International Journal of Engineering Education Vol. 32, No. 5(A), pp. 1847–1858, 2016
Printed in Great Britain
0949-149X/91 $3.00+0.00

Canadian Engineering Students' Motivation in the Context of a Shift Toward Student-Centered Teaching Methods in an Outcome-Based Education*

ANASTASSIS KOZANITIS
Université du Québec à Montreal, 405 Saint-Catherine Street, Montreal, Canada. E-mail: kozanitis.anastassis@uqam.ca

JEAN-FRANÇOIS DESBIENS
Université de Sherbrooke, 2500 University Boulevard, Sherbrooke, Canada. E-mail: jean-francois.desbiens@usherbrooke.ca

A recent transition to an outcome-based engineering education in Canada has prompted changes to instructional and pedagogical methods. Given that students can express a different degree of motivation depending on the course and on the learning activities within a course, there is a need to examine the motivational dynamics that drive the students in the learning process. Moreover, most studies on engineering students' motivation have examined motivational components independently. The purpose of this study is to analyze the joint contributions of student characteristics, their perception of instructors' attitudes and behavior when interacting with students, as well as their perception of the nature of the learning activities and their impact on student motivation within a course. The sample was composed of 215 students attending a francophone engineering school in Canada. Participants completed a questionnaire composed of 42 items from various existing instruments. Multiple linear regression analysis was used to predict the set of motivational components for this study. Instructors' attitudes and behavior, as well as higher-order cognitive tasks are significantly related to student motivational components, resulting in a positive impact on mastery goal, performance goal, task value, control beliefs, and self-efficacy.

Keywords: motivation; teaching methods; student-centered

1. Introduction

In 2009, the Canadian Engineering Accreditation Board (CEAB) [1] introduced a new criterion for undergraduate programs, shifting from an input-based education, focused on course content, to an outcome-based education, focused on what the students can do with their knowledge and abilities. This decision echoes similar choices from engineering accreditation boards around the world who have turned to student learning outcomes [2]. Since 2015, all engineering programs in Canada must demonstrate their students possess 12 attributes upon graduation. These attributes cover 12 areas relevant to the modern practice of engineering, such as problem analysis, investigation, design, communication and teamwork skills, to name a few. One of the benefits underlying this important shift is training students to be critical thinkers and to be capable of taking on the challenges of the twenty-first century [3]. In an outcome-based education, the focus is on understanding what students can do after they graduate that they couldn't do before. A careful articulation between curricular design, learning activities and the expected end result is crucial in order to help students achieve those outcomes [4].

Although no formal requests have yet been made by the CEAB as to which teaching methods should be chosen to this end, a shift to an outcome-based education underpins pedagogical opportunities, prompting for instructional strategies that are mainly student-centered and seek for increase student involvement and autonomy in the learning process [5, 6]. Student-centered teaching strategies include active and cooperative learning where students, either individually or in teams, are presented with challenges in the form of projects, questions or complex problems to solve. When addressing these challenges within a context of an outcome-based education, students are encouraged to take ownership of their learning process, reflect on what they are learning and how they are learning it. The instructor's role becomes one of support, mostly focusing on helping students to think autonomously, challenging them to critically analyze data and arguments, as well as providing them with useful feedback when they come up with solutions to real world problems.

However, changes in instructional strategies are generally slow to appear, and literature indicates that the traditional teacher-centered lecture continues to be the preferred teaching method in Canadian higher education [7]. Most instructor-centered methods, like the lecture, require students to listen and to take notes, as a result, students are

* Accepted 25 June 2016.

expected to receive, and to process information, not to use it in order to generate original solutions to practical problems. This can be an issue because the traditional lecture turns out to be less efficient for deep and significant learning [8], and also less likely to motivate students [9]. Indeed, empirical findings show that one of the most glaring and recurrent problem, as perceived by engineering faculty members, is lack of student motivation [10, 11]. For instance, instructors can wonder why such phenomena like low levels of student effort, lack of interest in the subject matter, or high levels of nonattendance can occur inside their classroom, be it an elective or required course. Many researchers have found that lack of engagement and low motivation are strongly related to college student dropouts [12, 13]. Recent data show that, on average in North America, forty percent of engineering major students do not complete their degree [14, 15]. Some of the main reasons for attrition in engineering programs, as perceived by students, are poor quality of instruction [16], lack of motivation in the learning environment [17–19], as well as a sense of loss and failure [20].

A vast body of research has highlighted the close link between motivation, engagement, and persistence in higher education [21–23]. Motivation to learn and student involvement are also considered crucial elements in determining academic achievement, perhaps more importantly than initial ability [13, 24–26]. Theoretical models explaining the motivational dynamic have integrated a myriad of variables, some of which are internal to the person such as precollege and personal characteristics (gender, age, family values, ability), social and cognitive characteristics (student perceptions of self and others, goals), while others are external such as contextual characteristics (instructor's interpersonal style, learning activities) [27].

However, in the majority of the recent research on engineering students' characteristics, motivation is discussed in terms of the motives that lead the students to undertake university studies or in terms of the degree of interest they show for the program in which they are enrolled [28, 29]. Also, some studies compare what motivates students in different engineering disciplines [30]. These are certainly relevant and important issues, particularly for program-level stakeholders. However, because of the transition to an outcome-based engineering education in Canada, there is also a need to examine the motivational dynamics that drive the students in the learning process; particularly in the context of a growing proportion of student-centered learning methods and the desire to enhance students ability to solve real world complex problems [31]. Moreover, most studies on engineering students' motivation have examined internal or external variables' impact on student motivational components separately [32, 33]. A relevant example of this is the extent attention that has been given in the last decade to self-efficacy, an important component in the definition of student motivation [34]. Also, based on the limited attention engineering education research has granted to task value, this construct seems an undervalued aspect when looking at how instructors and the design of learning tasks can help individual students succeed in the learning process.

A question we want to explore in the present study is the combined interrelation among internal and external factors and their influence on the multicomponent nature of motivation for students enrolled in an undergraduate engineering program. In this regard, the specific goal of this study is to explore the joint contributions of student characteristics, their perception of instructors' attitudes and behavior when interacting with them, as well as their perception of the nature of the learning activities and their effects on their motivation within a course. The existing literature offers a relevant framework for understanding the motivational dynamic inside a course, and sheds some light on these issues.

2. Theoretical framework

There is a rich base of motivational literature in higher education describing the multifactorial concept of motivation in detail and how it can be subject to numerous personal and contextual variables [35, 36]. Studies that examine students' perception of the learning context show that college and university instructors can influence motivation to learn [37]. For example, students can express a different degree of motivation depending on the course as well as on the teaching and learning activities within a course [38–40]. This is a very relevant finding because of its consideration of how course-specific factors are thought to influence students' motivation. It is also an empowering position because it strongly suggests that the instructor and his/her pedagogical decisions can be a key source of student motivation. What is more, findings in an extensive literature review suggests [41] that in the case of university students motivation to learn can vary across disciplines.

