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Upper secondary school students' conceptions of learning, learning strategies, and academic achievement

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ABSTRACT

The relations between more surface- or deep-level learning approaches and academic achievement were investigated. Gender, level of study, and type of schools were moderating variables. 170 upper-secondary school students' conceptions of learning and their chosen learning strategies were explored via two self-report questionnaires. Furthermore, their academic achievement in a range of subject areas was collected. A Confirmatory Factorial Analysis of the two questionnaires' dimensions identified two factors showing learning approaches of different qualitative nature, more surface- or deep-level. Then, General Linear Models showed that the predictive impact of the tracked factors was differently related to students' academic achievement. The factor "Deep metacognitive theory of learning" positively predicted academic achievement, whereas the factor "Surface metacognitive theory of learning" was a negative predictor.

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Highlights

- An Exploratory Factorial Analysis revealed two meaningful factors named as "Deep metacognitive theory of learning" and "Surface metacognitive theory of learning" grouping qualitatively different combinations of students' conceptions of learning and learning strategies.
- Results of General Linear Model (GLM) showed two opposite predictive directions: "Deep metacognitive theory of learning" predicted academic achievement in a positive way, whereas "Surface metacognitive theory of learning" predicted academic achievement in a negative way.
- Results opened discussion in relation to: the current learning theories; the necessity to promote an inclusive framework of learning processes; and their relevance to theoretical and practical orientations.

Because the learning process comes into play in students' higher-order processes, several elements of metacognition exert a crucial role in successfully pursuing educational goals and academic achievement (Boekaerts et al., 2000; Zimmerman, 2008). The construct of metacognition concerns two domains, "metacognitive knowledge" on the process of learning (what learning is, and how, when, and why it occurs) and "metacognitive regulation" of the process of learning (how students monitor and control their cognitive processes) (Nelson & Narens, 1990). The two domains are particularly relevant to support students across school transitions. At age 14 in Italy, students must choose and enter the upper-secondary school programs by making a choice among different curricular content and academic standards ("lyceum" or technical and vocational paths). Students can enroll either in general education in a state-run high school (offering programs in arts, classical studies, sciences, languages, music and dance, and social sciences) or in a state-run vocational or technical pathway offered by technical and vocational institutes, both of which provide access to higher education. Following the lower-secondary school years, upper-secondary school is a crucial period covering multiple psychological and academic challenges, such as the increasing high demand for autonomy and responsibility in managing the studying activity. Secondary school years are accompanied by a gradual decline in academic motivation, self-assessment, and engagement in school-related activities and practices (Organization for Economic Cooperation and Development [OECD, 2011]). European countries still show evident problems with the low performance and retention levels of their students. The long-term negative repercussions are a reduced rate of access to university programs, as well as to the labor market. In this perspective, prospects of personal, professional, and social advancement are compromised. For example, the Italian situation requires attention, upper-secondary graduation percentage rates were below the of OECD average. This might be a result of students not having developed an adaptive learning approach which fosters their self-regulation and motivation to learn. Therefore, efforts to advance our understanding of the factors able to successfully sustain upper-secondary school students' academic performance are urgent.

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The importance of students' metacognitive reflection about their conceptions of learning for academic achievement

In educational research, students' conceptions of learning are considered a significant construct in explaining success and failure in academic performance (e.g., Vettori et al., 2020). They are defined as individual metacognitive systems of beliefs aimed at describing the process of learning (e.g., Vermunt & Donche, 2017) construction of which is supported by the variety of school experience (e.g., Entwistle & Peterson, 2004; Robbers et al., 2018)

In reviewing the literature, individual differences when students conceptualize the learning process emerged. Different conceptions might result in success or failure in academic achievement (e.g., Robbers et al., 2015). Previous studies have shown that students' conceptions of learning orient and shape their motivation and metacognitive behaviors, such as their chosen learning strategies (Pinto et al., 2018; Prosser & Trigwell, 1999). Students' conceptions of learning embed the cognitive processes, learning conditions, scopes, and prospects of changes. Accordingly, previous studies provided a rich picture of students' conceptions along a qualitative and developmental continuum (e.g., Marton et al., 1993; Säljö, 1979). Conceptions describing learning as gaining knowledge refer to the surface level (e.g., Boulton-Lewis, Wills, & Lewis, 2001), for example students' view of learning as "increasing one's knowledge" or as "memorizing and reproducing" (see, Marton et al., 1993; Säljö, 1979). Conversely, conceptions describing learning as changing as a person refer to the deep level (e.g., Boulton-Lewis, Wills, & Lewis, 2001), for example students' view of learning as "understanding" or as "seeing things in a different way" (see, Marton et al., 1993; Säljö, 1979).

Further studies (e.g., Purdie & Hattie, 2002; Vermunt & Vermetten, 2004) have shown that students' conceptions of learning may also embed social components of learning, as well as personal motives and orientations. Accordingly, Peterson et al. (2010) showed that lower-secondary school students may hold different conceptions of learning, such as "understanding", "personal change", "social competence" "continuous", "gaining information", and "duty". Their findings showed that some conceptions resulted in different academic achievement. For example, students holding a conception of learning as a continuous or lifelong process were more likely to reach higher academic achievement. Conversely, students holding a conception of learning as a duty were more likely to reach lower academic achievement. Their findings are in line with the ascertained relation between conceptions of learning, orientations, and approaches (e.g., Entwistle & Peterson, 2004).

