	.7630	.7643	.71	8,131, 149,130, 298, 78

Note. k = number of latent profiles in the model; AIC = Akaike information criterion; BIC = Bayesian information criterion; p_{VLMR} = Vuong-Lo-Mendell-Rubin likelihood ratio test; p_{LMR} = Lo-Mendell-Rubin adjusted likelihood ratio test.

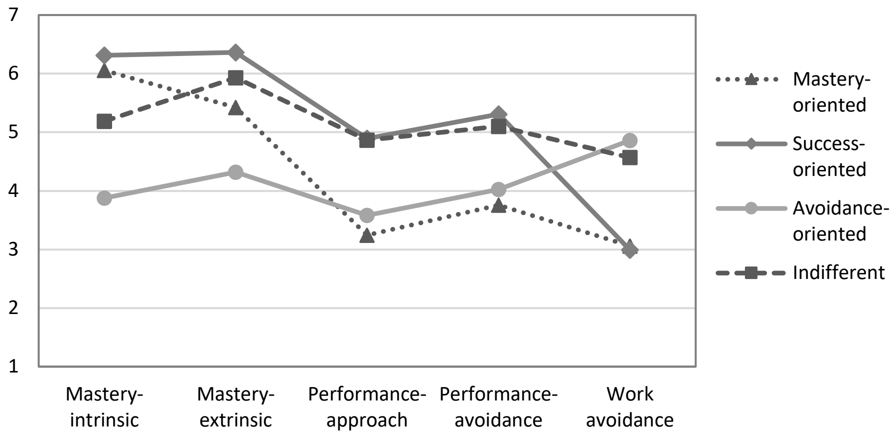
The four identified profiles were similar at both measurements, qualitatively informative and consistent with previous research and theory. The four groups were labelled according to the score mean profiles as *mastery-oriented*, *success-oriented*, *avoidance-oriented*, and *indifferent*. The covariate analyses conducted for both Time 1 and Time 2 showed that students' grade level did not predict profile membership. First and second grade students were equally likely to be classified across profiles ($p > .05$).

Stabilities and Transitions

The four time-invariant goal orientation profiles based on estimated means obtained by LTA are shown in Figure 1. The profiles were similar to solutions extracted in the cross-sectional LPAs performed separately for Time 1 and Time 2. Students in mastery-oriented group (29%$_{T1}$/ 27%$_{T2}$) reported high mastery-intrinsic orientation combined with high, but somewhat lower mastery-extrinsic orientation and relatively low performance-related and avoidance orientations. Success-oriented students (42%$_{T1}$/ 29%$_{T2}$) showed high emphasis on both mastery- and performance-related orientations along with relatively low avoidance orientation. Avoidance-oriented group represented the smallest profile (6%$_{T1}$/ 16%$_{T2}$) characterised by relatively high emphasis on avoidance orientation compared to the relatively low emphasis on the remaining goal orientations. Finally, indifferent students (23%$_{T1}$/ 27%$_{T2}$) displayed mainly moderate all goal orientations. The entropy of the LTA model was .77, indicating a clear classification.

Figure 1

Time-Invariant Achievement Goal Orientation Profiles (Estimated Means)



The cross-classification of the goal orientation profile membership over time and transition probabilities (i.e., within-person stability and change) from the LTA are presented in Table 3. As can be seen, the probabilities of remaining in the same profile were the highest (.70 to .98) pointing to a rather high stability in goal orientation profiles. In total, 77% of the students exhibited a stable profile over the time captured by this research. Concerning the changes between the two measurements, success-oriented students were likely to move to the indifferent profile (transition probability = .22). Mastery-oriented and indifferent students were likely to move to the avoidance-oriented profile with transition probabilities of .17 and .24, respectively. Overall, the observed transitions were mainly from more to less favourable profiles, specifically from mastery-oriented and indifferent to avoidance-oriented, and from success-oriented to indifferent. An exception referred to the transition from a success-oriented to a mastery-oriented profile, but the transition probability was rather low (.08).