2.1 Predictive model of student motivation

In the present study, following the work of [42], a simplified model of student motivation was used to explore the relationship between students' characteristics, their perception of instructors' attitudes and behavior towards students, their perception of tasks and learning activities, and several compo-

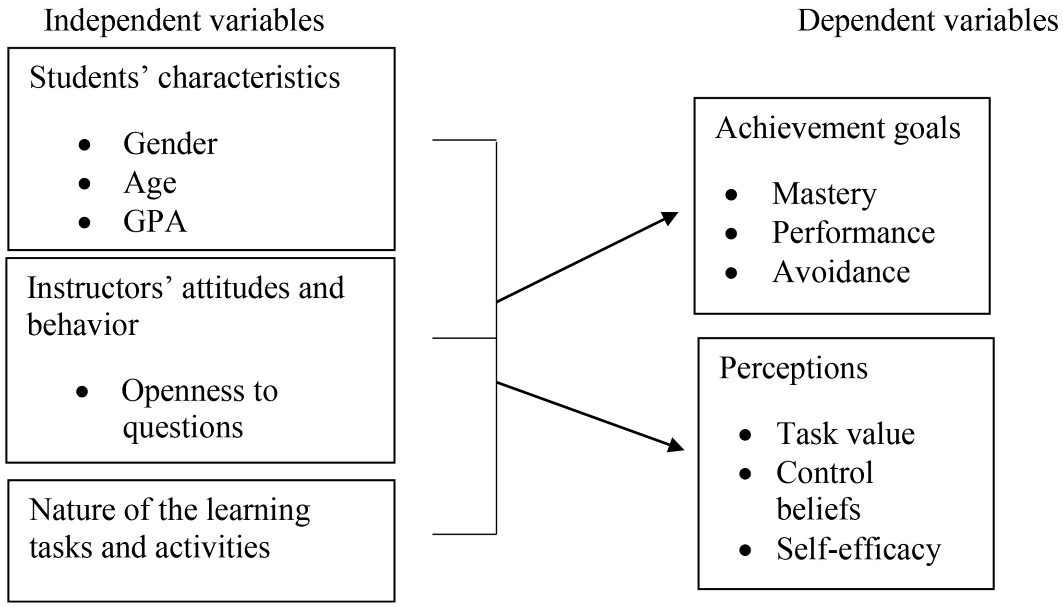

Fig. 1. Simplified model to predict student motivation.

nents of motivation to learn. Fig. 1 displays a conceptualization of these relations. Concepts on the left are hypothesized to influence concepts on the right. Arrows direction indicates that this study will focus exclusively on horizontal relationships, although vertical relationships between the concepts are also possible. Hence, student motivation is expressed through measures of various relevant motivational components (achievement goals, task value, control beliefs, and self-efficacy), which in turn are thought to be influenced by internal variables (students' characteristics), and external variables (instructors' attitudes and behavior; nature of the learning tasks and activities).

The model combines two well-known theoretical perspectives used in a number of studies on student motivation, the achievement goal theory [43], and the expectancy-value theory [37]. According to the socio-cognitive paradigm, cognitions and students' perceptions of their abilities, their school work and the learning environment all act as mediators of their behavior and explain much of the achievement-related behaviors, such as effort [44].

2.2 Achievement goal theory

The achievement goal theory is based on the assumption that students' academic motivation can be understood as attempts to achieve goals [45]. Recognizing the trichotomous model of goals, as suggested by Pintrich [46] and Elliot [47], this study selected three constructs of goal orientation: mastery goals, performance goals, and avoidance goals. Hence, as noted by Dweck and Leggett [48], when pursuing mastery goals, students are interested in the question: "How to increase my ability to successfully master the task?". When holding high mastery goals, students will use adaptive learning strategies such as seeking help when needed, and willingly choosing challenging tasks [49, 50]. When pursuing performance goals, however, students are interested in the question: "How can I obtain the highest grade?". High performance goals are associated with superficial learning strategies, and preference for easy tasks [49]. Avoidance goals are usually used as a mechanism to reduce the negative impact on self-esteem. Therefore, the student wants to avoid appearing incompetent. For some students, this may lead them to believe that having to make an effort for success is a sign of incompetence. So they try to work as little as possible and to have easy successes [51]. Researchers claim that university students can pursue multiple goals simultaneously, and this is not to be considered as incompatible [52, 53]. For example, students may want to pursue high mastery goals, in order to acquire deep knowledge and develop their skills, but at the same time pursue high performance goals, because of what's at stake in regards to grades [54]. Some researchers also suggest that classroom goal structures (i.e. general classroom practices and specific messages that instructors communicate to their students regarding what is valued in her or his class) can have a complex relation with personal-level goal orientation [55]. They found various direct, indirect, and interaction effects of classroom goal structures on student personal mastery and performance goal preferences.

2.3 The expectancy-value theory

The expectancy-value theory elucidates that motivation is the result of two factors, namely the expectancy regarding the performance on an activity and the value the activity's outcome holds for the student. An important aspect of this theory is the consideration of how course-specific factors are thought to influence learning motivation, because of their significant impact on students' perception of self and to what extent they value the course. Such factors include the perceived teachers' instructional practices, and the perceived nature of the tasks. Teaching and teachers are considered to be at the heart of student cognitive and behavioral engagement [13, 56]. Indeed, researchers have identified a variety of engagement-encouraging attitudes and behaviors. For instance, Mearns, Meyer, and Bharadwaj [57] found that when the teacher is perceived to be approachable, well prepared and sensitive to student needs, students commit to working harder, to get more out of the session and are more willing to express their own opinion. Bryson and Hand [58] concluded that students are more likely to engage if they feel supported by teachers who establish convivial learning environments, have high expectations and offer challenging tasks, but make themselves available for dialogue on academic matters. A number of studies emphasize in particular the importance of providing accurate and immediate feedback when a student asks a question or makes a comment [59]. Others found a positive relationship between student cognitive and behavioral engagement and instructor's behaviour like fostering a supportive learning environment, being well organized, and holding high expectations [60–62]. Finally, Bradley and Graham [63] found a positive relationship between instructor-student interactions and student academic engagement.

Cooper [64] was one of the first to study the link between learning activities and student motivation. The results of his research indicate the importance of presenting students with interesting activities. Covington [65] and Friedman, Rodriguez, and McComb [66] also emphasize that learning activities should be varied and interesting so that students are motivated to accomplish them. Others have found that instructional practices are related to student adoption of mastery and performance goals [67].

