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Students' self-worth protection and approaches to learning in higher education: predictors and consequences

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Abstract The aim of this study was to test a process model of students' learning in higher education, linking anxiety, course experience (positive and negative), self-worth protection (SWP) (self-handicapping, defensive expectations, reflectivity), student approach to learning (SAL) (deep/surface), and achievement. Path and bootstrap analyses of data from 899 first-year university students showed that anxiety significantly predicted all SWP strategies and that positive course experience negatively predicted defensive expectations, whereas negative course experience was linked to higher levels of self-handicapping and reflectivity. Deep approach was linked negatively to self-handicapping and positively to reflectivity, whereas surface approach was associated positively with both self-handicapping and defensive expectations. Finally, deep approach positively predicted achievement and partially mediated the effect of self-handicapping on achievement. These findings support the validity of linking SWP with SAL and demonstrate meaningful connections between these and the anxiety and course experience of students. Implications for theory and practice are discussed.

Keywords Self-handicapping · Defensive pessimism · Motivation · Learning approaches · Academic achievement · Higher education

Introduction

Self-worth protection (SWP) involves strategies that some students use in the face of academic failure or fear of it (De Castella et al. 2013). Although these strategies may serve to defend an

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individual from experiencing low self-worth (Martin and Marsh 2003), many are considered academically maladaptive (Urdan 2004). Although much is known about the relationship between SWP strategies and different contextual and person-related variables (e.g., see Martin and Marsh 2003 for a review), relatively less attention has been given to their role in students' approaches to learning in higher education. Instead, SWP strategies tend to be mapped against outcomes such as academic achievement and not so much against learning approaches that may mediate the link to achievement. Students' approaches to learning (SALs, e.g., deep and surface) refer to how students go about their learning, including intentions (motives) and methods (strategies) (Biggs 2001). In a recent meta-analysis into self-handicapping, for example, Schwinger et al. (2014) concluded, inter alia, it is important to analyze the associations between self-handicapping and the use of specific learning strategies.

It is also the case that SWP research often takes place with only a single SWP strategy as its empirical focus. For example, self-handicapping, but not other SWP strategies, will be investigated. Thus, alongside the need to explore SWP and SAL, there is also a need to consider multiple SWP strategies in order to control for their shared variance and thus assess their unique role in the academic process. The present study examined self-handicapping and defensive pessimism as two such SWP strategies and their role in predicting SAL. Relatively little is known about the extent to which SWP is related to surface and deep SAL, potential antecedents of this relationship (in this study: anxiety and course experiences), and how all these are linked to academic achievement. The aim of this study was, therefore, to propose and test a process model of students' learning in higher education, linking anxiety, course experience, SWP, SAL, and achievement.

SWP strategies: self-handicapping and defensive pessimism

Self-worth motivation theory (Covington 2000) states that individuals establish a sense of worth—a positive self-image—closely tied to ability, which they try to maintain. In the academic context, failure may be seen as a sign of low ability, which can translate to low self-worth, and this leads students to adopt strategies aimed at protecting self-worth (De Castella et al. 2013). Researchers have examined a wide variety of these SWP strategies, among which self-handicapping and defensive pessimism have been some of the more frequently examined strategies (Martin, Marsh & Debus 2001, 2003).

Self-handicapping is a strategy used to generate plausible explanations (excuses or alibis), other than lack of ability, for potential failure (Urdan 2004). By using this strategy, individuals obtain two benefits. The first is protection from failure and its harm to self-worth, and the second is more credit for their success if they do succeed (Alter and Forgas 2007). In the case of self-handicapping's self-enhancing function, on the relatively few occasions that students may succeed following self-handicapping behavior, there is the possibility that they will be seen as having higher ability. That is, having succeeded with relatively little effort (for example), the conclusion to be drawn is that the student must be high in ability (Covington 2000). Notwithstanding this self-enhancing possibility, the vast body of work demonstrates a predominantly protective function in the event of poor performance that is underpinned by maladaptive antecedents and negative outcomes (that connote self-protection) and not adaptive antecedents and positive outcomes (that connote a self-enhancing function; e.g., see Covington 2000; Martin et al. 2001, 2003). For this reason, we focus predominantly on self-handicapping as a self-worth protection strategy. Examples of self-handicapping include strategic lack of

effort or practice, procrastination, and ingestion of drugs or alcohol (Martin et al. 2003). These can then be used as an excuse in the event of possible failure and as a means to deflect the cause of poor performance away from a lack of ability (threatening to self-worth) and onto a lack of effort (less threatening to self-worth). In the main, self-handicapping is associated with negative academic outcomes (Covington 2000; Martin et al. 2001, 2003).

With regards to defensive pessimism, according to Norem and Cantor (1986), this SWP strategy comprises two components. First, students reduce their expectations of how they will perform in that task. By lowering their self-expectations, students establish performance standards that are safer and easier to achieve and by which their ability is judged, minimizing feelings of anxiety and protecting their ability and subsequent self-worth (Norem and Cantor 1986). This component is referred to as defensive expectations (Martin et al. 2001). Second, prior to a task or performance, students think about all possible positive and negative outcomes, as a means of primary control. This is referred to as reflectivity. Thinking through these various possibilities is a means of managing anxiety (Norem and Cantor 1986). Interestingly, the two components seem to impact academic outcomes in distinct ways: defensive expectations are negatively associated, while reflectivity is positively associated with outcomes (Martin et al. 2003).