Table 3

Cross-Classification of Goal Orientation Profiles and Transition Probabilities

Time 1	Time 2: Mastery-oriented		Success-oriented		Avoidance-oriented		Indifferent	
Mastery-oriented	.83	(181)	.00	(0)	.17	(42)	.00	(2)
Success-oriented	.08	(33)	.70	(243)	.00	(1)	.22	(62)
Avoidance-oriented	.00	(0)	.02	(1)	.98	(46)	.00	(0)
Indifferent	.00	(1)	.00	(0)	.24	(40)	.76	(142)

Note. Values in parentheses represent the number of students.

Achievement Goal Orientation Profiles and Experiences with Digital Technologies in Education

Profile differences in experiences with digital technologies in education at Time 1 and Time 2 were analysed by means of one-way ANCOVAs with students' grade level as covariate. All effects and the mean differences are summarized in Table 4. The results indicated that goal orientation groups differed significantly on all measures except for the perceived risks of ICT use for educational purposes at Time 1.

The pairwise comparisons of adjusted means showed that mastery-oriented and success-oriented students reported more frequent use of digital technology than indifferent students. Mastery-oriented students also scored higher on ICT use than avoidance-oriented students at both measurements, while success-oriented students used technology more frequently than avoidance students at Time 2 only. Mastery-oriented and success-oriented students perceived more benefits of ICT use in learning and school-related activities than other students at Time 1. At Time 2, indifferent students scored equally high on perceived benefits as mastery-oriented and success-oriented students, but only mastery-oriented students scored significantly higher than avoidance-oriented students. Concerning the perceived risks of using technology in education, all students had rather similar scores at Time 1. However, at Time 2, success-oriented students expressed more negative attitudes than mastery-oriented and avoidance-oriented students. The results further revealed that success-oriented and indifferent students reported equally high flow experiences while using ICT. Indifferent students scored higher than mastery-oriented and avoidance-oriented students at Time 1. At Time 2, indifferent students scored higher on flow experience than mastery-oriented students only, while success-oriented students scored higher than both, mastery-oriented and avoidance-oriented students. At time 2, mastery-oriented students reported a higher degree of satisfaction with the way technology is used in the classroom than avoidance-oriented and indifferent students but were equally satisfied as success-oriented students. Overall, the obtained effect sizes were small.

Table 4

Mean Differences in Experiences with Digital Technologies in Education between Latent Goal Orientation Profiles at Time 1 and Time 2

Measure	Mastery-oriented		Success-oriented		Avoidance-oriented		Indifferent		$F(3, 789)$	p	η^2
	M	SD	M	SD	M	SD	M	SD			
Time 1											
ICT use	2.41_{c}	0.47	2.37_{bc}	0.45	2.22_{ab}	0.47	2.15_{a}	0.43	14.05	.000	.05
Perceived benefits of ICT use	3.51_{b}	0.51	3.61_{b}	0.70	3.36_{a}	0.56	3.34_{a}	0.53	6.94	.000	.03
Perceived risks of ICT use	2.87_{a}	0.64	2.96_{a}	0.58	2.83_{a}	0.64	2.99_{a}	0.56	2.59	.052	.01
Flow during ICT use	2.52_{a}	0.70	2.54_{ab}	0.81	2.50_{a}	0.75	2.74_{b}	0.77	4.78	.003	.02
Time 2											
ICT use	2.50_{b}	0.48	2.47_{b}	0.50	2.25_{a}	0.52	2.26_{a}	0.47	14.34	.000	.05
Perceived benefits of ICT use	3.42_{b}	0.56	3.35_{ab}	0.78	3.21_{a}	0.60	3.31_{ab}	0.55	4.43	.004	.02
Perceived risks of ICT use	2.88_{a}	0.67	3.19_{b}	0.76	2.86_{a}	0.68	3.00_{ab}	0.54	6.52	.000	.02
Flow during ICT use	2.45_{b}	0.74	2.76_{c}	0.96	2.48_{ab}	0.77	2.66_{ac}	0.79	5.28	.001	.02
ICT implementation satisfaction	3.52_{b}	1.07	3.35_{ab}	1.12	3.11_{a}	1.09	3.17_{a}	0.97	5.89	.001	.02

Note. Means within a row sharing the same subscripts are not significantly different at the $p < .05$ level (with Bonferroni adjustment).