Task value corresponds to the meaning a student gives an object of knowledge. Task value may come from the student's perception of what the task may bring to his personal development, skills, and ability to solve problems or simply help him/her achieve the goals he has set for himself. This broad definition of task valuing encompasses students' subjective perception of the importance and the utility of the task, two central elements related to cognitive engagement [68]. It has been shown that students who perceive their teachers in a positive manner are more likely to positively value learning tasks [69, 70].

Control beliefs reveal whether the student attributes his success or failure to factors that can be mastered by him or not. The judgment for controllability is different from one individual to another. Factors such as luck or the degree of difficulty of a task are seen as factors over which students have no control, whereas effort is considered a controllable factor [71]. Controllability can be perceived positively when associated to causes like intelligence or effort. This dimension becomes critical to academic success in a postsecondary setting [72].

Self-efficacy can be defined as the assessment a student makes of his own ability to organize and execute actions to solve problems or tasks [44]. Success leads to an increased sense of self-efficacy, which in turn leads to higher levels of student engagement. Research has demonstrated that when faced with difficult tasks, students who have high self-efficacy beliefs are more likely to take on the challenge by increasing time on task and effort [73].

3. Methodology

The study was conducted at a public 4-year French speaking engineering school in Quebec, Canada, with an undergraduate population of approximately 4000 students (75% male/female ratio), and 215 full-time faculty members. The school has adopted an outcomes-based education for all of its 12 undergraduate programs since 2005. A convenience sampling technique was used to recruit faculty members who met the following criteria: teach an undergraduate course during the 2012 winter semester, allow a 15 minute period of class time for students to voluntarily fill out a questionnaire between the 9th and 10th week, and allow for student-centered learning activities during classroom time. Based on this initial screening process, a total of 14 full-time faculty members received an invitation, of whom seven accepted to participate in the study. The final sample was composed of 215 students (79 % male), with a mean age of 22.7, SD = 4.1, from seven different classrooms at different class levels (2 freshman, 3 sophomore, 1 junior, and 1 senior). All participants completed a self-administered questionnaire composed of 42 items from various existing instruments. They were asked to rate their motivation for the particular class they were seated in when they filled out the survey. Available student characteristics for this study were students' age, gender and prior achievement represented by the grade point average (GPA). Because the purpose of this study is to examine the combined effects of various independent variables, a multiple linear regression analysis was used to predict the set of motivational components. Independent variables were introduced with the forward method, in the following order: student characteristic, instructors' attitudes and behavior, and student perception of tasks and learning activities. The intention was to verify whether external factors add significant explanation of the variance, in comparison with internal factors.

3.1 Instruments

Motivational components were assessed using a condensed version of the Motivated Strategies for Learning Questionnaire (MSLQ) [74] that included 20 items. Students were instructed to respond to the items on a 5-point Likert scale (1 *not at all true of me* to 5 *very true of me*). Internal consistency of the subscales for the French version was tested using the standardized Cronbach's alpha, the standardization provides a mean of zero and a standard deviation equal to one. Four items comprise the mastery goals subscale (α = 0.74), such as, "In a class like this, I prefer course material that really challenges me so I can learn new things." The performance goals subscale (α = 0.70) consists of four items, such as "Getting a good grade in this class is the most satisfying thing for me right now." The task value subscale (α = 0.90) contains four items, such as, "It is important for me to learn the course material in this class." The control beliefs subscale (α = 0.70, contains four items, such as "My study skills are excellent compared with others in this class". The self-efficacy subscale (α = 0.93) is made up of four items, such as "I am confident I can understand the most complex material presented by the instructor in this course."

The MSLQ does not measure avoidance goals. Therefore, this construct was added, recognizing the trichotomous model of goals [46]. It comprises three items, such as "In this course, I just want to do enough in order not to fail." The French version of these items were validated in a previous study [9]. The standardized Cronbach alpha value obtained is α = 0.70.

The instructor's attitude and behavior are captured through teacher reaction and openness to questions. Students' perception of teacher support of questioning was measured with a previously validated French version of the *Perceived Teacher Support of Questioning (PTSQ*; [75]. The PTSQ contains five items (α = 0.80), two of which are worded in the supportive direction, and three of which are formulated in the non-supportive direction [70]. Likewise, instructors' reaction to questions was measured with a previously validated French version scale created from various existing questionnaires [70]. This scale includes four items (α = 0.80), aimed at assessing student perceptions of instructors' verbal and non-verbal behavior towards questions.

The Student Engagement Survey [76] includes 14 key questions about student engagement at the course level with an emphasis on collaborative learning, cognitive development and personal skills development. Items are divided into three sections, and are measured on a scale of 1 (very little/never) to 4 (very much/very often). Section A includes 4 items: "During your class, about how often have you asked questions or contributed to class discussions; Worked with other students on projects; Worked with classmates outside of class to complete class assignments; Tutored or taught the class material to other students in the class?"

Following Bloom's Taxonomy of the cognitive domain, section B includes 5 items: "To what extent has this class emphasized the following mental activities: Memorizing facts (. . .) so you can repeat them in almost the same form; Analyzing the basic elements of an idea (. . .) in depth and considering its components; Synthesizing and organizing ideas (. . .) into new, more complicated interpretations and relationships; Evaluating the value of information (. . .) assessing the accuracy of their conclusions; Applying theory to practical problems or in new situations?"

Section C includes the following 5 items: "To what extent has this course contributed to your knowledge, skills, and personal development in the following: Acquiring job or career related knowledge and skills; Writing clearly, accurately, and effectively; Thinking critically and/or analytically; Learning effectively on your own, so you can identify, research, and complete a given task; Working effectively with other individuals?"

4. Results

Table 1 shows the adjusted fraction of variance (adj-R^2) explained for all six components of student motivation, which acted as the dependent variables in the multiple linear regression models. The first model of independent variables consists of the students' characteristics: gender, age and GPA. In general, the first model indicates weak, but significant relations with mastery (0.10) and avoidance goal (0.06), task value (0.14) and self-efficacy (0.06). In the second model, two independent variables were added by introducing instructors' attitudes and behavior. The second model shows higher significant relations with all of the dependent variables. In the third model, the independent variables of student involvement in learning tasks were added by introducing the items from section A, which offered a slight increase in the explained variance.

Table 1. Fraction of variance explained for motivational components

	Mastery Goal		Performance		Avoidance		Task Value		Control Beliefs		Self-efficacy	
Model	**R^{2*}**	**F**	**R^{2*}**	**F**	**R^{2*}**	**F**	**R^{2*}**	**F**	**R^{2*}**	**F**	**R^{2*}**	**F**
1	0.10	5.37**	0.02	1.91	0.06	3.84**	0.14	7.50**	0.03	1.35	0.06	3.71*
2	0.26	9.54**	0.05	2.38*	0.21	7.66**	0.25	9.03**	0.20	7.14**	0.23	8.19**
3	0.25	5.23**	0.06	1.76	0.23	4.68**	0.29	6.13**	0.22	3.74**	0.25	5.08**
4	0.28	4.17**	0.09	1.82*	0.23	3.51**	0.30	4.48**	0.22	3.10**	0.23	3.44**
5	0.28	3.20**	0.11	1.74*	0.25	2.92**	0.35	4.16**	0.25	2.87**	0.26	3.09**

R^{2*} = adjusted R-squared; * $p < 0.05$; ** $p < 0.01$.