Predictors of SWP

Anxiety and course experiences are chosen as predictors of SWP strategies on the basis of two theoretical frameworks: the general model of behavior outlined by Buss and Cantor (1989) and Biggs' (2001) model of the teaching–learning system. As relevant to SWP predictors, encompassing and integrative models of human functioning are in broad agreement that there are dispositions and characteristic orientations of the individual that impact behavior. For example, under the general model of behavior outlined by Buss and Cantor (1989), core dispositions and characteristic orientations influence the strategies that individuals use to negotiate demands in their environment. Indeed, there has been much research on the dispositions and characteristic orientations that may operate as antecedents of SWP, such as uncertainty about one's ability (Jones and Berglas 1978), intelligence beliefs, performance orientation, and level of .self-esteem (Ferradás et al. 2016a; Martin et al. 2001). The present study seeks to extend understanding of these antecedents by exploring other factors suggested to be of pertinence to self-worth protection. As relevant to the academic domain, these factors include anxiety and course experience.

According to Biggs' (2001) model of the teaching–learning system, the way students perceive and experience the learning environment (herein referred to as "course experience") (Baeten et al. 2010) and their level of anxiety in this environment are presage factors that influence their academic behaviors and approaches to learning. Although research has linked domain-general test anxiety (i.e., anxiety caused by evaluative situations in general) with students' self-handicapping or defensive pessimism (e.g., Higgins et al. 1990; Norem and Cantor 1986), little research has investigated the link between mathematics-specific anxiety and these SWP strategies. Dowker et al. (2016), who reviewed what research over 60 years revealed about mathematics anxiety, mentioned that the latter correlates with domain-general test anxiety but is not the same as it. Mathematics anxiety refers to a discomfort state (e.g., worry, fear, dislike) accompanied by behavioral manifestations (e.g., tension, nervousness, distress) that arises specifically when a person is faced with situations involving mathematical

tasks that are perceived as threatening to self-esteem (Cemen 1987; Dowker et al. 2016; Trujillo and Hadfield 1999). It is well-established that mathematics evokes levels of anxiety (Hembree 1990) and threat to self-worth (Urdan and Midgley 2001) not seen in most other subjects, and it is thus likely a domain in which SWP may be salient. The present study seeks to explore the role of domain-specific anxiety with regards to self-handicapping and defensive pessimism. We envisage anxiety will predict self-handicapping, defensive expectations, and reflectivity.

Although there has been some research linking the learning environment with SWP, most studies have focused on students' perceptions of classroom goal structures (e.g., Midgley and Urdan 2001), with performance-oriented goal structures positively associated with SWP and mastery-oriented goal structures negatively associated with SWP. Whereas these SWP studies have investigated the influence of motivational climates, to our knowledge, the role of specific course (or subject) experience has received very limited empirical attention with respect to SWP. Dorman and Ferguson (2004), who noted that "no previous studies have investigated the relationship between mathematics classroom environment and self-handicapping" (p. 75), analyzed this link and showed, through regression analyses, that positive course experiences were associated with reduced levels of self-handicapping. Course experience refers to how students perceive and experience the quality of their teaching–learning environment. Drawing on SWP (Covington 2000) and SAL (Biggs 2001) theorizing, course experience might be intertwined with self-worth motivation. Positive course experience connotes good teaching and clear subject goals, which are likely to lead to seeking meaning (e.g., understand ideas for yourself, engage with those ideas, and enjoy intellectual challenge) (e.g., Baeten et al. 2010; Entwistle and Peterson 2004; Prosser et al. 2000) and thus may be related to adaptive student behaviors oriented to academic success, not protection of self-worth. On the other hand, negative course experience connotes inappropriate assessment and workload, which are likely to lead to reproducing content and superficial learning strategies (e.g., to cope with course requirements, feel undue pressure and fear of failure) (e.g., Entwistle and Peterson 2004; Lizzio et al. 2002) and thus may exacerbate maladaptive behaviors and students' motives for protecting their self-worth from potential failure. With regards to self-handicapping and defensive pessimism (defensive expectations and reflectivity), exploring the roles of positive and negative course experiences is an empirical focus of the present investigation. We tentatively suggest positive and negative course experiences will negatively and positively predict self-handicapping and defensive expectations. However, we are unsure of their role in predicting reflectivity since students' more sustained process of thinking things through (i.e., reflectivity) can be a functional academic response distinct from the defensive expectation component of defensive pessimism (Martin et al. 2001).

SAL and SWP predictors

Student approaches to learning are students' ways of experiencing and managing learning situations and tend to be defined as a fusion of motivation and strategy (Biggs 2001). Marton and Säljö (1976) identified two distinct levels of processing that subsequently came to be identified as deep and surface approaches to learning (see Richardson (2015) for a discussion of foundational scholarship in this area by the Göteborg Group in the 1970s). A surface approach is related to students' extrinsic motivation (e.g., avoiding failure, fulfilling requirements) and their use of relatively simple, non-analytical, and straightforward strategies (e.g.,

reproducing facts, learning by rote). A deep approach to learning is related to students' intrinsic motivation (e.g., understanding ideas for oneself, trying to find self-fulfillment from the material) and the use of analytical and inferential strategies (e.g., active searching for meaning, integrating new knowledge with personal experience). Although an achieving approach (achieving strategy and achieving motive) was also initially included (Biggs 2001), its poor construct validity led Biggs et al. (2001) to reconsider and finally to disregard it.

We suggest that the motive to protect self-worth may give rise to SAL. The learning process relevant to self-handicapping (e.g., choosing obstacles or impediments to successful performance) and defensive expectations (e.g., setting unrealistically low expectations) relies on intentions (e.g., avoiding failure) and processes (e.g., learning by rote) that tend to be typical of a surface approach to learning (Biggs 2001). Moreover, from a self-worth motivation perspective, a surface approach to learning may itself be an acquired impediment or lower the weight of expectation in order to protect a sense of ability and consequent self-worth.