Recent studies have shown that lower-secondary school students' conceptions of learning mirror a wide range of cognitive and socio-cultural, affective/motivational, and attributional/regulative areas of learning differently associated with academic performance. Using the "Learning Conceptions Questionnaire" (LCQ; Perez-Tello et al., 2005), Vezzani et al. (2018a, 2018b) found lower-secondary school students' conceptions related to cognitive processes, the nature of learning as an individual process or collective practice, the learners' active or passive role. Furthermore, they found conceptions related to students' positive or negative emotions and to their tendency to make internal or external attributions of success and failure outcomes. A further advancement was provided by exploring the predictive role of the LCQ (Pérez-Tello et al., 2005) factorial dimensions on academic achievements in a range of subjects among lower-secondary school students (see, Vettori et al., 2018). The results of General Linear Model (GLM) principal effects showed that conceptions of learning differently predicted academic achievement in a range of school subjects. Specifically, the conception of learning as "Personal challenge, self-efficacy and personal growth" was a significant predictor of high academic achievements in the subjects of language and literature. The conception of "Learning as co-constructive and cultural process" was a significant predictor of high academic achievements in the subject of foreign language. Conversely, the conception of "Learning as a reduction of deficit through individual effort" predicted a decrease of academic achievements in the subjects of language and literature and mathematics. Conceptions of qualitatively different nature may activate alternative processes of learning which shape the adoption of processes appropriate to varying tasks and school subjects they are studying (e.g., Entwistle & Peterson, 2004). The results of Vettori et al. (2018) have also shown that the relation between middle-school students' conceptions of learning and academic achievement was sensitive to gender. Specifically, female high-achiever students significantly benefited from a conception of learning embedding social and motivational aspects with respect to male students. Little is known, however, about the relation between students' conceptions of learning and academic achievement in a range of subjects among upper-secondary school students. The necessity to advance our knowledge of factors and processes able to sustain upper-secondary school students' academic performance requires further investigation.

Students' Metacognitive Regulation: Learning Strategies and Scholastic Achievements

The domain of metacognitive regulation focuses on students' learning strategies. The construct of learning strategies includes a wide range of processes and behaviors to plan, for example when students are setting their learning goals in accordance with strategies to be used. Furthermore, learning strategies include monitoring processes, such as when students are checking their correct understanding of contents, and control processes, for example when students are re-reading slowly to assure better comprehension of concepts. Finally, self-regulated learning strategies assure effective cognitive, emotional, social, and motivational processes (Nelson & Narens, 1990). Upper-secondary school requires students to develop their sense of autonomy and self-managing of learning processes and outcomes. A metacognitive approach is required across scholastic subjects to a greater extent than in the early phase of schooling.

Different tasks and school subjects may require the adoption of different learning strategies. Students may show different processing strategies along a continuum from surface to deep (e.g., Somuncuoglu & Yildirim, 1999). Students adopting a surface processing strategy show rehearsal and non-elaborative activities. For example, students might simply note if they know something or not and maintain information at the surface level (Harvey & Goudvis, 2007). Students adopting a deep processing strategy show meaning-making processes and critical thinking (Harvey & Goudvis, 2007; Schneider, 2008). For example, they spend a lot of effort on planning the studying activity, organizing homework (Assor et al., 2002), applying strategies that help them to interpret and elaborate concepts (e.g., highlighting and making lists; Pintrich & De Groot, 1990). They also display monitoring and revision processes.

The adoption of effective learning strategies positively impacts on academic achievement (i.e., Pennequin et al., 2010; Robbins et al., 2004; White & Frederiksen, 1998). A result confirmed across cultural and educational contexts (Yip, 2017). For example, the use of time management (Garg, 2011), self-testing strategy (Pinto et al., 2018; Wadsworth et al., 2007) were positively associated with students' academic achievement.

A longitudinal study by Nota et al. (2004) conducted with Italian students during the final years of upper-secondary school showed that the cognitive self-regulated strategy of organizing and transforming was a significant predictor of academic achievement in a range of subject areas, as well as of their subsequent university outcomes. Furthermore, the use of self-regulated strategy was a significant predictor of upper-secondary school leaving certificate grades and of their intention to continue their education path. Accordingly, Diseth and Kobbeltvedt (2010) found that undergraduate students' academic achievement was positively correlated with strategic learning strategies, meanwhile it was negatively correlated with surface-learning strategies. A further study conducted with upper-secondary school students in Hong Kong (Yip, 2013) confirmed that learning and study strategies are significant predictors of academic performance. Previous findings showing that the association between metacognition and academic achievement varied substantially across contexts of different economic and cultural background (e.g., Chiu, Chow, & McBride-Chang, 2007) recall the necessity to expand research in different educational contexts.

The impact of different patterns of conceptions of learning and learning strategies on academic achievement

The research literature suggests that academic achievement is better explained by patterns of relations between conceptions of learning and learning strategies (Loyens et al., 2008). Dart et al. (2000) found that deep conceptions (e.g., *understanding, meaning making processes*) were linked with the use of more effective approaches to learning. Accordingly, other studies have shown that deep-level conceptions viewing learning as understanding were associated with a more frequent use of self-regulated learning strategies (Purdie et al., 1996). Accordingly, Pinto et al. (2018) shed light on relations between middle-school students' conceptions of learning and their chosen metacognitive strategies. Their findings have shown that a conception of learning as internal attribution of success and failure act as a mediator in the relation between their chosen metacognitive strategies and their academic performance.