The same is true for the fourth and fifth model, which introduced items from section B and C, respectively. Model five indicates that the final regression equation accounted for 28.0 % of the variability for mastery goal, 11.0 % for performance goal, 25.0 % for avoidance goal, 35.0 % for task value, 25.0 % for control beliefs, and 26.0 % for self-efficacy.

Results shown in table 1 were used to decide which model to retain for further analysis. Hence, the fifth model was chosen, based on the strength of the adjusted fraction of variance for the majority of the motivational components, suggesting it is a better fit in general. Indeed, all the dependent variables, with the exception of mastery goal, show an increase in the fraction of variance ranging from 0.02 % to 0.05 % compared with model four. Moreover, from a qualitative point of view, model 5 has the advantage of containing variables from section C, which are of interest for student classroom engagement.

Table 2 shows the standardized beta coefficients and t test values for the significant independent variables only. Also, for the sake of parsimony, any independent variable that did not display a significant beta value does not appear in table 2. This allows us to identify which particular independent variables considered in the study obtain the greatest effect on the variability of each of the dependent variables. Verification for excess collinearity between the independent variables was ensured by computing the variance inflation factors (VIF). Values for the retained model varied between 1.103 and 3.125, which are below the commonly suggested threshold values [77]. Students' characteristics variables show that gender didn't render a significant influence on any of the motivational components. Students' age is only positively related to task value (β = 0.16), and GPA is positively related to mastery goal (β = 0.23). On the other hand, instructor attitudes and behaviors have a significant impact on all the dependent variables. More specifically, instructor's reaction to student classroom verbal interventions shows a positive impact on mastery goal (β = 0.46), performance goal (β = 0.41), task value (β = 0.35), control beliefs (β = 0.27), and self-efficacy (β = 0.37). Whereas instructor's openness to student classroom verbal

Table 2. Standardized coefficients and t test values for significant independent variables

	Mastery Goals		Performance		Avoidance		Task Value		Control Beliefs		Self–efficacy	
Variables	**Beta**	**t**	**Beta**	**t**	**Beta**	**t**	**Beta**	**t**	**Beta**	**t**	**Beta**	**t**
Student characteristics												
Age	–	–	–	–	–	–	0.16	2.02*	–	–	–	–
Gender	–	–	–	–	–	–	–	–	–	–	–	–
GPA	0.23	2.44*	–	–	–	–	–	–	–	–	–	–
Instructor's behavior												
Reaction	0.46	3.75**	0.41	3.04**	–	–	0.35	3.03**	0.27	2.26*	0.37	3.05**
Openness	–	–	–	–	–0.56	–4.62**	–	–	–	–	–	–
Task–related												
Section A												
Ask question	–	–	0.21	2.12*	–	–	–	–	–	–	0.21	2.29*
Section B												
Apply to new situations	–	–	–0.27	–1.98*	–	–	–	–	–	–	–	–
Synthesize	0.23	2.03*	–	–	–	–	–	–	–	–	–	–
Evaluate	–	–	–	–	–	–	0.20	1.96*	–	–	–	–
Section C												
Job related	–	–	–	–	–	–	0.29	2.63*	–	–	–	–
Think critical	–	–	–	–	–	–			–	–	–0.27	–2.05*
Autonomous learning	0.27	2.19*	–	–	–	–	0.25	2.14*	–	–	0.35	2.84

* $p < 0.05$; ** $p < 0.01$.

interventions is inversely related to avoidance goal (β = –0.56). Finally, tasks and learning activities show a significant relationship with mastery goal (autonomous learning, β = 0.27; synthesize, β = 0.23); performance goal (ask question, β = 0.21; apply to new situations, β = –0.27), task value (autonomous learning, β = 0.25; evaluate, β = 0.20; job related, β = 0.29), and self-efficacy (ask question, β = 0.21; autonomous learning, β = 0.35; thinking critically, β = –0.27).

5. Discussion

Recently introduced new accreditation criterion for engineering programs in Canada is looking to change how students are trained, by shifting to an outcome-based education. This has spurred instructors and programs to rethink all or part of their pedagogy and teaching methods, by adopting student-centered learning activities. The purpose of this study was to explore the joint contributions of student characteristics, their perception of instructors' attitudes and behavior when interacting with students, as well as their perception of the nature of the learning activities and their effects on student motivation within a course. A multiple regression analysis using the forward method was conducted in order to arrive at variables that best predict students' motivation.

Results show that instructor and context-related variables are significantly related to student motivational components, and provide us with important information about engaging teaching practices. What's more, they tend to have a broader effect on motivation than most student-related variables when considered concurrently.

5.1 Student characteristics

The only student-related variables found to have a significant relationship with motivational components were age and prior achievement represented by GPA. Older students tend to lend higher value to learning tasks, confirming previous findings [78, 79]. As for GPA, it is significantly related to mastery goals, whilst unrelated to performance goals, suggesting that learning strategies employed by students pursuing high mastery goals are compatible with a high GPA. Conversely, those employed by students pursuing high performance goals do not necessarily give the desired end result. Although, it is not possible to conclude that pursuing high mastery goals will result in a higher grade for the course, this finding conveys support that mastery and performance goals are not incompatible, and the former need not to be considered detrimental to a desired high achievement outcome [53]. Also, we found no significant relations for the gender variable with any of the dependent variables. A similar finding was reported by [80], who concluded that, in the engineering field, the gap between the genders for students' academic motivation is narrowing. Additional elements concerning goal orientation and its relationship with the other two independent variables, instructor-related and task-related characteristics, are discussed in the following paragraphs.

5.2 Instructor's attitude and behavior

Instructor-related variables, namely reaction to student questioning is positively related to all motivational components, with the exception of avoidance goals, which is, not surprisingly, inversely related to instructor's openness. This data is consistent with previous research results, and supports the notion that instructors' attitudes and behavior play an important role in creating a supportive learning environment, where students feel free to ask questions and contribute to classroom discussions, which in turn enhances their motivation for the subject matter [58, 81, 83]. In this case, students' positive assessment of their instructor's classroom attitude and behavior contributes to their goal orientation as well as to expectancy-value components, as also reported by [56] and [13]. The effect is significant for mastery as well as for performance goals, which might at first glance seem an incompatible arrangement. Nonetheless, this result supports the view that university students can pursue multiple goals simultaneously, where mastery and performance goals can function, not as antagonists, but in a complementary manner [52]. It might suggest that students are sensitive to instructors' efforts to create a supportive learning environment, which is conducive to mastery goals, but, at the same time they remain aware that grades become important for admission to graduate programs, obtaining scholarships, and employment [54]. As for avoidance goals, the mitigating effect of instructor's openness towards student classroom participation has important practical implications, particularly for overcoming feelings of helplessness in the presence of students who display low levels of engagement and lack of effort triggered by self-esteem-preserving strategies like the pursuit of avoidance goals [51]. Being aware of such undesirable strategies, particularly in the context of student-centered learning activities, instructors' verbal affective support can prevent students from resorting to avoidance goals when challenged with complex learning tasks.