However, research evidence linking SWP and SAL is limited to a handful of studies. An early investigation by Zuckerman et al. (1998) found that self-handicapping predicted inefficient ways of learning, but learning approaches in their study were narrowly defined (by way of study habits) and assessed qualitatively. The results of other investigations in which person-centered analyses were used (e.g., Heikkila and Lonka 2006) suggested that surface approaches clustered together with self-handicapping and poor regulation, suggesting potentially similar findings for self-handicapping and reflectivity in our study. Gadbois and Sturgeon (2011) and Thomas and Gadbois (2007) showed that self-handicapping was positively correlated with surface approaches and negatively with deep approaches. In that vein, Thomas and Gadbois (2007, p. 105) stated that "it makes sense that individuals who self-handicap are more likely to be high in surface learning (and low in deep learning) because they are focused externally on avoiding failure." Similarly, Covington (2000) noted that self-handicappers may be "foreclosed from deep-level processing" (p. 186).

These studies are suggestive of links between SWP and SAL. However, they were focused on a single SWP strategy (viz., self-handicapping), only inferred a presence for reflectivity, and did not address defensive expectations. Thus, they were unable to assess the unique contributions of SWP strategies other than SAL when controlling for shared variance among the SWP strategies. The present study seeks to redress these limitations by exploring more than one SWP strategy (self-handicapping, defensive expectations, reflectivity) within a multivariate setup and using a "fully forward" (i.e., saturated) path model that freely estimates all possible paths.

SAL and links with achievement

The final substantive component in our study involves the link between SAL and achievement. SALs are process factors that influence their learning outcomes (Biggs 2001). Previous variable-centered (e.g., Diseth 2003) and person-centered (e.g., Prosser et al. 2000) studies have shown that deep SAL tend to be positively linked to achievement, whereas surface SAL tend to be negatively linked. Notwithstanding this, the research is not unequivocal. In some cases this link has been positive for surface SAL (Lizzio et al. 2002) and non-existent for both deep (Trigwell et al. 2013) and surface (Clinton 2014) SALs. A possible explanation for these mixed effects may lie in the amount of shared variance between deep and surface SALs, as

recently pointed out by Trigwell et al. (2013). The present study is an opportunity to bring some clarity to this debate by modeling both surface and deep SALs.

Another feature of this study is its exploration of SAL and achievement with regards to SWP. There is some research to suggest a potential mediating role for SAL in linking SWP with achievement. Zuckerman et al. (1998), for example, found that the effect of self-handicapping on academic achievement was partially mediated by the efficiency of students' study habits. Specifically, self-handicapping was related to shorter and less efficient exam preparations which were related to lower GPAs. In explaining these results, the authors argued that self-handicappers' excuse of studying less well obtained attributional benefits for them, but at the expense of achievement. With regard to defensive expectations, there is no research evidence about whether or not its association with achievement is mediated by a surface approach. It might be that defensive expectations do not lead anxious students to disengage from learning but help them to manage learning situations by fusing an external motivation (e.g., fulfilling requirements) and a relatively simple strategy (e.g., learning by rote), typical of a surface approach that, as mentioned, might be an acquired impediment to protect their sense of ability and subsequent self-worth. Thus, alongside our investigation of SWP → SAL and SAL → achievement, we will also formally assess (by way of bootstrapping) the indirect paths, SWP → SAL → achievement.

Aims of the present study

The aim of this study is to explore a process model of students' learning in higher education that brings together their experiences of the course, anxiety, SWP, approaches to learning, and achievement. We constructed a "fully forward" path model in which course experience and anxiety predict self-handicapping and defensive pessimism (operationalized via defensive expectations and reflectivity); all these factors predict deep and surface SALs, which all in turn predict academic achievement. Figure 1 demonstrates this. Age, sex, and disciplinary area were included as covariates (i.e., modeled as exogenous variables predicting each of the study variables in the substantive model) to account for their variance and thus better estimate the unique effects attributable to substantive variables.

The hypotheses of this study were organized according to the three groups of predictors included in the proposed model.

– With regard to predictors of SWP,

(a) anxiety will positively predict self-handicapping, defensive expectations, and reflectivity;
(b) positive course experiences will negatively predict self-handicapping and defensive expectations; and
(c) the opposite pattern of associations is expected with regard to negative course experience; with regard to reflectivity (and course experience), we make no directional hypotheses.

– With regard to predictors of SAL,

(d) self-handicapping and defensive expectations will negatively and positively predict deep approaches and surface approaches to learning, respectively, but we make no formal predictions about reflectivity.