The results of logistic regression examining whether the experiences with digital technologies in education at Time 1 predicted maladaptive/adaptive change in the most probable goal orientation profile group as the outcome variable are reported in Table 5. Only 4.5% of the students showed adaptive change in goal orientation profile from Time 1 to Time 2, while 18.5% demonstrated a maladaptive change[1].

[1] Possible configurations of transitions reflecting *adaptive change*: from avoidance-oriented to indifferent, success-oriented or mastery-oriented; from indifferent to success-oriented or mastery-oriented; from success-oriented to mastery-oriented, and *maladaptive change*: from mastery-oriented to success-oriented, indifferent or avoidance-oriented; from success-oriented to indifferent or avoidance-oriented; from indifferent to avoidance-oriented.

Table 5

Predictors of Adaptive Change in Goal Orientations

Time 1 predictor	Adaptive change			
	B	*SE B*	*OR*	95% CI *OR*
ICT use	.32	.44	1.38	[.58, 3.28]
Perceived benefits of ICT use	.16	.41	1.18	[.53, 2.62]
Perceived risks of ICT use	.10	.35	1.10	[.55, 2.20]
Flow during ICT use	-.62*	.29	.54	[.30, 0.95]

Note. *B* = standardized coefficient; *SE* = standard error; *OR* = odds ratio; CI = confidence interval.
*$p < .05$.

The logistic regression model was not statistically significant, $\chi^2(4) = 5.54$, $p > .05$. Still, the Hosmer and Lemeshow test indicated a good fit, $\chi^2(8) = 15.35$, $p > .05$. The model explained 4.8% (Nagelkerke R^2) of the variance of adaptive change and correctly classified 80.8% of cases. The results showed that only flow during ICT use reported at Time 1 made a significant contribution. The negative estimate suggests a greater likelihood of adaptive change for students who experienced flow while using ICT less frequently.

Discussion

This research aimed to examine the prevalence and stability of achievement goal orientation profiles in Croatian gymnasium students in relation to their experiences with digital technology in education across a period of e-School pilot project implementation.

The results revealed that students endorsed different combinations and levels of achievement goal orientations, indicating a tendency to pursue multiple goals or place emphasis on several goal orientations simultaneously. In terms of within-sample stability, the results indicated that the set of profiles found in this study were similar across measurement occasions. Aligned with the assumptions of this study, four distinct goal profiles were identified: mastery-oriented, success-oriented, avoidance-oriented, and indifferent. These profiles correspond to those found in prior studies across various age groups and educational contexts in general, and more specifically, in prior studies utilizing the five-dimensional conceptualization of goal orientations (Niemivirta et al., 2019; Wormington & Linnenbrink-Garcia, 2017).

Mastery-oriented students were primarily focused on meaningful learning and understanding. These students invest a lot of effort into acquiring new knowledge and improving their competencies. They also strived for absolute success (i.e., getting good grades) but did not show a tendency to demonstrate competence compared to others or concern about failure in front of others. Alongside success-oriented students, they were the least inclined to minimize the effort and time spent on studying. Predominantly mastery goal profile is commonly found across studies irrespective of participants' age or level of schooling (Mädamürk et al., 2021; Nadon et al., 2023; Pahljina-Reinić, 2022; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012). As expected and consistent with previous research findings (e.g., Tuominen-Soini et al., 2011, 2012), a group of success-oriented students pursuing multiple goals was identified. These students strived for both absolute and relative success but also aimed at learning and understanding. The small group of avoidance-oriented students deliberately aimed at minimizing the effort and time spent on studying. Compared to the remaining groups these students displayed the lowest mastery aspirations. Indifferent students display a kind of non-commitment as they do recognize the importance of learning and doing well in studying but are somewhat unwilling to invest effort in achieving those goals. This finding corresponds with previous person-oriented studies extracting a group of high school students with a moderate or average goal profile (e.g., Hietajärvi et al., 2015; Pahljina-Reinić & Kolić-Vehovec, 2017; Tuominen-Soini et al., 2011, 2012).