The findings reported in this study are in line with the expectancy-value theory that postulates how course-specific factors, such as instructor's behavior can have an impact on student motivation [36]. They also confirm studies that refer to a socio-affective dimension in teaching, emphasizing the importance for instructors to establish interpersonal rapport through dialogue with students and to demonstrate a caring attitude [60, 62]. Result show that spontaneous expression of an adequate attitude and supportive verbal behavior towards students can be very efficient in positively influencing students' perception of self and the value they place on the learning activities. More specifically, such beneficial attitudes lead to greater task value, as well as high control and self-efficacy beliefs, confirming previous studies [69, 70, 82]. This is a noteworthy outcome, since positive perceptions of self and high task value might be the two most salient components of motivation because of their well-documented impact on student cognitive and behavioral engagement [68, 72, 73]. It also has significant practical implications for instructors, particularly when it involves helping students to value higher-order cognitive tasks and inciting their perception of controllability and self-efficacy when performing such tasks. What is more, it does not require excessive effort or any particular skills from instructors, nor does it involve any prior planning or preparation, and requires very little class time.

5.3 Nature of the learning tasks

With regard to task-related variables, one very interesting finding is that, unlike low-order cognitive tasks, like memorization and repetition of information, most higher-order cognitive tasks are significantly related to all motivational components. Overall, our results coincide with [13], showing that instructors who provide higher-order cognitive learning experiences promote student motivation. Hence, instructors play a crucial role in designing tasks that are engaging and meaningful and promote effective motivational components. However, some of these tasks are inversely related to motivation, and reveal nuances worth mentioning. We will unpack these beneficial and detrimental effects in the following paragraphs.

5.4 Student verbal participation

Tasks that encourage students' verbal participation, like asking questions, show a positive relation with self-efficacy beliefs and performance goals. Whilst this result parallels previous work from [57, 75], the relation with performance goals however, is not consistent with other previous studies, where mastery goals are usually the ones related with student classroom verbal participation [70, 84]. These authors conclude that when goals are mainly mastery oriented, students demonstrate greater cognitive and behavioral engagement in the task. Since this study adopted a classroom-level approach for its methodology, two plausible explanations can be raised to elucidate such discrepancies. The first draws on recent studies that revealed the existence of a complex relation between classroom goal structures and personal goal orientation [55]. The second reason may be that motivational factors are discipline-specific and do not extend uniformly across all disciplines [39]. Our contradicting results with previous studies raise the question whether engineering students portray a distinct pattern of personal goal orientation. Whatever the case, our findings seem to corroborate the existence of a more complex relationship between classroom learning activities and student goal orientation that deserves further investigation [84].

5.5 Student autonomy

When presented with tasks that elicit their autonomy, students pursue high mastery goals, they also value the task and demonstrate higher self-efficacy beliefs. A positive link between autonomy-seeking tasks and motivational components, from both goal-orientation and expectancy-value theories is a very interesting finding and brings to light several practical implications. Autonomy denotes one's capacity to choose the path to follow for a desired outcome-result. It also represents the capacity for self-regulation and self-determination, and taking responsibility for one's actions, which are sought after qualities for the engineering disciplines [5, 6]. Providing learning tasks that allow students to act autonomously encourages them to want to master the skills and knowledge underlying these tasks. Likewise, students are likely to value the task more and feel capable of successfully completing high-order cognitive tasks when instructors offer them an experience of autonomy [73].

5.6 Higher-order cognitive tasks

The two highest cognitive levels from Bloom's taxonomy, evaluate and synthesize, have also rendered positive relations with motivational components. Learning activities that request students to synthesize or creatively link information, which can definitely be considered as challenging tasks, seem to encourage mastery goals [49, 50]. Whereas asking students to evaluate or connecting the material to real world experiences, like to their future job for instance, can positively influence the value individuals hold for participating in these types of learning activities. These findings have several implications for instructors and strongly suggest that several student-centered teaching methods, as well as tasks offering opportunities for autonomous learning, evaluating information, and that comprise job related knowledge, can have a positive impact on mastery goals and task value.

On the other hand, critical thinking activities seem to be negatively related to self-efficacy beliefs, and students tend to pursue lower performance goals when they are asked to participate in learning activities that require applying their knowledge to new or unforeseen situations. One possible explanation to these results might ensue from the scarcity of such activities at the undergraduate level, and therefore students feel insufficiently prepared to do well.

Since successfully completing such higher-order cognitive tasks is paramount for engineering majors, it makes sense to turn to self-efficacy theory for finding ways to reduce feelings of discomfort with such tasks based on self-efficacy theory. Self-efficacy theory acknowledges four essential sources of efficacy expectations: prior performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal [44]. Of these, vicarious experience and verbal persuasion can directly be influenced by instructors. As for the other two, they can be addressed through indirect actions by instructors, for example by increasing the opportunities students have to perform such tasks.

Finally, there was no relationship between any of the task-related variables and students' control beliefs. One probable explanation is that this component is more relevant when summative assessment activities are involved, rather than formative learning activities, as is the case in this study [71]. Had such situations been included, they would have made control beliefs more salient, given the higher stakes associated with summative assessments and how they induce students to explain the outcome in relation to internal and external factors [53].

5.7 Limitations

Although the results from the present study provide insight into the relationships between motivational components and various predictive variables, some limitations are to be noticed. The results are correlational in nature; therefore, it is hazardous to infer causality from the observed relationships. Even though the results suggest fairly robust relations between the measured variables, the direction of influence between the motivational components and the predictive variables studied has to be considered with caution, and further controlled research is needed before establishing definitive pathways. Also, with respect to generalizability and scope of the findings, the analysis of student motivation in a single francophone engineering school in Quebec are to be considered indicative, not definitive, because the data pool is small and originates from a convenient sample. Though what is learned from the results provides evidence that supports the hypothesis that learning activities, along with instructors' attitude and behavior influence student motivation in an outcome-based education framework. Furthermore, future research should expand to different course contexts, involve data collected over a longer period and across numerous courses, and include more direct observations of behavioral indicators during learning tasks.

6. Conclusion

When analyzing the joint contributions of the variables investigated in this study, overall results show the more compendious model to be a better fit, for it explains a larger percentage of variance for the majority of the motivational components.