A significant advancement of our comprehension of relations between conceptions of learning, learning strategies, and academic performance has been provided by Vermunt (1998; 2005). Their findings have shown four qualitatively different university students' learning patterns mirroring more and less adaptive approaches to learning. The "Reproduction-directed learning" pattern grouped a conception as "Intake of knowledge for storage", external regulation, and a performance goal orientation. This learning pattern was negatively associated with mean exam scores. The "Meaning-directed learning" pattern grouped a conception as "Construction of knowledge", self-regulation, and master goal orientation. This learning pattern was positively associated with mean exam scores. The "Application-directed learning" pattern grouped a conception as "Use of knowledge", a strategic processing approach, and a vocational orientation. This learning pattern was not associated with mean exam scores. Finally, the "Undirected learning" pattern grouped conceptions as "Stimulating education", and "Cooperative learning", lack of regulation, and ambivalent learning orientation. This learning pattern was negatively associated with mean exam scores. The investigation of the relation between surface-level and deep-level approaches to learning to academic achievement needs to be investigated among upper-secondary school students.

Rationale, aims and hypotheses

The current literature shows that academic achievement is better explained when considering patterns of relations between conceptions of learning and learning strategies. Previous studies, however, were mainly focused on university or middle-school students, so they cannot easily generalize to other phases of schooling. Evidence is lacking for Italian upper-secondary school students experiencing a significant and challenging period of scholastic transition. Given the high demand to autonomously manage the studying activity characterizing upper-secondary school, it is important to ascertain whether academic achievement in a range of subject areas can be explained by factors that emerge from the combination of conceptions of learning and learning strategies.

In order to provide an advance of the current state of knowledge, the aims of the present study were the following:

1. to identify the existence of factors composed of different combinations of upper-secondary school students' conceptions of learning and learning strategies;

2. to explore whether the tracked factors are predictors of upper-secondary school students' academic achievements in a range of subject areas.

Regarding the first aim, following the literature, the existence of different factors was expected that collectively encompass more surface-level and deep-level upper-secondary school students' conceptions of learning and learning strategies.

Regarding the second aim, following the literature, it was expected that a combination of more deep-level conceptions of learning and learning strategies would be a positive predictor of academic achievement across subject areas. Conversely, it was expected that a combination of more surface-level conceptions of learning and learning strategies would be a negative predictor of academic achievement across subject areas.

Upper-secondary school requires students to develop their sense of autonomy and self-regulation; thus, we might expect a beneficial effect of a deep-level approach to learning on upper-secondary school students' academic achievements across subject areas, gender, level and type of school considered.

Method

Participants

The research was conducted with 170 upper-secondary school students (male: 45.9%; female: 54.1%) randomly selected by a convenience sampling (White & McBurney, 2012) from medium-sized urban upper secondary schools (student numbers 601–1,500; see, Lee & Burkam, 2003) located in the outskirts of Florence, in the central part of Italy. The convenience sample was balanced for gender, level of school (i.e. 9 classes in total: 3 first classes, 3 third classes and 3 fifth classes) and for type of school (i.e. humanities-based, academic curriculum and institute of Arts).

The confidence intervals at the 95% for age of all the participants was equal to 16.51 ± 3.96 years old, respectively for male of 16.44 ± 3.45 years old and for female of 16.57 ± 4.37 years old. In Italy, upper-secondary school education (e.g., "Lyceum" courses and technical programs in a specific field of studies) lasts five years (age 14 to 19). Compulsory education covers the first two years of upper-secondary school education (European Commission/EACEA/Eurydice, 2018). This research has been conducted with 64 students (37.6%) attending the first year, while 52 students (30.6%) were attending the third year, and 54 students (31.8%) were in the fifth year of upper-secondary school education. Regarding the typologies of upper-secondary school, 65 students (38.2%) were attending a lyceum course with a humanities-based academic curriculum, 59 students (34.7%) were attending a lyceum course with a scientific-based academic curriculum, whereas 46 students (27.1%) were attending a lyceum course with an artistic academic curriculum.

The three grades of upper-secondary school chosen allowed us to cover multiple significant transitions representing critical breakpoints accompanied by academic and psychological challenges (e.g., Vettori, Vezzani, Pinto, & Bigozzi, 2020), that need interventions (Wang & Amemiya, 2019). The first grade of upper-secondary school is a crucial year for the transition from the first cycle of education (i.e., primary and lower-secondary school) to the second one, that is upper-secondary school education, which is different in terms of academic curriculum and courses, relationships with teachers and peers, and personal involvement in the studying activity (e.g., Benner & Graham, 2009).

The first two years of the second cycle of education are compulsory (age 14-16). Thus, the third grade of upper-secondary school is attended only by those students who have decided to continue their school path. It is a further key breakpoint that requires management of the pressure to reach excellent performances in view of the conclusion of the upper-secondary school path.

Finally, the fifth year of upper-secondary school corresponds to the last year that is characterized by increasing academic and psychological demands. Students, in fact, prepare themselves to successfully pass the final exam to obtain the "upper secondary school leaving certificate". Also, they experience a vocational decision-making process about their personal long-term trajectories (e.g., university, high level institute, workplace) that might coincide with the conclusion of their academic path.

The participants were comparable in terms of socio-economic features, ranging from lower-middle class to middle class. They were all Italian mother-tongue speakers. Students with a certified learning and/or disorder disability according to the National Law 104/1992 and 170/2010 were excluded, meanwhile foreign students (1%) in the country for more than five years were included in the study. This research project received the permission of the institutional authorities as well as the consent of the students themselves and their parents and it was approved by the Ethics Committee of the University of […] (Italy).

Context of research

The Italian education system is mainly public, and formalized education begins at age 6. From that point, it is compulsory until age 16. The first step comprises five years of primary education (from age 6 to 10). Subsequently, there are three years of lower-secondary education (from age 11 to 14), ending with a national examination. Then, at age 14 children must choose and enter the upper-secondary school programs by making a choice among different curricular content and academic standards ("lyceum" or technical and vocational paths). Students can enroll either in general education in a state-run high school (offering programs in arts, classical studies, sciences, languages, music and dance, and social sciences) or in a state-run vocational or technical pathway offered by technical and vocational institutes, both of which provide access to higher education. The upper-secondary leaving certificate (formerly known as *Diploma di Maturità*) is attained after 5 years and gives unconditional access to university, even though for some academic areas enrollment is limited and regulated by admission tests.