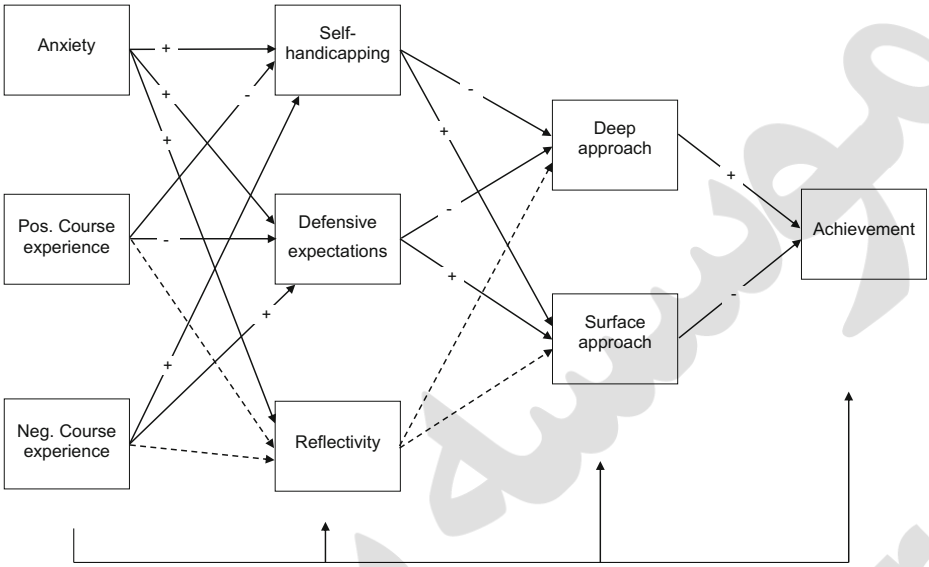

Fig. 1 Hypothesized fully forward model. Solid lines represent predictions, whereas dashed lines indicate that no hypothesis is made a priori. For the sake of clarity, distal paths between the four groups of variables are represented in an overall way (paths at the bottom of the figure)

– With regard to predictors of achievement,

(e) deep and surface approaches are expected to positively and negatively (respectively) predict achievement.

The "distal" direct and indirect roles of course experience, anxiety, self-handicapping, defensive expectations, and reflectivity on achievement are explored as research questions.

Method

Participants and procedure

Participants were 899 first-year students enrolled in mathematic classes across 13 different disciplines at a major, state-supported university. The majority were white (98%), female (57%), and between the ages of 18 and 24 (97%).The proportions from each division were 48% sciences, 45% social sciences, 5% medical sciences, and 2% life and environmental sciences. In terms of Biglan's (1973, hard–soft) more aggregate dimension, 40% was categorized as "hard" academic disciplines (e.g., chemical engineering, mathematics), while 60% was categorized as "soft" academic disciplines (e.g., business administration, sociology). Participants all received a guarantee of the confidentiality of their responses; completed the questionnaires during regular class time, midway through their first semester; and gave written consent for access to their mathematics examination results in university records.

Measures

Course experience, anxiety, self-worth protection, and approaches to learning

Items on these scales were rated on a five-point Likert-type scale, from 1 ("never or rarely true of me") to 5 ("always or almost always true of me"). Participants were instructed to think specifically about mathematics when responding. Reliability and distribution statistics for these measures in the present study are presented in Table 1 (the table of items, M and SD, for each item are available from the first author on request).

Course experience A short version of the Course Experience Questionnaire (CEQ; Wilson et al. 1997) provided information about students' course-related experiences. In line with Crawford et al. (1998), we reversed one item ("We are generally given enough time to understand the things we have to learn") before calculating the Inappropriate Assessment (IA) and Inappropriate Workload (IW) scores. Moreover, similar to Prosser et al. (2000), the average of these two subscales was used as a measure of negative course experience (e.g., "To do well on this course all you really need is a good memory"), and the average of Good Teaching and Clear Goals subscales (e.g., "Staff put a lot of time into commenting on students' work") was used as a measure of positive course experience.

Anxiety This was measured with the Fennema and Sherman (1976) math anxiety scale, which comprised 12 items (e.g., "Math usually makes me feel uncomfortable and nervous").

SWP strategies These were assessed using three reliable and valid scales from Martin et al. (2001). The self-handicapping scale is composed of eight items (e.g., "I don't attend all the classes in this area so I have an excuse if I don't do as well as I hoped"), the defensive expectation scale has eight items (e.g., "No matter how well I have done in the past, I often expect I will do more poorly in the future"), and the reflectivity scale comprises seven items (e.g., "I spend a lot of time thinking through possible outcomes when a test or assignment is coming up").

Student approaches to learning These were assessed using the revised two-factor Study Process Questionnaire (Biggs et al. 2001), which consists of 20 items measuring two main scales for deep SAL (e.g., "I work hard at my studies because I find the material interesting")

Table 1 Descriptive statistics, distributional properties, and reliability (Cronbach's α) of the substantive variables

Variables	Mean	SD	Skew	Kurtosis	α
Anxiety	2.59	0.77	0.33	−0.32	0.88
Positive course experience	2.79	0.59	0.05	0.02	0.81
Negative course experience	2.90	0.58	−0.04	−0.25	0.60
Self-handicapping	1.69	0.61	1.02	0.69	0.83
Defensive expectations	2.53	0.98	0.31	−0.79	0.91
Reflectivity	3.10	0.75	−0.19	−0.17	0.77
Deep approach	2.73	0.61	0.19	−0.01	0.80
Surface approach	2.53	0.64	0.22	−0.04	0.79
Achievement	60.27	20.38	−0.32	−0.15	–

and surface SAL (e.g., "I only study seriously what's given out in class or in the course outlines").

Achievement

Students' final-year examination marks in mathematics, reported as a percentage, were used as the measure of achievement.

Covariates

Demographic factors used as covariates were age (retained as a continuous variable), sex (coded as dummy variable: 0 = female; 1 = male), and disciplinary area (coded as dummy variable: 0 = soft; 1 = hard). These were included to partial out their variance and thus facilitate understanding of the unique variance attributable to substantive variables with which they may share significant variance, as prior studies have shown (e.g., Baeten et al. 2010; Laird et al. 2008; Schwinger et al. 2014).