Another important conclusion from this study is that instructors' classroom attitudes and behavior as well as their pedagogical decisions can have a direct influence on student motivation, regardless of students' characteristics. Thus, a positive perception of instructor's reaction to student classroom verbal participation has proven to be an important trigger for all the coveted motivational components. Such behavior promotes the pursuit of higher mastery and performance goals, it increases the value students confer to the learning tasks, and elevates self-efficacy and control beliefs. And although perception of instructor's openness to student questioning had a less extensive impact, its contribution to decrease the pursuit of avoidance goals is a salient finding. Finally, this study bears evidence that task-related variables can have a significant impact on task value and mastery goal, considered as two of the most pre-eminent motivational components.

Acknowledgement—This project was publicly funded by a federal organism in Canada, the SSHRC #410-2009-1646.

References

1. Engineers Canada/Ingénieurs Canada, Canadian Engineering Accreditation Board: Accreditation Criteria and Procedures/Bureau canadien d'agrément des programmes de génie: Normes et procédures d'agrément, 2008. (Latest edition: http://www.engineerscanada.ca/e/files/Accreditation_Criteria_Procedures_2009.pdf, Accessed 12 June 2015.
2. L. Lattuca, P. Terenzini and F. Volkwein. Engineering change: A study of the impact of EC2000, 2006, http://www.abet.org/wp-content/uploads/2015/04/Engineering-Change-executive-summary.pdf, Accessed 12 June 2015.
3. Association of American Colleges and Universities. *College learning for the new global century: A report from the National Leadership Council for Liberal Education and America's Promise (LEAP)*. Washington, DC: Association of American Colleges and Universities, 2007.
4. W. Spady, Outcome-based education: Critical issues and answers. 1994, Arlington, VA: American Association of School Administrators.
5. A. Glatthorn, Outcome based education: reform and the curriculum process, *Journal of Curriculum and Supervision*, **8**, 1993, pp. 324–63
6. M. Kaliannan and S. D. Chandran, Empowering Students

through Outcome-Based Education (OBE), *Research in Education*, **87**(1), 2012, pp. 50–63.
7. B. Gopaul, G. A. Jones and J. Weinrib, *The changing academic profession in Canada: perceptions of Canadian university faculty on research and teaching*, Paper presented at the annual conference of the Canadian Society for Research in Higher Education, 2012, May, Waterloo, Ontario.
8. S. Freeman, S. Eddy, M. McDonough, M. K. Smith, N. Okoroafor, H. Jordt and M. P. Wenderoth, Active learning increases student performance in science, engineering, and mathematics, *Proceedings of the National Academy of Sciences of the United States of America*, **111**(23), 2014, pp. 8410–8415.
9. J.-F. Desbiens and A. Kozanitis, Les facteurs d'influence de l'engagement en classe d'étudiants en éducation physique et en kinésiologie. In: C. Spallanzani, R. Goyette, M. Roy, S. Turcotte and S. Beaudoin (dir.), *Mieux former pour agir dans une société en movement*, 2010, (pp. 318–321). Sainte-Foy, Québec: PUQ/numérique.
10. American Society for Engineering Education, Creating a Culture for Scholarly and Systematic Innovation in Engineering Education, 2009, Retrieved from http://www.asee.org/about-us/the-organization/advisory committees/CCSSIE/CCSSIEE_Phase1Report_June2009.pdf, Accessed 10 may 2015.
11. E. Seymour and N. Hewitt, *Talking about leaving: Why undergraduates leave the sciences?* Boulder, CO: Westview Press, 1997.
12. L. Bullard, R. Felder and D. Raubenheimer, Effects of Active Learning on Student Performance and Retention. *Proceedings of the Annual Conference of the American Society for Engineering Education*, 2008, http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/ASEE08%28ActiveLearning%29.pdf, Accessed 22 July 2015.
13. G. D. Kuh, J. Kinzie, J. Buckley, B. Bridges and J. Hayek, What Matters to Student Success: A Review of the Literature, NPEC, 2006, http://nces.ed.gov/npec/pdf/kuh_team_report.pdf, Accessed 22 July 2015.
14. American Society for Engineering Education, Going the Distance. Best practices for Retaining Engineering, Engineering Technology and Computing Students, 2012, Retrieved from http://www.asee.org/retention-project
15. M. L. Murray, 3 Reasons for High Engineering Dropout Rates, 2013, Retrieved from: http://typesofengineeringdegrees.org/engineering-school-dropout-rates/
16. W. Tyson, Negative impact of employment on engineering student time management, time to degree, and retention: Faculty, administrator, and staff perspectives, *Journal of College Student Retention, Theory and Practice*, **13**, 2012, pp. 479–498.
17. L. Forest, Enquête sur les motifs d'absentéisme dans les cours du baccalauréat [Survey on absenteeism patterns in undergraduate courses]. Unpublished manuscript, 2003.
18. J. Hamann, Un enjeu pour la collectivité. [A challenge for the community]. *Journal de la Communauté Universitaire*, **42**(10), 2006, Retrieved from : http://www.lefil.ulaval.ca/articles/enjeu-capital-pour-collectivite-85.html
19. T. Tseng, H. L. Chen and S. Sheppard, *Early academic experiences of non-persisting engineering undergraduates*. Paper presented at the annual conference of the ASEE, Vancouver, British Colombia, Canada, 2011.
20. M. Meyer and S. Marx, Engineering dropouts: A qualitative examination of why undergraduates leave engineering, *Journal of Engineering Education*, **103**(4), 2014, pp. 525–248.
21. G. D. Kuh, Assessing what really matters to student learning: Inside the National Survey of Student Engagement, *Change*, **33**(3), 2001, pp. 10–17.
22. D. Lester, A review of the student engagement literature. Focus on college, universities, and Schools, **7**(1), 2013, Retrieved from: http://www.nationalforum.com/Electronic%20Journal%20Volumes/Lester,%20Derek%20A%20Review%20of%20the%20Student%20Engagement%20Literature%20FOCUS%20V7%20N1%202013.pdf
23. D. Schunk and Zimmerman, Motivation and self-regulated learning: Theory, research, and applications, *Journal of Higher Education*, **80**(4), 2009, pp. 476–479.
24. N. Gillet, R. J. Vallerand, M. A. Lafrenière and J. S. Bureau, The mediating role of positive and negative affect in the situational motivation-performance relationship. *Motivation and Emotion*, 1–15, 2012, Retrieved from http://www.er.uqam.ca/nobel/r26710/LRCS/papers/Gillet2012mediatingrole.pdf, 2012.
25. S. C. Howey, Factors in student motivation, 2008, Retrieved from http://www.nacada.ksu.edu/Resources/Clearinghouse/View-Articles/Motivation.aspx, 2008.
26. S. Hu and G. D. Kuh, Being (eds) Engaged in Educationally Purposeful Activities: The Influence of Student and Institutional Characteristics, *Research in Higher Education*, **43**(5), 2002, pp. 555–575
27. J. Reeve and H. Jang, What teachers say and do to support students' autonomy during a learning activity, *Journal of Educational Psychology*, **98**(1), 2006, pp. 209–218.
28. C. J. Atman, S. D. Sheppard, J. Turns, R. S. Adams, L. N. Fleming, R. Stevens, R. A. Streveler, K. A. Smith, R. L. Miller, L. J. Leifer, K. Yasuhara and D. Lund, *Enabling Engineering Student Success: The Final report for the center for the advancement of engineering education*, San Rafael, CA: Morgan and Claypool Publishers, 2010.
29. Q. Li, H. Swaminathan and J. Tang, Development of a classification system for engineering student characteristics affecting college enrollment and retention, *Journal of Engineering Education*, **98**(4), 2009, pp. 361–376.
30. S. Parikh, H. Chen, K. Donaldson and S. Sheppard, Does major Matter? A look at what motivates engineering students in different majors, in *Proceedings of the American Society for Engineering Education Annual Conference, Austin, TX*, 2009, Retrieved from: http://search.asee.org/search/fetch; jsessionid=4quugalgd53f1?url=file%3A%2F%2Flocalhost%2FE%3A%2Fsearch%2Fconference%2F19%2FAC%25202009Full1304.pdf&index=conference_papers&space=129746797203605791716676178&type=application%2Fpdf&charset=
31. M. W. Ohland, D. Giurintano, B. Novoselich and P. Brackin, Supporting Capstone Teams: Lessons from Research on Motivation, *International Journal of Engineering Education*, **31**(6), 2015, pp. 1749–1759.
32. B. D. Jones, M. C. Paretti, S. F. Hein and T. W. Knott, An Analysis of Motivation Constructs with First-Year Engineering Students: Relationships Among Expectancy, Values, Achievement, and Career Plans, *Journal of Engineering Education*, **99**(4), 2010, pp. 319–336.
33. J. Stock, and J. Harari, Student motivations as predictors of high-level cognitions in project-based classrooms, *Active Learning in Higher Education*, **15**(3), 2004, pp. 231–247.
34. S. P. Schaffer, X. Chen, X. Zhu and W. C. Oakes, Self-efficacy for cross-disciplinary learning in project-based teams. *Journal of Engineering Education*, **101**(1), 2012, pp. 82–94.
35. P. R. Pintrich, A motivational science perspective on the role of student motivation in learning and teaching contexts, *Journal of Educational Psychology*, **95**(4), 2003, pp. 667–686.
36. A. Wigfield and J. S. Eccles, Expectancy-value theory of achievement motivation, *Contemporary Educational Psychology*, **25**, 2000, pp. 68–81.
37. S. Lindbloom-Ylänne, K. Trigwell, A. Nevgi and P. Ashwin, How approaches to teaching are affected by discipline and teaching context, *Studies in Higher Education*, **31**(3), 2006, pp. 285–298.
38. Z. E. Dadach, Quantifying the Effects of an Active Learning Strategy on the Motivation of Students, *International Journal of Engineering Education*, **29**(4), 2013, pp. 904–913.
39. R. M. Felder and R. Brent, Understanding student differences, *Journal of Engineering Education*, **94**(1), 2005, pp. 57–72.
40. K. A. Smith, S. D. Sheppard, D. W. Johnson and R. T. Johnson, Pedagogies of engagement: Classroom-based practices, *Journal of Engineering Education*, **94**(1), 2005, pp. 87–101.
41. E. Lai, Motivational theory, *StudyMode.com*, 2012, Retrieved from http://www.studymode.com/essays/Motivational-Theory-1069525.html
42. P. Pintrich and D. Schunk, *Motivation in education: Theory, research, and applications* (2nd ed.), Upper Saddle River, NJ: Merrill, 2002.

