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Beyond Grade Point Average of University Students: Theoretical Foundations for the
Achievement as a Process Approach with an Empirical Illustration

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Abstract

Psychological research in tertiary education typically follows the *achievement as an outcome approach* in which the focus is placed on inter-individual differences in the achievement level of students (e.g., semester GPA, cumulative GPA). In this article, the *achievement as a process approach* is proposed to reconceptualise academic achievement as a developmental story with far reaching consequences. Three principles are articulated to posit that the trajectory of academic achievement differ across students (principle #1) and that such inter-individual differences are consequential (principle #2) and far reaching (principle #3) predictors of long-term success of students (e.g., retention, timely graduation). An empirical illustration is presented and results of growth curve analyses indicate that (a) an achievement shock during the first year, (b) a bounce back effect during the second year, and (c) continuous improvement during the junior and senior years improves our capacity to predict long-term success of university students and outperforms the typical predictors used by universities. This new approach has far reaching consequences for the management, services, policies, and research agenda of people working to promote the success of students. Six broad implications are delineated to steer research and practices in novel, needed, and promising directions across tertiary education and beyond.

Keyword: achievement, performance, tertiary education, learning, retention, graduation, perseverance, success

Beyond Grade Point Average of University Students: Theoretical foundations for the Achievement as a Process Approach with an Empirical Illustration

Universities invest considerable resources to offer an optimal learning environment to their students. Despite such efforts, tertiary education institutions face many challenges. Tuitions increase more steeply than what the middle-class students and their parents can realistically afford. Skeptics voice their doubts about the proclaimed advantages of tertiary education. Policy makers, employers, and students ask difficult questions about the preparedness of university graduates for real-life challenges. We live in a time of economic scarcity and universities, once again, face the challenging task of justifying their socio-economical plus-value (e.g., Evans, Kandiko Howson, & Forsythe, 2018). Given all of the above, educational researchers must pay even closer attention to understand and promote the academic achievement and success of the millions of undergraduates studying in our campuses each and every year.

Psychological sciences is strategically positioned to foster a deeper understanding of the many social, organizational, motivational, emotional, and cognitive factors contributing to the academic success of students in tertiary education. In this article, my goal is to delineate the theoretical and empirical foundations for a way of conceptualizing academic achievement beyond the typical focus on Grade Point Average (GPA). More precisely, I will advance that consequential information can be uncovered by conceptualizing academic achievement as a developmental process. I will delineate *three key principles* and examine how they come into play at critical periods for students enrolled in four-year programs. What we know about the academic achievement of 1st year students, sophomores, juniors and seniors will be overviewed. Accompanied with an empirical illustration, I will showcase how the trajectory of achievement – rather than the level of achievement itself – can improve our capacity to predict, understand, and

eventually intervene to promote both year-to-year retention of students and their timely graduation – two critical indicators defining the long-term success of both students and tertiary education institutions. Finally, I will discuss the broader implications of the achievement as a process approach in tertiary education and beyond.

The Traditional Definition of Academic Achievement: Achievement as an Outcome

Promoting the success of students is the prime mission of tertiary education. Two sustained and ongoing streams of psychology research significantly contribute to this mission (for an extensive review, see Hattie, 2009). On the one hand, proponents of a correlational approach devise cross-sectional and longitudinal studies to identify and compare the psychosocial correlates of academic achievement (e.g., Fong et al., 2016; Richardson, Abraham, & Bond, 2012; Schneider & Preckel, 2017). On the other hand, tenants of an experimental approach create lab and field experiments in which they manipulate and intervene on psychosocial factors to cause changes in academic achievement (e.g., Harackiewicz & Priniski, 2018; Lazowski & Hulleman, 2016; Robbins, Oh, Le, & Button, 2009). Both streams of research are needed for theory development and refinement and to help universities in creating an optimal learning environment.

Defining, studying, and intervening on academic achievement is a complex and multifaceted endeavor. Academic achievement is a multilevel construct with specific instances of performance nested into growingly larger units of achievement (see Dalal, Bhavé, & Fiset, 2014 for similar ideas in the work domain). The many assignments of a course (i.e., task performance) are aggregated to represent the level of achieved performance in that course (i.e., class grade). Students take multiple courses during each semester. Hence, their grades in individual courses are averaged and weighted by the number of credits earned during a semester (i.e., semester

GPA), which are then aggregated across all semesters already taken by a student to create a cumulative GPA. Academic achievement should be conceived and investigated at different levels of analysis.