Procedure and measures

Early in the semester at the end of September, information about the study was shared with the classes involved. Then, students' conceptions of learning and learning strategies

were assessed via two validated self-report questionnaires. The questionnaires were handed out collectively in the presence of the teacher and the researcher during school hours. During administration, the researcher and the teacher were available to answer any questions. Finally, at the end of the school year in the month of June, students' academic achievement in a range of subjects were collected.

Conceptions of learning

Students' conceptions of learning were measured with the "Learning Conceptions Questionnaire" (LCQ; Pérez-Tello et al., 2005). The self-report consists of 49 items with statements to be answered on a five-point Likert-scale (scores ranging from (1) 'I strongly disagree' to (5) 'I strongly agree'). The structure of LCQ is based on several learning dimensions, such as cognitive and socio-cultural (the section on beliefs; 18 items), affective/motivational (the section on emotions; 17 items), and attributive/regulative (the section on attribution; 14 items). Regarding the factorial structure of LCQ, four factorial dimensions referred to the area of Beliefs as follows: "Relationship between your own ideal and the observation of an expert model", "Comparison with others and culture", "Individual concentrated listening", and "Reduction of deficiency by other people". The variance explained by the first section was 47.18% of the total variance. Then, three factorial dimensions referred to the area of Emotions as follows: "Negative experience and duty", "Opportunity, self-efficacy and challenge to success", and "Act of will". The variance explained was 53.59% of the total variance. Finally, three factorial dimensions referred to the area of Attribution as follows: "External attribution of error by students and teachers", "Success as well-being and training value of errors" and "External attribution of success and internal of errors". The variance explained was 46.88% of the total variance. The goodness of fit indexes resulted very good: RMSEA was lower than .05 and the NNFI was higher than .90 for all three sections of the questionnaire (Pérez-Tello et al., 2005).

Learning strategies

The "Learning Strategies Questionnaire" (LSQ; Pellerey, 1996) was used to explore students' learning strategies. Validation of the LSQ was carried out on a sample of 9,959 subjects (3,770 were students in the first year of upper-secondary school; 4,148 students in the first year of vocational training, and 2,041 in the second year of vocational training). The questionnaire contains a hundred items on a 5-point Likert scale, divided into fourteen scales. Drawing on the metacognition theoretical framework, seven scales concern cognitive aspects, as follows: "Processing strategies" explores processes and strategies for understanding and remembering (i.e., attention, planning, and organization) (10 items); "Self-regulation" (11 items); "Disorientation and difficulties in planning studying activities" in organizing the study (9 items); "Willingness to collaborate" (7 items); "Use of semantic organizers"(6 items); "Concentration and time-planning difficulties" (5 items); "Self-inquiry" to check and monitor one's own teachers and peers' comprehension and text understanding (3 items). An Exploratory Factor Analysis (EFA) showed that the variance explained by the cognitive section was 37.80% of the total variance. Then, seven scales concern the affective and motivational factors involved in the learning process, as follows: "Underlying anxiety and difficulties in managing emotive emotions" (10 items); "Willingness and effort" in managing the learning process (4 items); scholastic success and failure as "Attribution to controllable causes" (7 items); scholastic success and failure as "Attribution to uncontrollable causes" (8 items); "Lack of perseverance" in carrying on studying activities and scholastic goals (5 items); "Self-efficacy and sense of responsibility" in the studying process (6 items); "Occasional emotional interferences". The EFA showed that the variance explained by this section was 40.30% of the total variance. In the published literature, the LSQ has been used with university students (Tomai et al., 2014) and it has inspired innovative methods to identify students' personal profiles in E-learning systems (Lanzilotti et al., 2009).

Academic achievement

Students' academic achievement in language and literature, mathematics, foreign language, and history were collected. The score is the average mark obtained by students at the end of the school year. The score resulted from school reports of tests, oral and written examinations carried out during the school year and evaluated by teachers. The score is expressed on a ten-point scale, in which the point of 6 is considered the minimum. Students must obtain at least a minimum score of 6 points in each subject to be admitted to the following year.

Data analysis

Preliminary, the descriptive statistics (mean, standard deviation, skewness and kurtosis coefficients) were carried out and normality assumptions were checked for all the metric variables. The variables were considered normally distributed when skewness and kurtosis coefficients ranged between −1/+1 (Tabachnick & Fidell, 2013). In line with the first aim, a Confirmatory Factorial Analysis (CFA) regarding the dimensions of the two questionnaires (LCQ and LSQ) was carried out by Maximum Likelihood (ML) method, and the reliability of each factor was checked by Cronbach alpha. Factorial loadings were considered statistically significant when their value was higher than .40. The purpose of the CFA was to track the factors composed of different combinations of the several dimensions of the two questionnaires, both conceptions of learning and learning strategies. The effect-size of each regressor was estimated by partial eta-squared. In line with the second aim, a GLM on academic performance in all subject areas considered (i.e., total score of academic performance, and also the scores in language and literature, foreign language, mathematics, and history) was carried out to check the predictive impact of the tracked factors of conceptions of learning (metric predictors) and learning strategies on academic performance. The use of GLM was necessary

Table 1. Descriptive statistics of the factorial dimensions of academic performance (i.e., mean scholastic grade), *LCQ* and *LSQ*: mean (*M*), standard deviation (*SD*), skewness and kurtosis coefficients.