43. J. Harackiewicz, K. Barron, P. Pintrich, A. Elliot and T. Thrash, Revision of achievement goal theory: Necessary and illuminating, *Journal of Educational Psychology*, **94**(3), 2002, pp. 638–645.
44. A. Bandura, Self-efficacy: Toward a unifying theory of behavioral change, *Psychological Review*, **84**(2), 1977, pp. 191–215.
45. T. Seifert, Understanding student motivation, *Educational Research*, **46**(2), 2004, pp. 137–149.
46. P. R. Pintrich, Multiple goals, multiple pathways: The role of goal orientation in learning and achievement, *Journal of Educational Psychology*, **92**, 2000, pp. 544–555.
47. A. J. Elliot, The hierarchical model of approach–avoidance motivation, *Motivation and Emotion*, **30**, 2006, pp. 111–116.
48. C. S. Dweck and E. L. Leggett, A social-cognitive approach to personality and motivation, *Psychological Review*, **95**, 1988, pp. 256–273.
49. A. Kaplan, M. Middleton, T. Urdan and C. Midgley, Achievement goals and goal structures, in. C. Midgley (ed.), *Goals, goal structures, and patterns of adaptive learning*, Mahwah, NJ: Erlbaum, 2002, pp. 21–53
50. J. C. Turner and H. Patrick, Motivational influences on student participation in classroom learning activities, *Teacher College Record*, **106**, 2004, pp. 1759–1785.
51. E. A. Linnenbrink and P. R Pintrich, Motivation as an enabler for academic success, *School Psychology Review*, **31**(3), 2002, pp. 313–327.
52. K. Barron and J. Harackiewicz, Achievement goals and optimal motivation: Testing multiple goals models. *Journal of Personality and Social Psychology*, **80**(5), 2001, pp. 706–722.
53. A. J. Elliot, K. Bouas Henry, M. M. Shell and M. A. Maier, Achievement goals, performance contingencies, and performance attainment: An experimental test, *Journal of Educational Psychology*, **97**(4), 2005, pp. 630–640.
54. R. Mattern, College students' goal orientations and achievement, *International Journal of Teaching and Learning in Higher Education*, **17**(1), 2005, pp. 27–32.
55. K. Murayama and A. J. Elliot, The joint influence of personal achievement goals and classroom goal structures on achievement-relevant outcomes, *Journal of Educational Psychology*, **101**(2), 2009, pp. 432–447.
56. H. L. Chen, L. R. Lattuca and E. R. Hamilton, Conceptualizing engagement: contributions of faculty to student engagement in engineering, *Journal of Engineering Education*, **97**(3), 2008, pp. 339–353.
57. K. Mearns, J. Meyer and A. Bharadwaj, *Student engagement in human biology practical sessions*, Refereed paper presented at the Teaching and Learning Forum, Curtin University of Technology, 2007, Retrieved from: http://otl.curtin.edu.au/tlf/tlf2007/refereed/mearns.html
58. C. Bryson and L. Hand, The role of engagement in inspiring teaching and learning, *Innovations in Teaching and Education International*, **44**(4), 2007, pp. 349–362.
59. D. Nicol, From monologue to dialogue: improving written feedback processes in mass higher education, *Assessment and Evaluation in Higher Education*, **35**(5), 2010, pp. 501–517.
60. J. Davies, C. Arlett, S. Carpenter, F. Lamb and L. Donaghy, L, What makes a good engineering lecturer? Students put their thoughts in writing, *European Journal of Engineering Education*, **31**(5), 2006, pp. 543–553.
61. J. Levy, P. Den Brok, Th, Wubbels and M. Brekelmans, Significant variables in students' perceptions of teacher interpersonal communication styles, *Learning Environments Research*, **6**, 2003, pp. 5–36.
62. J. J. Teven and J. C. McCrosky, The relationship of perceived teacher caring with students learning and teacher evaluation, *Communication Education*, **46**, 1997, pp. 167–177.
63. J. S. Bradley and S. W. Graham, The effect of educational ethos and campus involvement on self-reported college outcomes for traditional and non-traditional undergraduates, *Journal of College Student Development*, **41**(5), 2008, pp. 488–502.
64. R. Cooper, Task characteristics and intrinsic motivation, *Human Relations*, **26**(3), 1973, pp. 387–413.
65. M. V. Covington, A motivational analysis of academic life in college, in J. C. Smart (ed.), *Higher education: Handbook of theory and research*, IX, Springer, Norwell, MA, 1993, pp. 50–93.
66. P. Friedman, F. Rordriguez and J. McComb, Why students do and do not attend classes: Myths and realities, *College Teaching*, **49**(4), 2001, pp. 124–133.
67. L. H. Anderman, H. Patrick, L. Z. Hruda and E. A. Linnenbrink, Observing classroom goal structures to clarify and expand goal theory, in C. Midgley (ed.), *Goals, goal structures, and patterns of adaptive learning*, Lawrence Erlbaum Associates, Mahwah, NJ, 2002, pp. 234–278.
68. P. C. Blumenfeld, T. M. Kempler and J. S. Krajcik, *Motivation and cognitive engagement in learning environments*, in R. K. Sawyer (ed.), *The Cambridge handbook of the learning sciences*, Cambridge University Press, New York, NY, 2006, pp. 475–488.
69. J. Kerssen-Griep, Teacher communication activities relevant to student motivation: classroom facework and instructional communication competence, *Communication Education*, **50**(3), 2001, pp. 256–273.
70. A. Kozanitis and R. Chouinard, Les effets directs des variables d'influence de la participation verbale en classe d'étudiants universitaires, *Revue canadienne d'enseignement supérieur*, **37**(2), 2007, pp. 1–28.
71. B. Weiner, Motivation from an attribution perspective and the social psychology of perceived competence, in A. J. Elliot and C. S. Dweck (eds.), *Handbook of Competence and Motivation*, Guilford, New York, 2005.
72. M. J. Findley and H. M. Cooper, Locus of control and academic achievement: A literature review, *Journal of Personality and Social Psychology*, **44**, 1993, pp. 419–427.
73. F. Pajares, Toward a positive psychology of academic motivation: The role of self-efficacy beliefs, in R. Gilman, E. S. Huebner and M. J. Furlong (eds.), *Handbook of positive psychology in schools*, Taylor & Francis, New York, 2009, pp. 149–160, Retrieved from: http://books.google.com/books?id=5qhjolwnQIEC
74. P. R. Pintrich, D. A. F. Smith, T. Garcia and W. J. McKeachie, Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ), *Educational and Psychological Measurement*, **53**, 1993, pp. 801–813.
75. S. A. Karabenick and R. Sharma, Seeking academic assistance as a strategic learning resource, in P. R. Pintrich, D. R. Brown and C. E. Weinstein (eds.), *Student motivation, cognition, and learning: Essays in honor of Wilbert J. McKeachie*, Lawrence Erlbaum Associates, Hillsdale, NJ, 1994, pp. 189–211.
76. S. Ahlfeldt, S. Mehta and T. Sellnow, Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction are in use, *Higher Education Research & Development*, **24**(1), 2005, pp. 5–20.
77. J. Fox, J. of *Applied Regression Analysis, Linear Models, and Related Methods*, CA: Sage, Thousand Oaks, 1997.
78. A. Kozanitis, J.-F. Desbiens and R. Chouinard, Perception of Teacher Support and Reaction Towards Questioning: Its Relation to Instrumental Help-Seeking and Motivation to Learn, *International Journal of Teaching and Learning in Higher Education*, **19**(3), 2008, pp. 238–250.
79. Fi. Michie, M. Glachan and D. Bray, An Evaluation of Factors Influencing the Academic Self-concept, Self-esteem and Academic Stress for Direct and Re-entry students in Higher Education, *Educational Psychology*, **21**(4), 2001, pp. 455–472.
80. C. Brouse, C. Basch, M. LeBlanc, K. McKnight and T. Lei, College students' academic motivation: Differences by gender, class, and source of payment, *College Quarterly*, **13**(1), 2013, Retrieved from http://www.collegequarterly.ca/2010-vol13-num01-winter/brouse-basch-leblanc-mcknight-lei.html
81. J.-F. Desbiens, A. Kozanitis and S. Lanoue, Qu'est-ce qui influence la participation verbale en classe d'étudiants en enseignement de l'éducation physique et en kinésiologie?, *Revue canadienne d'enseignement supérieur*, **43**(2), 2013, pp. 100–131.