Results

Initial analyses

Descriptive information for each variable, shown in Table 1, indicated that all values were approximately normally distributed. Five extreme multivariate outliers were detected because their Mahalanobis distance exceeded the critical χ^2 value of 27.87 (df = 9, $p > .001$) and were deleted, leaving a final total of 894 participants. Table 2 shows correlations among the variables. Many of the key correlations were statistically significant, either among proximal variables in the model (e.g., anxiety and negative course experience positively correlated with self-handicapping, $r = .18$, $p < .001$; $r = .12$, $p < .001$) or among distal variables (e.g., self-handicapping negatively correlated with achievement, $r = -.14$), suggesting preliminary support for the hypothesized relationships in the process model.

Central path analysis

Having established that key variables do yield significant bivariate correlations, analyses moved onto multivariate techniques that control for shared variance while estimating unique effects among factors. Accordingly, path analysis (LISREL, 9.1, Jöreskog and Sörbom 2013) was conducted to test the hypothesized model depicted in Fig. 1. Table 3 presents all standardized parameter estimates, and Fig. 2 presents only statistically significant findings.

Given the just-identified nature of this model, the fit is perfect ($\chi^2 = 0.00$, $p = 1.00$, AGFI = 1.00, RMR = 0.00), and therefore, the assessment of results must be focused on the statistical significance of standardized beta coefficients and on alternative model ordering. After controlling for demographic variables, it was found that anxiety significantly predicted the three SWP strategies ($\beta = 0.19$, $p < .001$; $\beta = 0.26$, $p < .001$; and $\beta = 0.21$, $p < .001$ for self-handicapping, defensive expectations, and reflectivity, respectively) such that higher levels of anxiety were associated with higher levels of SWP strategies. Negative course experience predicted

Table 2 Correlations of all variables (including sex, age, and disciplinary area)

Variables	2	3	4	5	6	7	8	9	10	11	12
1. Sex	.12***	.21***	−.20***	−.04	.02	.06*	−.16***	−.03	−.06*	.16***	−.02
2. Age		−.06*	.04	.13***	−.03	.03	−.11***	.00	.04	.01	−.02
3. Disciplinary area			−.06*	−.18**	.21**	−.02	.03	.03	.04	−.02	−.03
4. Anxiety				−.19***	.25***	.18***	.34***	.23***	−.32***	.32***	−.16***
5. Positive course experience					−.37***	−.08*	−.20***	−.05*	.28***	−.18***	.04
6. Negative course experience						.12***	.18***	.19***	−.13***	.29***	−.11***
7. Self-handicapping							.32***	.21***	−.15***	.41***	−.14***
8. Defensive expectations								.39***	−.06*	.21***	−.01
9. Reflectivity									.14***	.18***	−.02
10. Deep approach										−.44***	.16***
11. Surface approach											−.16***
12. Achievement											

*$p < .05$; **$p < .01$; ***$p < .001$

Table 3 Standardized beta values for fully forward model

Variables	Anx	Pos. c. exper.	Neg. c. exper.	Self-hand.	Defensive expect.	Reflect	Deep approach	Surface approach	Achiev.
Sex	−0.33***	0.04	−0.12***	0.21***	−0.14***	0.01	−0.29***	0.48***	0.04
Age	0.06	0.11***	−0.01	0.01	−0.10**	−0.01	0.04	−0.02	−0.01
Disciplinary area	0.01	−0.40***	0.50***	−0.15***	0.03	0.01	0.26***	−0.30***	−0.02
Anxiety				0.19***	0.26***	0.21***	−0.36***	0.29***	−0.09*
Pos. c. experience				−0.04	−0.12***	0.04	0.26***	−0.07*	−0.03
Neg. c. experience				0.11**	0.06	0.15***	−0.09*	0.27***	−0.07
Self-handicapping							−0.07*	0.23***	−0.12**
Defens. expectations							−0.01	0.08**	0.09*
Reflectivity							0.25***	0.01	0.00
Deep approach									0.11**
Surface approach									−0.05

*$p < .05$; **$p < .01$; ***$p < .001$

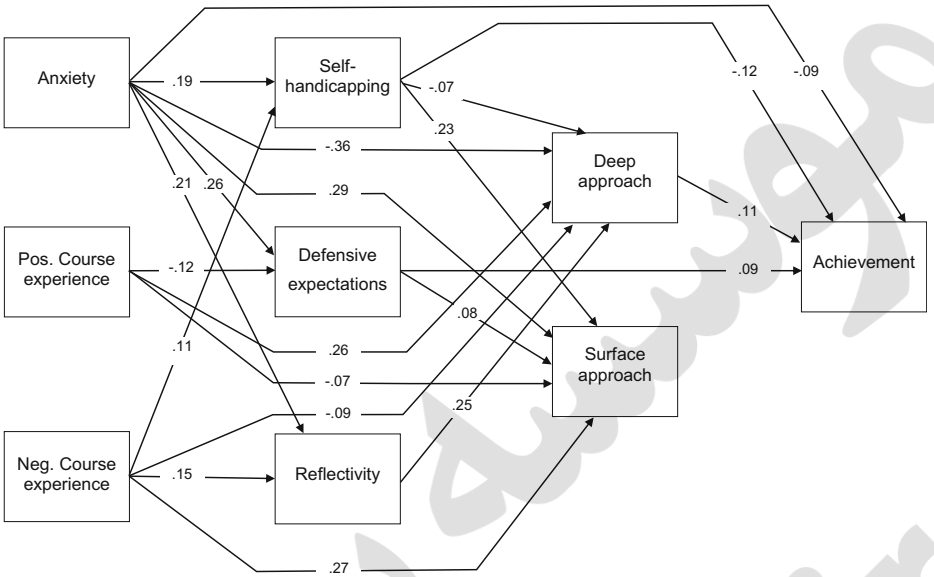

Fig. 2 Empirical fully forward model showing only significant substantive beta paths (controlling for sex, age, and disciplinary area)

two of the SWP strategies ($\beta = 0.11$ and 0.15, $p < .01$ and $p < .001$, for self-handicapping and reflectivity) such that more negative experiences were associated with higher self-handicapping and reflectivity. Positive course experience predicted defensive expectations ($\beta = -0.12$, $p < .001$), with more positive experiences being associated with less defensive expectations.