Students' goal orientation profiles were clearly stable over the period of e-School pilot project implementation, as 77% of the students displayed identical profile in both assessment time points. This result is consistent with findings of existing studies, which have also demonstrated notable stability in goal profiles employing similar analytical methods and exploring stability over approximately the same period (Mädamürk et al., 2021; Tuominen et al., 2020; Tuominen-Soini et al., 2011, 2012). Concerning the evidence of profile changes across measurement points, the results indicated that only a minor percentage of students (4.5%) were likely to undergo an adaptive change, primarily transitioning from the success-oriented to the mastery-oriented group. Most of the detected changes (18.5%) were directed from more to less favourable goal profile group. Besides the changes from success-oriented to indifferent and from indifferent to avoidance-oriented group, a substantive maladaptive shift from mastery-oriented to avoidance group was observed. In this regard, our findings corroborate with a substantial body of research showing the decline of academic motivation during adolescence (Wigfield et al., 2019). In addition to changes and challenges characteristic of adolescence, these results might reflect the higher demands posed by gymnasium educational context. The competitive and high-stakes nature of this learning environment may have stimulated more fear of failure and thus made avoidance goals more salient than approach-based goals.

The comparison of the goal orientation profiles showed that, at the beginning of the pilot project, the more adaptive goal orientation profiles were more inclined towards digital technology for educational purposes. Mastery-oriented students reported that they used digital technologies for educational purposes more frequently than avoidance-oriented and indifferent students. The success-oriented students used ICT more frequently than indifferent students. Both adaptive groups perceived more benefits of ICT use for school and learning than the avoidance-oriented and indifferent students. This is consistent with our hypothesis that adaptive groups have more positive attitudes towards the use of technology for educational purposes and that they report more frequent use of technology for school-related tasks, while the avoidance-oriented students use technology for educational purposes less frequently and report fewer benefits. Hietajärvi et al. (2015) also found that the avoidance-oriented group had the lowest digital academic participation, but the differences between the other groups were not as apparent. In the study by Mädamürk et al. (2021), digital learning preference was particularly high in the success-oriented group, and the results indicated that mastery-oriented students did not seem to be particularly interested in using more digital tools for their schoolwork. In our study, the two adaptive profiles did not differ in the perceived benefits. Interestingly, the four goal orientation profiles did not differ in terms of perceived risks of ICT use for educational purposes and showed moderate levels of perceived risks.

Similar results to those at the beginning of the project were obtained at the second assessment point, as both adaptive groups reported more frequent ICT use than the remaining groups. They also tended to see more benefits, but success-oriented students did not differ from the indifferent students. Adaptive profiles were also more satisfied with the way technology was implemented in lessons, but success-oriented students did not differ from the other groups. Success-oriented students also perceived more risks of ICT use and reported more flow experiences compared to the avoidance-oriented and mastery-oriented groups. It seems that they recognized the potential risks of ICT use, e.g., that ICT in the classroom distracts students from the subject matter and that students are more likely to learn superficially. Indeed, although digital technologies have the potential to promote active and meaningful student engagement and thus improve understanding (Kolb, 2017), they can also be perceived as a distraction from learning and lead to procrastination (Selwyn, 2016), since they enable different types of digital engagement. Mädamürk et al.'s (2021) findings showed that success-oriented students, despite their good learning outcomes, reported similar schoolwork and sleep impairment related to Internet use as avoidance-oriented students, who had lower GPAs. The authors conclude that success-oriented students might be more critical toward their learning outcomes, but it is also possible that they have difficulty balancing schoolwork and other types of ICT use they tend to engage in. Our results indicate that success-oriented and indifferent students had similar experiences with digital technologies at the second assessment point suggesting that success-oriented students possibly lowered their initial expectations regarding technology use in education.

As lower levels of flow experience in ICT were a significant predictor of adaptive changes in goal orientation profiles, it could be assumed that students experience flow primarily in activities that are not related to learning but to leisure, such as gaming and social networking, which can distract students from engaging in learning activities.