Questionnaire	Variable	Min	Max	M	SD	Skewness	Kurtosis
	School grade (mean)	3.88	8.00	6.29	0.83	−0.38	0.37
LCQ	Relationship between your own ideal and the observation of an expert model	14	42	26.34	5.37	0.25	−0.10
	Comparison with others and culture	13	39	27.17	4.01	−0.27	0.41
	Individual concentrated listening	10	29	17.50	4.17	0.52	−0.21
	Reduction of deficiency by other people	7	28	18.55	3.99	−0.08	−0.08
	Negative experiences and duty	6	24	15.37	4.00	−0.15	−0.47
	Opportunity, self-efficacy and challenge to success	6	19	12.99	2.55	0.01	−0.26
	Act of will	3	12	7.46	2.06	−0.18	−0.51
	External attribution of error by students and teachers	10	40	23.91	6.01	0.05	−0.18
	Success as well-being and training value of errors	11	34	24.07	4.05	−0.24	−0.08
	External attribution of success and internal of errors	14	30	21.89	3.29	−0.07	−0.05
LSQ	Processing strategies	7	24	14.92	3.19	0.46	0.12
	Self-regulation	8	20	12.93	2.69	0.56	−0.27
	Disorientation and difficulties in planning studying activities	5	19	11.87	2.81	0.16	−0.27
	Willingness to collaborate	5	16	11.15	2.31	0.07	−0.47
	Use of semantic organizers	1	5	3.26	0.70	−0.38	−0.11
	Concentration and time-planning difficulties	2	5	3.78	0.45	−0.17	−0.06
	Self-inquiry	1	5	3.50	0.61	−0.88	0.89
	Underlying anxiety and difficulties in managing emotive emotions	2	5	3.53	0.60	0.05	−0.42
	Willingness and efforts	2	4	2.70	0.66	0.56	−0.53
	Attribution to controllable causes	1	5	3.19	0.76	−0.13	−0.80
	Attribution to uncontrollable causes	1	5	3.07	1.28	−0.03	−0.97
	Lack of perseverance	2	4	2.43	0.40	0.44	0.35
	Self-efficacy and sense of responsibility	2	5	3.15	0.65	0.14	−0.35
	Occasional emotional interferences	2	5	3.13	0.57	0.15	0.21

for the heterogeneous measurement scales of the predictors (categorical vs. metric). In a first step, the interactions with gender, level of study, and types of school were controlled (categorical predictors); in a second step, all GLMs were re-estimated without the interaction effects, in those cases where the interactions were statistically not significant. The algorithm used for implementation of the GLM was the Least Squares method.

The general formula of the several GLMs was as follows, in the first step:

$$\begin{aligned}\hat{Y} = {} & \gamma 1{*}\mathrm{G} + \gamma 2{*}\mathrm{LS} + \gamma 3{*}\mathrm{TS} + \beta 1{*}\ \mathrm{F1} + \beta 2 * \mathrm{F2} \\ & + \zeta 1{*}(\mathrm{G} * \mathrm{F1}) + \zeta 2{*}(\mathrm{G} * \mathrm{F2}) + \zeta 3{*}(\mathrm{LS} * \mathrm{F1}) \\ & + \zeta 4{*}(\mathrm{LS} * \mathrm{F2}) + \zeta 5{*}(\mathrm{TS} * \mathrm{F1}) + \zeta 6{*}(\mathrm{TS} * \mathrm{F2}),\end{aligned}$$

in which G = Gender, LS = Level of school, TS = Type of school, F_1 = Deep metacognitive theory of learning, and F_2 = Surface metacognitive theory of learning.

In the second step, the formula of the GLMs without interactional effects was simplified as follows:

$$\hat{Y} = \gamma 1{*}\mathrm{G} + \gamma 2{*}\mathrm{LS} + \gamma 3{*}\mathrm{TS} + \beta 1 * \mathrm{F1} + \beta 2 * \mathrm{F2}.$$

Results

The results of descriptive statistics of each factorial dimension of the two questionnaires are presented in Table 1. The skewness and kurtosis coefficients reveal the normality of the probability distributions of several factorial scores regarding both LCQ and LSQ.

For what concerns the first aim, the results of CFA are reported in the next paragraph. Two factors composed of different combinations of conceptions of learning and learning strategies were detected. The goodness of fit indexes resulted good (CFI = .95, RMSEA = .047, SRMR = .070). All the significant factorial loadings, i.e. higher than .40, are reported in the table below (Table 2).

The first second-order factor was named "Deep metacognitive theory of learning". It resulted significantly loaded by several first order dimensions regarding both the questionnaire (LCQ and LSQ) such as "Willingness and will to persevere" (LSQ), "Self-regulation" (LSQ), "Opportunity, self-efficacy and challenge to success" (LCQ), "Success as well-being and training value of errors" (LCQ), "Attribution to controllable causes" (LSQ), "Processing strategies" (LSQ), "Comparison with others and culture" (LCQ),"Self-inquiry" (LSQ) and "Perception of her/his own skill" (LSQ) (Table 2).

This second-order factor encompasses more deep-level conceptions of learning and learning strategies.

The second dimension pointed out by CFA was named "Surface metacognitive theory of learning". It resulted loaded by "Disorientation and difficulties in planning studying activities", "Attribution to uncontrollable causes" (LSQ), "Underlying anxiety" (LSQ), "Lack of perseverance" (LSQ), "Concentration and time-planning difficulties" (LSQ) and "Negative experiences and duty" (LCQ) (Table 2). This second-order factor encompasses more surface-level conceptions of learning and learning strategies.