Beyond the variance explained by demographics, anxiety, and course experience antecedents, SWP strategies significantly predicted SAL, as follows: Self-handicapping predicted both deep approach (negatively; $\beta = -0.07$, $p < .001$) and surface approach (positively; $\beta = 0.23$, $p < .001$), and reflectivity significantly positively predicted deep approach ($\beta = 0.25$, $p < .001$). Deep approach significantly positively predicted achievement ($\beta = 0.11$, $p < .01$), but surface approach ($\beta = -0.05$, $p > .05$) did not.

In addition to the hypothesized proximal effects, there were some statistically significant distal paths worth noting. This was the case for links between antecedents and SAL variables. Anxiety was directly associated with both deep (negatively) ($\beta = -0.36$, $p < .001$) and surface approaches (positively) ($\beta = 0.29$, $p < .001$). Course experiences were also directly and positively associated with SAL such that positive experiences predicted a deep approach ($\beta = 0.26$, $p < .001$) and negative experiences were associated with a surface approach ($\beta = 0.27$, $p < .001$). Moreover, one of the antecedent variables, anxiety, was directly and negatively associated with achievement ($\beta = -0.09$, $p < .05$), and achievement was also predicted (negatively) by self-handicapping ($\beta = -0.12$, $p < .001$) and (positively) by defensive expectations ($\beta = 0.09$, $p < .05$).

Subsidiary analyses

Indirect effects Indirect effects, chiefly those suggesting a partial mediation between the variables under study, were tested using the SPSS macro PROCESS (Hayes 2013), which

provides unstandardized coefficients and bias-corrected 95% confidence intervals (CIs) (using 10,000 bootstrapped samples) around the effect. CIs that do not include 0 indicate significant effects ($p < .05$). These analyses suggested (see Table 4) that most of these indirect effects (e.g., SWP strategies as partial mediators of the effects of anxiety and negative course experience on SAL) were statistically significant. Thus, for example, anxiety was connected with deep SAL via self-handicapping (effect = − 0.01, SE = 0.00, CI [− 0.02, − 0.00]) and reflectivity (effect = 0.04, SE = 0.00, CI [0.02, 0.06]) and with surface SAL via self-handicapping (effect = 0.05, SE = 0.01, CI [0.03, 0.07]) and defensive expectations (effect = 0.04, SE = 0.01, CI [0.02, 0.06]).

Alternative models Given the cross-sectional nature of our data, alternative orderings of our constructs were tested, recording the number of total significant paths (given in brackets) in the hypothesized and alternative models.

For the hypothesized model: anxiety and course experiences → SWP → SAL → achievement (20 paths were statistically significant). Alternative models: (a) anxiety and course experiences → SAL → SWP → achievement (18 paths were statistically significant); (b) SWP → anxiety and course experiences → SAL → achievement (20 paths were statistically significant); (c) SWP → SAL → anxiety and course experiences → achievement (19 paths were statistically significant); (d) SAL → SWP → anxiety and course experiences → achievement (17 paths were statistically significant); and (e) SAL → anxiety and course experiences → SWP → achievement (18 paths were statistically significant). Although alternative model (b) and the hypothesized model had an equally high number of significant paths, the theoretical rationale for the hypothesized model was better and for this reason was the preferred model. Taken together, we suggest our hypothesized model accounts for interfactor relationships better than the alternative models.

Discussion

The findings of the present study supported the validity of a process model of learning in higher education that links course experience and anxiety with SWP, SAL, and academic

Table 4 Indirect effects between the substantive variables under study

Variables	Effect	SE	LLCI[a]	ULCI[a]
Anx → Deep_ap (via SH)	− 0.01	0.00	− 0.02	− 0.00
Anx → Deep_ap (via REF)	0.04	0.00	0.02	0.06
Anx → Surf_ap (via SH)	0.05	0.01	0.03	0.07
Anx → Surf_ap (via DE)	0.04	0.01	0.02	0.06
Pos_ce → Surf_ap (via DE)	− 0.04	0.01	− 0.07	− 0.02
Neg_ce → Surf_ap (via SH)	0.05	0.01	0.02	0.07
Neg_ce → Deep_ap (via SH)	− 0.01	0.00	− 0.03	− 0.00
SH → Achiev. (via Deep_ap)	− 0.71	0.22	− 1.21	− 0.34
Anx → Achiev. (via SH and Deep_ap)	− 0.04	0.02	− 0.12	− 0.01

SH self-handicapping, *DE* defensive expectations, *REF* reflectivity, *LLCI* lower-limit confidence interval, *ULCI* upper-limit confidence interval, → effects

[a] Level of confidence for all bootstrapped confidence intervals set at 95%

achievement. These findings also suggest a mediating role for SAL in linking SWP with achievement and point to meaningful connections with the mathematics anxiety and course experience of students.

Findings of particular significance

Generally consistent with our prediction, course experience (positive and negative) was associated with SWP, after controlling for sociodemographic variables. Specifically, positive course experience negatively predicted defensive expectations, whereas negative course experience was associated not only with higher levels of self-handicapping but also, interestingly, with reflectivity. Self-handicapping, however, was not significantly influenced by positive course experience. Because the bulk of research linking the learning environment to SWP has examined the role of classroom goal structures (e.g., motivational goal climate), our findings are noteworthy because they demonstrate that students' specific course experience, particularly if it is negative (i.e., if it connotes inappropriate assessment and workload), may elevate both the self-handicapping and reflectivity of students.