82. H. Jang, J. Reeve and E. Deci, Engaging students in learning activities: It's not autonomy support or structure but autonomy support and structure, *Journal of Educational Psychology*, **102**(3), 2010, pp. 588–600.
83. J. Chesebro and J. McKroskey, The relationship between students' reports of learning and their actual recall of lecture material: A validity test, 1988, Retrieved from: http://www.jamescmccroskey.com/publications/188.pdf
84. C. M. Spray, S. J. H. Biddle and K. R. Fox, Achievement goals, beliefs about the cause of success and reported in post-16 physical education, *Journal of Sports Sciences*, **17**, 1999, pp. 213–219

Anastassis Kozanitis is an associate professor in the Department of didactics at the Université du Québec à Montréal, Canada. He received a M.A. (psychopedagogy) in 1997 from Université Laval, and a Ph.D. (psychopedagogy and andragogy) in 2005 from Université de Montréal. His areas of research interest include higher education pedagogy, student motivation and pedagogical innovations.

Jean-François Desbiens is a professor in the Department of education at the Université de Sherbrooke, Canada. He received a M.A. (kinanthropology) in 1994 from the same university and a Ph.D. (psychopedagogy) in 2001 from Université Laval. His areas of research interest include pedagogical supervision, higher education pedagogy, and classroom management.