The Cronbach alpha resulted optimal for both second order factors ("Deep metacognitive theory of learning": $\alpha = .71$; "Surface metacognitive theory of learning": $\alpha = .74$). The two second-order factors were not significantly correlated.

For what concerns the second aim, academic performance (encoded as the mean of the grades obtained by students in the subject areas of language and literature, foreign language, mathematics, and history and as each single mark in each different subject) was assumed as a dependent variable and the two factors pointed out by CFA, as well as gender, level of study, and type of school (and their interactions, in the first step) as independent variables.

Table 2. Factorial loadings of *CFA* model.

Variable	Factors	
	Deep metacognitive theory of learning	Surface metacognitive theory of learning
	Factorial loadings	
Willingness and efforts	.69	
Self-regulation	.63	
Opportunity, self-efficacy and challenge to success	.62	
Attribution to controllable causes	.57	
Processing strategies	.56	
Success as well-being and training value of errors	.55	
Self-inquiry	.48	
Perception of her/his own skill	.45	
Comparison with others and culture	.41	
Disorientation and difficulties in planning studying activities		.79
Attribution to uncontrollable causes		.73
Underlying anxiety and difficulties in managing emotive emotions		.63
Lack of perseverance		.61
Concentration and time-planning difficulties		.55
Negative experiences and duty		.52

In the first step of GLM estimate, all the interactional effects were included in the analysis. Regarding the predictivity of the two factors pointed out by CFA with respect to the main academic achievement, which are reported in the table below (Table 3), show how both factors are significant predictors of the students' main academic achievement, without any significant interactions with gender, level of study, or type of school of the participants.

Regarding the significant predictive effect of Gender (F (1, 152) = 6.27, $p < .05$, $\eta 2 = .04$), females showed higher academic achievement ($M = 6.47$, $SD = 0.76$), than males ($M = 6.07$, $SD = 0.86$), independently of their level of study, type of school or conceptions of learning. Furthermore, "Deep metacognitive theory of learning" positively predicted students' academic achievement (F (1, 152) = 8.97, $p < .01$, $\eta 2 = .06$) with an explained variance of 6%, while "Surface metacognitive theory of learning" was negatively associated with students' academic achievement (F (1, 152) = 6.97, $p < .01$, $\eta 2 = .04$) with an explained variance of 4% (Table 3). Thus, the predictive effect of the two second-order factors was independent of gender, level of study, and type of school.

Regarding the prediction of each academic achievement obtained in language and literature, the results of the GLM analyses are summarized in the table below (Table 4).

Regarding the predictive effect of "gender" on academic achievement obtained in each subject area considered, a significant predictive role emerged when considering academic achievement at language and literature (F (1, 152) = 12.17, $p < .001$, $\eta 2 = .07$), in which females showed higher academic achievement ($M = 6.82$, $SD = 0.90$), than males ($M = 6.23$, $SD = 0.93$), independently of their level of study, type of school or conceptions of learning (Table 4).

No significant predictive effect resulted for level of study or type of school when considering academic achievement in language and literature (Table 4).

The factor "Deep metacognitive theory of learning" was a significant and positive predictor of academic achievement in language and literature (F (1, 152) = 5.44, $p < .05$, $\eta 2 = .04$). Conversely, the factor "Surface metacognitive theory of learning" a significant and positive predictor of academic achievement at language and literature (F (1, 152) = 9.89, $p < .01$, $\eta 2 = .06$. Furthermore, the results of the interaction analyses showed that the predictive effect of the two second-order factors is confirmed across gender, level of study, and type of school (Table 4). In step 1, no significant predictive model resulted for academic achievement in foreign language, mathematics, or history.

Because of the non-significance of the interactions in all the GLMs, in step 2 all the interactional effects were removed, and the parameters of all the GLMs were re-estimated. The results are shown in the following tables (Tables 5–8).

Concerning GLMs without interactional effects (Step 2), the principal effect of gender showed a significant predictive impact on mean academic performance (F (1, 162) = 7.95, $p < .01$, $\eta 2 = .05$), on language and literature (F (1, 162) = 12.65, $p < .001$, $\eta 2 = .07$) and, finally, on history (F (1, 162) = 5.75, $p < .05$, $\eta 2 = .04$) (Table 5), whereas level of study and type of school showed no significant effects on mean academic performance or on each academic subject.

The factor "Deep metacognitive theory of learning" resulted a significant and positive predictor of mean academic achievement (F (1, 162) = 9.63, $p < .01$, $\eta 2 = .06$) and of academic achievement in language and literature (F (1, 162) = 4.85, $p < .05$, $\eta 2 = .03$), in mathematics (F (1, 162) = 9.12, $p < .01$, $\eta 2 = .05$) and in history (F (1, 162) = 4.09, $p < .05$, $\eta 2 = .03$) (Tables 5– 8).

Conversely, the factor "Surface metacognitive theory of learning" was a significant and positive predictor of mean academic achievement (F (1, 162) = 7.49, $p < .01$, $\eta 2 = .04$) and of academic achievement in language and literature (F (1, 162) = 10.05, $p < .01$, $\eta 2 = .06$) and in mathematics (F (1, 162) = 5.22, $p < .05$, $\eta 2 = .03$) (Tables 5–8).

Likewise, in Step 2 of the GLM analysis (i.e. without interactional effects), no significant GLM resulted for academic achievement in foreign language.

Discussion

This study sheds light on two factors that collectively encompass surface-level and deep-level approaches to learning. They emerged from qualitatively different combinations

Table 3. *GLM* of the mean academic performance on the two factorial dimensions pointed out by second order *CFA*, gender, level of study, type of school and interaction effects: Sum of Squares (*SS*), degree of freedom (*df*), Mean of Squares (*MS*), Fisher's *F*, *p*-value and partial eta-squared.