Overall, the results show that availability of technology will not automatically foster reluctant students to use digital technologies for learning purposes. Students who have tendency to engage in learning activities will also be more prone to use digital technologies for educational purposes, but avoidance-oriented students will still avoid learning tasks even though they are delivered by means of technology. The results obtained on teachers involved in e-Schools pilot project show that teachers primarily employed digital technologies for content presentation, and collecting and publishing student schoolwork, while they less frequently engaged students in student-centred activities (Mohorić et al., 2020). The time period studied may not have been long enough for teachers to implement digital technology in a manner that fosters the attainment of higher-order learning outcomes. It is crucial to support teachers in unlocking the potential of digital technologies for learning through constructive and interactive learning activities that engage students and enable them to achieve learning goals in ways they could not with traditional tools (Sailer et al., 2021).

Limitations and Future Directions

The present study has some limitations. First, the initial assessment was conducted in two grade levels at separate times due to the participation of these students in the e-Schools project. Unfortunately, assessing eighth-grade students proved unfeasible as it was not possible to anticipate which high school they would attend. Consequently, they were assessed at the onset of their first grade instead. Second, although it was plausible to assess perceived risks and benefits as well as flow experience and satisfaction with technology implementation using self-report measures, the use of digital technologies was also self-reported, lacking accompanying objective measures of behaviour. Additionally, although the variables were assessed longitudinally, inferences about causal relationships could not be implied and the results should be interpreted with caution. Furthermore, given that the research was conducted on gymnasium students, specifically those in the first two grades, the findings cannot be generalized to other schools, nor to students in the final grades of gymnasiums.

Future studies should focus on more specific types of digital engagement, using measures that are more objective and relating them with distinct teaching practices. Conducting further longitudinal studies within different periods and across diverse schools will enhance the generalizability of the findings.

Despite the limitations, this study makes a valuable contribution to understanding the interplay between goal orientation profiles and the use of digital technologies within educational settings. While cognitive and motivational outcomes of endorsing distinct goal orientation profiles have been extensively explored, the relationship of these profiles to digital technologies in education has received less attention. The results of this study suggest that the goal orientation profiles in

Croatian gymnasiums are fairly stable and comparable to the profiles obtained in other countries. The findings build on previous work while also offering novel perspectives on the relations between goal orientation profiles and experiences with digital technologies in education, thereby enhancing goal orientation theories by suggesting that fundamental principles can be applied in technologically enriched educational environments. Additionally, the results underscore the importance of integrating personal values and goals into technology acceptance models, as the results suggest that attitudes toward digital technology in education are affected by achievement goal orientations, unrelated to technology. The implementation of digital technology in education should be carefully planned to leverage its potential and increase the likelihood of acceptance, especially among work-avoidant students.

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Appendix

Table A1

Goodness of Fit Statistics for the Measurement Invariance Models

Model	$\chi^2(df)$	CFI	RMSEA	SRMR	Model comp	$\Delta\chi^2(\Delta df)$	p	Δ CFI	Δ RMSEA	Δ SRMR
M1: Configural invariance	1383.41 (360)	.885	.060	.059	-	-	-	-	-	-
M2: Metric invariance	1397.94 (370)	.885	.059	.061	M2-M1	14.53 (10)	0.1502	.000	- .001	.002
M3: Scalar invariance	1463.78 (380)	.879	.060	.063	M3-M2	65.84 (10)	0.0000	- .006	.001	.002
M3a: Partial scalar invariance[a]	1429.02 (378)	.882	.059	.063	M3a-M2	31.08 (8)	0.0001	- .003	.000	.002
M4: Strict invariance	1466.70 (393)	.880	.059	.064	M4-M3a	37.68 (15)	0.0010	- .002	.000	.001
M4a: Partial strict invariance[b]	1451.74 (392)	.881	.058	.064	M4a-M3a	22.72 (14)	0.0649	- .001	- .001	.001

Note. [a] M3 + two pairs of intercepts free. [b] M4 + one pair of residual variances free. χ^2 = chi-square; *df* = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.