It is well-established that anxiety is a major impetus for self-handicapping (Martin et al. 2003; Schwinger et al. 2014), and the present finding aligns with this. Further, negative course experience yields a significant effect on self-handicapping once anxiety variance is removed from it. It was also the case that anxiety positively predicted defensive expectations and reflectivity. In relation to the broader defensive pessimism construct, previous research has shown that domain-general test anxiety is associated with it (e.g., Norem and Cantor 1986). However, as we disaggregated defensive pessimism into defensive expectations and reflectivity (following previous recommendations; Martin et al. 2001, 2003), our findings contribute to this research space in showing anxiety is implicated in both defensive expectations and reflectivity. We found that mathematics-specific anxiety is associated with self-handicapping, defensive expectations, and reflectivity.

We also observed that self-handicapping negatively predicts a deep approach to learning and positively predicts a surface approach, as hypothesized. Martin et al. (2001, p. 88) asserted that "self-handicapping involves an active choice of impediments to success," and it seems that this contention holds across diverse learning strategies with greater adoption of a surface approach and lesser adoption of a deep approach. Martin et al. (2003) also identified reflectivity as a SWP self-regulatory function that would typically lead to adaptive academic strategies. We found support for this in that reflectivity was a salient positive predictor of a deep approach to learning. Thus, although not significantly associated with a surface approach, its connection to the more adaptive SAL construct (deep approach) was clear. Also in partial support of Martin et al.'s (2003) contentions and in line with our hypotheses, defensive expectations were positively associated with a surface approach.

Consistent with Biggs's (2001) and Buss and Cantor's (1989) theoretical models, SAL and SWP appear to be intertwined aspects of students' learning experience. The present study has identified some of the nuanced ways this was (and was not) the case. Although previous literature (e.g., Heikkila and Lonka 2006; Thomas and Gadbois 2007) has suggested links between SAL and self-handicapping, our findings confirm their suggestions by showing that students' motives to protect self-worth give rise to their approaches to learning. Moreover, our findings regarding defensive pessimism are unique in offering evidence of distinct patterns corresponding to its two components. Whereas defensive expectations were directly linked to surface approaches, reflectivity was directly linked to deep approaches.

In terms of academic outcomes, as hypothesized, deep approaches positively predicted achievement, in line with previous research (e.g., Diseth 2003). By contrast, we found no evidence of a direct contribution of surface approaches to achievement. Although the research evidence on this is mixed (e.g., Lizzio et al. 2002), we suggest our modeling of both deep and surface approaches as predictors of achievement was critical to understanding their unique effects. As pointed out by Trigwell et al. (2013), surface approaches share variance with deep approaches and once surface approaches are purged of any shared variance with deep approaches, they yielded no noteworthy effect. The question as to why a surface approach did not exert a significant negative effect remains, but it may be that it is not a necessarily maladaptive strategy—simply one that is not conducive to achievement in the ways observed for a deep approach. Further research is warranted to improve our understanding of this issue.

In addition to direct effects (discussed above), the results of subsidiary analyses revealed notable indirect effects. One of the more salient indirect paths was between self-handicapping and achievement via deep approach. Notably, then, from a SWP perspective, it is evident there exists a partial mediating role of deep SAL, with higher self-handicapping associated with lower levels of deep SAL that in turn was associated with lower achievement. This might extend Zuckerman et al.'s (1998) results regarding simple study habits, in that deep approach avoidance may be a means by which self-handicapping is translated into study behaviors that ultimately undermine students' performance. Table 4 shows that other significant indirect effects confirmed links between SWP and SAL and that these links have implications for academic achievement. For example, defensive expectations, reflectivity, and self-handicapping played significant roles as mediators between factors such as anxiety and SAL.

Limitations and future directions

There are some limitations to this study. Although its reliability was minimally acceptable, negative course experience did not reach the ideal of 0.70; therefore, the corresponding findings should be interpreted accordingly. It is also worth noting that anxiety and course experiences are not the only SAL-related variables that might give rise to students' SWP; therefore, other factors might merit consideration as predictors of SWP. Finally, participants in this cross-sectional study were all first-year students immersed in a critical transition period from school to university, which implies both social and academic adjustments (e.g., social integration, independence in learning) (e.g., Fryer 2017). However, changes during the first year and beyond (e.g., across the lifetime of their degree) in the variables defining the proposed path model were not addressed.

Despite these potential limitations, some implications of our findings will be of interest to teachers and researchers. Further studies are needed to advance this research line by (i) examining in depth the distinction between reflectivity and defensive expectations in the context of the interplay between SWP and SAL perspectives and of their possible influence on academic achievement via SAL, (ii) exploring other important and reliable SAL variables probably linked to SWP (e.g., preferences for teaching methods, initial approach to learning), and (iii) performing longitudinal studies with multiple waves to address these relationships over time, particularly from a person-oriented perspective. This is why we cannot ignore that (a) contextual differences between different courses and study years exist, (b) several profiles (i.e., combinations) of self-worth protection strategies have been found (e.g., Ferradás et al. 2016b), and (c) students showing different profiles of learning approaches change differently, since this change is individual in nature (Asikainen and Gijbels 2017; Fryer 2017).