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Gender	3.91	1	3.91	6.27	.013	.040
Level of study	1.84	2	0.92	1.47	.232	–
Type of school	1.13	2	0.56	0.90	.408	–
Deep metacognitive theory of learning	5.60	1	5.60	8.97	.003	.056
Surface metacognitive theory of learning	4.35	1	4.35	6.97	.009	.044
Gender * Deep metacognitive theory of learning	0.05	1	0.05	0.08	.783	–
Gender * Surface metacognitive theory of learning	0.12	1	0.12	0.20	.657	–
Level of study * Deep metacognitive theory of learning	0.08	2	0.04	0.07	.936	–
Level of study * Surface metacognitive theory of learning	0.21	2	0.11	0.17	.844	–
Type of school * Deep metacognitive theory of learning	0.49	2	0.24	0.39	.677	–
Type of school * Surface metacognitive theory of learning	0.20	2	0.10	0.16	.851	–
Error	94.94	152	0.62			
Total	6839.03	170				

Note. R^2 – adjusted = .10, $p < .05$.

Table 4. *GLM* of the academic performance in language and literature on the two factorial dimensions pointed out by second order *CFA*, gender, level of study, type of school and interaction effects: Sum of Squares (*SS*), degree of freedom (*df*), Mean of Squares (*MS*), Fisher's *F*, *p*-value and partial eta-squared.

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Gender	9.18	1	9.18	12.17	.001	.074
Level of study	4.01	2	2.00	2.66	.073	–
Type of school	0.23	2	0.11	0.15	.861	–
Deep metacognitive theory of learning	4.10	1	4.10	5.44	.021	.035
Surface metacognitive theory of learning	7.46	1	7.46	9.89	.002	.061
Gender * Deep metacognitive theory of learning	0.43	1	0.43	0.57	.451	–
Gender * Surface metacognitive theory of learning	0.12	1	0.12	0.16	.690	–
Level of study * Deep metacognitive theory of learning	0.07	2	0.03	0.04	.957	–
Level of study * Surface metacognitive theory of learning	1.85	2	0.93	1.23	.296	–
Type of school * Deep metacognitive theory of learning	1.80	2	0.90	1.19	.306	–
Type of school * Surface metacognitive theory of learning	3.61	2	1.80	2.39	.095	–
Error	114.63	152	0.75			
Total	7442.00	170				

Note. R^2 – adjusted = .18, $p < .001$.

Table 5. *GLM* of the mean academic performance on the two factorial dimensions pointed out by second order *CFA*, gender, level of study and type of school, without interaction effects: Sum of Squares (*SS*), degree of freedom (*df*), Mean of Squares (*MS*), Fisher's *F*, *p*-value and partial eta-squared.

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Gender	4.72	1	4.72	7.95	.005	.047
Level of study	3.13	2	1.56	2.63	.075	–
Type of school	1.03	2	0.52	0.87	.421	–
Deep metacognitive theory of learning	5.72	1	5.72	9.63	.002	.056
Surface metacognitive theory of learning	4.45	1	4.45	7.49	.007	.044
Error	96.26	162	0.59			
Total	6839.03	170				

Note. R^2 – adjusted = .14, $p < .001$.

Table 6. *GLM* of the academic performance in language and literature on the two factorial dimensions pointed out by second order *CFA*, gender, level of study and type of school, without interaction effects: Sum of Squares (*SS*), degree of freedom (*df*), Mean of Squares (*MS*), Fisher's *F*, *p*-value and partial eta-squared.

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Gender	9.50	1	9.50	12.65	<.001	.072
Level of study	3.86	2	1.93	2.57	.080	–
Type of school	1.42	2	0.71	0.95	.389	–
Deep metacognitive theory of learning	3.64	1	3.64	4.85	.029	.029
Surface metacognitive theory of learning	7.54	1	7.54	10.05	.002	.058
Error	121.64	162	0.75			
Total	7442.00	170				

Note. R^2 – adjusted = .18, $p < .001$.

Table 7. *GLM* of the academic performance in mathematics on the two factorial dimensions pointed out by second order *CFA*, gender, level of study and type of school, without interaction effects: Sum of Squares (*SS*), degree of freedom (*df*), Mean of Squares (*MS*), Fisher's *F*, *p*-value and partial eta-squared.

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Gender	3.97	1	3.97	2.84	.094	–
Level of study	2.74	2	1.37	0.98	.376	–
Type of school	3.89	2	1.95	1.40	.250	–
Deep metacognitive theory of learning	12.72	1	12.72	9.12	.003	.053
Surface metacognitive theory of learning	7.27	1	7.27	5.22	.024	.031
Error	225.83	162	1.39			
Total	6030.75	170				

Note. R^2 – adjusted = .093, $p < .01$.

Table 8. *GLM* of the academic performance in history on the two factorial dimensions pointed out by second order *CFA*, gender, level of study and type of school, without interaction effects: Sum of Squares (*SS*), degree of freedom (*df*), Mean of Squares (*MS*), Fisher's *F*, *p*-value and partial eta-squared.

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Gender	6.01	1	6.01	5.75	.018	.034
Level of study	4.76	2	2.38	2.28	.106	–
Type of school	3.47	2	1.73	1.66	.193	–
Deep metacognitive theory of learning	4.27	1	4.27	4.09	.045	.025
Surface metacognitive theory of learning	0.80	1	0.80	0.77	.383	–
Error	169.23	162	1.04			
Total	7679.25	170				

Note. R^2 – adjusted = .061, $p < .05$..

of upper-secondary school students' conceptions of learning and learning strategies. Expanding previous results in the literature (i.e., Pennequin et al., 2010; Robbins et al., 2004; White & Frederiksen, 1998), the findings of this study provide an interesting picture of relations between approach to learning and academic achievements focusing on the scarcely investigated population of upper-secondary school students.