Most psychology research has remained rather vague in their definition of academic achievement. The umbrella term “grade point average” or GPA is typically used to denote any types of objective academic achievement retrieved from the office of the registrar. In their meta-analysis of the correlational literature, Richardson and her colleagues (2012, see p. 354) clearly defined the GPA as the “means of marks from weighted courses contributing to assessment of the final degree”. Yet, their meta-analysis reverted back to an umbrella definition that included “students’ overall degree marks, quarter, semester, course, or test marks” (see p. 363). Similarly, Robbins et al. (2009) included together GPA, cumulative GPA, semester GPA, and grades in individual courses in their meta-analysis of the experimental literature. In all fairness, meta-analysts are often forced to bundle because their primary sources rarely define the precise unit of analysis under investigation. When the unit of analysis is clearly specified (e.g., Credé & Kuncel, 2008), the effect size of psychosocial factors appears to be fairly comparable across units of analysis (e.g., grades in individual classes, semester GPA, cumulative GPA). Yet, the effect of psychosocial interventions with university students appear to yield stronger effects on grades in individual classes than on cumulative GPA (Robbins et al., 2009). The unit of analysis does matter.

The correlational and experimental research streams respectively aim at identifying and intervening on the precursors of academic achievement. Failure to clearly specify the unit of analysis can easily lead to biased interpretation, tautological reasoning, and model misspecifications. For example, several social/educational psychology theories (e.g., Bandura,

2001; Lazarus & Folkman, 1984; Marsh & Craven, 2006) postulate a bidirectional relationship between non-cognitive factors (e.g., self-efficacy, academic self-concept) and academic achievement. Imagine that a researcher correlates self-efficacy with cumulative GPA in a sample of 2nd year students. Their cumulative GPA will conflate information about both their past and subsequent performances. As a result, the correlation between self-efficacy and cumulative GPA will muddle the effect of self-efficacy on future academic achievement and the effect of past academic achievement on self-efficacy. Despite the intricate presence of conflated effects, several researchers and their readers will inadvertently conclude that self-efficacy influences achievement and is therefore a prime candidate for intervention to promote academic success. Greater precision in our operationalization of academic achievement is required to separate cause and effect to ensure the proper specification of both theories and intervention programs.

Research from both the correlational and experimental traditions typically follows what I will hereafter call the *achievement as an outcome approach*. In this approach, indicators of achievement (e.g., grade in one course, semester GPA, cumulative GPA) are conceptualized as time-invariant and static dependent variables. This conceptualization, albeit pragmatic and efficient, solely focuses on inter-individual differences in the achievement level of university students. Some students are more academically successful than others and this analytical paradigm aims solely at explaining the between-person variance in achievement. Members of the tertiary education community (e.g., teachers, service providers, administrators) rarely question the utility of this measurement approach. Why would they? On the one hand, some students are undeniably more academically successful than others (e.g., Krapohl et al., 2014; R. C. Martin, 2015). Individual differences in academic achievement are both real and consequential. On the other hand, members of the tertiary education community also use a similar premise to appraise

university students. Recruitment, grading, scholarship, probation, and admission to graduate school policies are strongly determined by the rank-ordering of students' academic achievement. Inter-individual differences are the yardstick upon which students, and the institutions hosting the students (e.g., retention, graduation rates), are assessed and held accountable.

Beyond GPA: The Achievement as a Process Approach

Despite both their usefulness and face validity, aggregated achievement outcomes (e.g., GPA) provide limited insight about how the achievement of students develops over time. The first panel of Figure 1 shows the case of two students graduating with the same GPA of B. The first student started off strong in his/her 1st year and he/she kept a comparable level of achievement throughout. In contrast, the second student experienced numerous setbacks in his/her 1st year but steadily improved up to a point where he/she was a straight "A" student in his/her 3rd and 4th year. Using the typical achievement as outcome approach, both students would be categorized as "average students" despite their very distinct development of achievement.