Implications for theory

Our findings hold implications for SWP theory insofar as they suggest the feasibility of accommodating students' course experience and SAL as relevant factors. To the extent this is the case, we suggest it contributes additional insights into the factors and processes relevant to Buss and Cantor's (1989) general model of behavior and Martin et al.'s (2001) model of antecedents and consequences of SWP. In relation to the former, SWP strategies as middle-level units of personality description may be elicited not only by dispositions but also by contextual factors such as students' perceptions of academic quality (course experience). In relation to the latter, motivation may be seen not only as an antecedent of SWP, but also as a consequence of it. In this case, students combine motives and learning strategies (i.e., SAL) to manage learning situations. This expansion of the two models and the links among the mentioned variables contributes to an increased understanding of the interrelationship between SWP and SAL research perspectives. Moreover, whereas many studies of SWP investigate implications for achievement outcomes, the present study extended this to focusing also specifically on learning and so extends SWP conceptualizing into this substantive terrain. For SAL theory, the present study also offers relevant insights. This theory typically emphasizes presage factors tied to students' learning, and these typically encompass factors such as course experience. The present study suggests the presence of SWP factors in this learning process—an inclusion that is consistent with the dynamic relational nature of SAL proposed by Biggs (2001). From a theoretical point of view, the SWP construct does not refer to a stable disposition that may operate as presage factor (e.g., broad personality traits, intellectual ability). Quite the contrary, it refers to a core process factor that, like SAL, plays a central role in academic learning in three ways: (i) SWP is intertwined with SAL, (ii) SWP may partially mediate the effects of presage factors on SAL, and, in addition, (iii) SWP may have an impact on academic achievement. These theoretical links, as reflected in the findings, represent an excellent initial step towards the attainment of a comprehensive process model of students' learning in higher education (in mathematics).

Implications for practice

These implications are explained according to the different components of the proposed model of students' learning in higher education.

Anxiety and course experience It seems important that instructors focus on math anxiety as an antecedent of students' experience of learning in terms of SWP and SAL. Understanding of this common phenomenon among university students may be helpful both in advancing their regulation and reframing of anxiety and in diminishing their tendency to self-handicap, engage in surface approaches, and/or under-achieve. Dowker et al. (2016) mention some recent techniques such as instructing students to reassess the nature and consequences of maths anxiety, writing about the discomfort state (e.g., worry, fear) generated by maths, and cognitive tutoring. Instructors could play a role in encouraging students' positive course experience if their approaches to teaching were more student-centered (e.g., openness, interest in students, encouragement, and support for learning) than teacher-centered, explanations were clearly structured and helpful, and goals and the standard of work expected were clear throughout the course. They also could lessen students' negative course experience by promoting assessment perceived as authentic, relevant, and formative; by assigning a manageable volume of work; and by allowing a reasonable time in which to cover curriculum content (Baeten et al. 2010; Lizzio et al. 2002). If instructors want to offer good

quality in teaching and learning, they might also focus on designing their courses in line with the suggestions mentioned and note well how student are experiencing learning.

SWP Students' motives for SWP may be reduced by intervening where some personal and contextual motivational factors are involved. Previous research designed to assist students has suggested emphasizing mastery goals, encouraging internal and controllable attributional patterns, and developing constructive interpretations of mistakes and failure (e.g., Elliot 2005; Martin et al. 2003; Schwinger et al. 2014). At the classroom level, students' tendency to protect their self-worth may also be diminished by instructional practices and policies that emphasize mastery-oriented classroom goal structures and focus on effort, improvement, and learning (rather than comparative ability) (Martin et al. 2003). Moreover, as our findings suggest, improving students' experience of their courses (e.g., by removing inappropriate assessments and workload and by facilitating quality teaching, clear goals, and standards) may be another way to decrease the motivation to maneuver in a defensive manner and to support their efforts to learn in a meaningful manner, thereby improving their subsequent achievement. In this regard, instructors might pay extra attention to self-handicapping that, being grounded in anxiety and negative course experiences, has a deleterious impact on achievement. It, thus, seems important that instructors (i) include some key information in their curriculum about some antecedents of SWP (self-handicapping, particularly); (ii) provide some opportunities for students to reflect on their learning experience (e.g., proclivity for procrastination; Steele 2007) and, specifically, on their propensity to interpret failure as a sign of low ability; and (iii) help them to attribute low performance to inappropriate learning strategies and motives.

SAL With regards to SAL, our findings suggest that decreasing self-handicapping (and anxiety) while preserving reflectivity (and positive course experience, as mentioned above) may be a means of facilitating deep learning approaches. Previous research has suggested that deep approaches may be favored by an emphasis on such factors as autonomous motivation, formative assessment, and student-centered learning environments via teaching quality (Baeten et al. 2010; Entwistle and Peterson 2004). This does not mean, however, that there is no place for surface approaches (e.g., memorization) at appropriate points in the (deep) learning process, since "students using a deep approach usually recognise that understanding may demand memorisation [for example] at some stage, or for certain purposes (e.g., preparing for final examinations)" (Entwistle and Peterson 2004, p. 416).

Although these theoretical and practical implications have been presented separately for each of the components of the proposed model, it seems evident that taken together, they point to two consequences: (i) Teaching and learning are bound together and form a unified system of which SAL and SWP are part, and (ii) students' learning experience is, therefore, embedded in the teaching–learning system. Hence, the more the intertwined components of students' learning experience are taken into account, the greater the probability of success of the interventions designed to enhance it.

Conclusion

In sum, this research contributes to current understanding of the complexity of students' learning experience in higher education (in mathematics) by providing empirical

evidence for a process model linking course experience and anxiety with SWP, SAL, and achievement. These findings hold substantive implications for researchers seeking an integrative view of students' learning experience and are relevant to instructors wanting to foster an optimal teaching–learning environment in which students can achieve their potential.

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