The first factor named "Deep metacognitive theory of learning" encompasses more deep-level conceptions of learning and learning strategies. The second factor named "Surface metacognitive theory of learning" encompasses more surface-level conceptions of learning and learning strategies.

More specifically, the first factor "Deep metacognitive theory of learning" combined deep-level views of learning embedded by significant aspects, such as the opportunity to reach success, the feelings of self-efficacy and controllability, the importance of comparison with others, and high confidence in the teacher, along with learning strategies denoting willingness and effort, self-regulation, internal attribution, and a sense of responsibility. Previous studies have shown an association between deep-level conceptions of learning and effective learning strategies in lower-secondary school (e.g., Cano & Cardelle-Elawar, 2004; Purdie et al., 1996) and university students (e.g., Vermunt, 2005). The results of this study contribute to advance our knowledge by providing evidence for upper-secondary school students.

The second factor "Surface metacognitive theory of learning" combined surface-level views of learning characterized by unpleasant feelings and negative emotions, duty, and external locus of control, along with learning strategies denoting disorientation and difficulties in planning studying activities, lack of perseverance, a lacking sense of control and responsibility. The result of this study advances previous knowledge (e.g., Cano & Cardelle-Elawar, 2004; Purdie et al., 1996; Vermunt, 2005) on the association between surface-level conceptions of learning and lacking self-regulated learning strategies, shedding light on the relations between two main core dimensions that are external attribution and negative emotions, specifically anxiety. Upper-secondary school students showing a high level in this factor might appear disoriented and scarcely capable of mastering the learning process. Thus, the second factor "Surface metacognitive theory of learning" configures a potential dysfunctional approach to learning.

The results of the regression analyses help us to clarify this point. The two factors predicted overall academic achievement in the expected directions. The first factor "Deep metacognitive theory of learning" positively predicted overall academic achievement probably because, as emerged in prior studies with university students (e.g., Saele et al., 2017), a deep and strategic learning approach leads to seeking meaning of complex topics by the use of self-regulatory behaviors and advantageous study habits. The second factor "Surface metacognitive theory of learning" resulted as a negative predictor of overall academic achievement, confirming its dysfunctional role among upper-secondary school students, as already emerged in university populations (see review of Vermunt, J. D., & Donche, V. (2017).

Moreover, our findings have shown that the first factor "Deep metacognitive theory of learning" positively predicted upper-secondary school students' academic achievement in the range of subject areas considered (i.e., language and literature, mathematics, and history). Conversely, the second factor "Surface metacognitive theory of learning" negatively predicted upper-secondary school students' academic achievements in almost all of the subject areas considered (i.e., language and literature, mathematics). The results indicated that students' worse achievements are predicted by a combination of conception of learning and learning strategies characterized by external attribution of success and failure, anxiety, and lack of persistence.

The two factors did not predict foreign language grades, probably because individuals' views and approaches to learning a foreign language are different from those used when facing other school subjects (e.g., Grossman & Stodolsky, 1994). When students are involved in the acquisition of advanced foreign language ability, it is evident that their approach as novice students constrained by need to master the automatization of basic learning processes may provide less opportunity for the traditional deep approach to studying.

The results have also provided confirmation that the two mutually exclusive predictive effects of the two factors on academic achievement is preserved across gender, level of study, and type of school. The phase of schooling explored requires students to develop their sense of autonomy and self-regulation in approaching the learning processes. Thus, it is not surprising that all upper-secondary school students benefited from a deep-level approach to learning, meanwhile a surface-level configures as a risk factor for their academic success.

Implications

Our findings clearly indicate that upper-secondary school students' failure and success in scholastic achievement can be predicted by qualitatively different combinations of conceptions of learning and learning strategies. The results allow us to consider upper-secondary school as a significant period for intervention to limit and prevent academic difficulties which might constrain their short- and long-term educational path. Upper-secondary school students benefit from a high level 'deep metacognitive theory of learning'. To sustain students, secondary educational curricula, as well as teachers and tutoring programs should foster a view of learning as personal and social value, alongside self-regulation. For example, students might benefit from teaching practices and activities supporting their active engagement, comparisons with other ideas, and collaboration. This might also help to recognize peers and teachers as valuable promoters of one's own learning process, as well as being important models of learning behaviors and habits to be adopted. Furthermore, teachers should encourage students to be actively involved in learning, supporting them to take responsibility of their study work, setting studying activity, and self-evaluation of their success and failure at school.

Finally, given the increasingly complex emotional sphere in the transitional period of upper-secondary school, an adequate consideration of emotions in learning should find room in scholastic programs. Classroom activities, such as talking about emotional experiences, might be a useful tool to learn how to self-regulate emotions in learning (Fried, 2011). This might improve students' feelings of belonging to the school environment, giving the basis for the development of protective factors for academic success (Osterman, 2000).

Limitations and Future Research

Alongside the consideration of practical implication, some aspects of limitation of this research need to be underlined. Although the use of self-reports is particularly useful with upper-secondary school, future studies should adopt multi-method designs, such as strategy questionnaires, interviews, and think-aloud method (e.g., Van Hout-Wolters, 2000) to triangulate information and maximize the reliability of findings. Furthermore, the consideration of different educational contexts is encouraged. Our study is grounded in the Italian education system, in future research different cultures and educational situations should be acknowledged to allow a better comparison of results.

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Compliance with Ethical Standards

The authors declare that they have no conflict of interest.

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