The same observation generalizes at other levels of analysis. The second panel of Figure 1 shows the disaggregated achievement of two students finishing their 1st semester with a semester GPA of B. The first student only had slight fluctuations in his/her grades across five courses. The second student showed flashes of brilliance with a few A and instances of academic difficulties with a few disappointing results. Both students would be categorized as "average students" despite the different within-person fluctuations of their grades in their courses.

In the current research, I articulate the foundations of a novel approach to unravel the uncaptured richness underlying academic achievement. Hereafter, I will refer to this approach as *the achievement as a process approach*. This approach acknowledges and does not dismiss the

existence and the consequential nature of between-person differences in academic achievement. Yet, it switches the focus to within-person fluctuations and developmental changes in achievement (e.g., Beal, Weiss, Barros, & MacDermid, 2005; Dalal et al., 2014; Kljajic & Gaudreau, 2018; Roe, 2014) to offer a new platform to help researchers and practitioners uncovering novel information beyond the GPA of university students.

The achievement as a process approach conceives academic achievement as both an episodic and a developmental process. On the one hand, the approach focuses on the episodic and ecological context in which specific instances of achievement occurs. For example, the achievement of students in the context of a course is potentially better understood through the psychosocial experience of the students in that particular course (e.g., Kljajic & Gaudreau, 2018). Similarly, the achievement of students during their 1st semester on campus is potentially better understood through their psychological experience while transitioning from high school to the university. On the other hand, the achievement as a process approach is developmental because it focuses on how the story of achievement develops over time for university students. I assume that academic achievement differently unfolds for different students (principle #1). Plus, I advance that such inter-individual differences in the developmental course of achievement are consequential (principle #2). So far, the generalized focus on between-person differences in GPA has prevented our research community from paying closer attention to the types of within-person differences portrayed in the case of our two prototypical students in Figure 1. In fact, classic statistical analyses (e.g., between-group comparison) and our cumulative scores of achievement (e.g., GPA) have treated within-person fluctuations as mere measurement error or an artefactual methodological nuisance (e.g., Beal et al., 2005; Dalal et al., 2014). In contrast, the achievement as a process approach offers a roadmap to look beyond GPA by examining academic

achievement at multiple levels of analysis. *Inter-individual differences in the developmental course* of academic achievement should explain unique variance in academic success (e.g., 2nd year retention, graduation rates) over and above *inter-individual differences in the level or point estimate of achievement*. For example, the change in academic achievement from high school to the 1st semester of tertiary education should predict the likelihood of returning after the first year (e.g., 2nd year retention) over and above admission GPA and the 1st semester GPA. Finally, I advance that such effects should be far reaching, extend beyond the 1st year of tertiary education, and predict indicators of long-term academic success such as retention beyond the 2nd year and timely graduation (principle #3).

In the following sections, I will focus on the developmental course of academic achievement (a) during the transition from high school to the 1st year at the university, (b) during the 2nd year, and (c) beyond the 2st year of tertiary education. Each of the three sections will start with an overview of the literature to summarize each of these important developmental periods. Then, I will showcase the findings from a four-year longitudinal study conducted on a large sample of university students with the goal of illustrating the three principles of the achievement as a process approach. Description of the sample and more technical information about the statistical analyses are reported in a supplementary file.

The First-Year at the University

Academic Achievement of 1st Year Students

The transition from high school to university is generally described as a demanding and stressful developmental task (e.g., Bruffaerts et al., 2018; Hurst, Baranik, & Daniel, 2013; Lane, 2018). In fact, researchers, practitioners, and administrators commonly assume that 1st year

university students will experience an “academic shock” in which their academic achievement will severely drop compared to high school (Finnie & Martinnello, 2010). As a result, the correlational research stream produces a countless number of studies each year on the psychological experience of 1st university students (Richardson et al., 2012; van der Zanden, Denessen, Cillessen, & Meijer, 2018). Over the last three decades, a specific line of investigations has focused on the measurement of students’ adaptation to tertiary education (Baker & Siryk, 1984; Credé & Niehorster, 2012). Orientation programs, workshops, mentoring, and counseling specifically designed to help 1st students are manifolds and widespread (e.g., Lane, 2018). Systematic and rather costly interventions such as the First Year Seminars are commonly offered and sometimes universally implemented on campuses across North America (Permzadian & Credé, 2015). A peer-reviewed scientific outlet – the *Journal of the First-Year Experience and Students in Transition* – is even dedicated to the experiences of transitioning to tertiary education. All that to say, frosh students are attracting a big part of the lion’s share of correlational and experimental research on academic achievement in tertiary education.

Limited empirical effort has been allocated to investigate the extent to which the grades of an average student normatively decrease from high school to the 1st year of university. Three set of valid and informative empirical findings could help explain why the mean-level drop in academic achievement remains under-studied. First, meta-analyses provided robust evidence for the moderate-to-strong rank-order stability of grades across time. In their meta-analytical review of 46 studies with 34,724 students, Richardson and her colleagues (2012) found a test-retest correlation of .40 between high school GPA and university GPA. Based on the data of 189,612 students across 50 institutions, Westrick and his colleagues (2015) reported a correlation of .47 between self-reported high school GPA and 1st year GPA. Second, many solid research programs

have shown the incremental validity of high school GPA to predict downstream academic achievement of university students. In their meta-analytical multiple regression, Robbins and his colleagues (2004) revealed that high school GPA remains a significant predictor of university GPA after controlling for socio-economic status, college admission tests, achievement motivation, academic goals, and academic self-efficacy. Given its strong incremental validity, the tertiary education community still rely on high school GPA as a golden criterion to administer their recruitment, admission, and scholarship policies.

The rank-order stability and incremental validity of academic achievement, in isolation or taken together, should not be taken as evidence against the need to investigate the mean-level *normative decreases* in grades. Test-retest correlations and regression paths can only answer questions about the stability in the rank-ordering of students' achievement. A moderate-to-strong correlation only indicates that most individuals are keeping approximately the same relative positioning in the distribution of grades over time. In other words, most of the top-ranked high school students remain amongst the top-ranked university students while most of the students with the lowest admission GPA remain on the left tail of the distribution once at the university. Such evidence, however, offers little indication about the extent to which the grades of the students numerically and normatively decrease across measurement points. Rank-order stability often combines with mean-level change. Although people can keep the same relative positioning in the population over time, they nonetheless tend to normatively become better or worse with the passage of time (e.g., Caspi, Roberts, & Shiner, 2005; McAdams & Olson, 2010).

Results from a representative sample of 5,200 Canadian university students have shown that a typical student should expect to experience a 9.7% decrease in their grades from their last year of high school compared to their 1st year GPA at the university (Finnie & Martinnello,

2010). A majority of students in Canadian universities are admitted with high school GPA above 80%. Based on these findings, a student admitted with 85% should expect to finish his/her 1st year with a cumulative GPA of B+ and would be right on the bubble or below the required threshold to maintain his/her scholarship. Considering that tuitions have significantly increased (and will likely continue to do so), the “academic shock” of the 1st year holds consequential socioeconomic outcomes for students and families.

Normative mean-level change in academic achievement does matter and deserves more theoretical and empirical attention. In our work as teachers and service providers, we rarely come across students saying “I was at the 85th percentile in high school and I am still at the 85th percentile this year; therefore, I feel like a good university student even if my grades have decreased”. Students are mostly unaware of their exact relative positioning in the overall distribution of grades. In their respective high school, a majority of university students were on top of the pot (e.g., the big fishes of their pound) but they now compete against other big fishes with comparable ability and skills (Marsh et al., 2008). Despite not being aware and fully informed of such details, they are definitively aware and discouraged when their grades plunges one or two marks bellow their high school grades (e.g., from A to B+). Such changes, even in the unperceivable presence of rank-order stability, are perceptible and disheartening to students.

As teachers, service providers, or administrators you may have come across some students who walk through their 1st year as if it was “a walk in a park”. There is no doubt that inter-individual differences exist in the developmental course of academic achievement during transition periods (e.g., Suarez-Orozco et al., 2010; Yeager & Dweck, 2012). In the achievement as a process approach, I advance that these inter-individual differences in development are not only interesting but pivotal. Although the academic achievement is likely to decrease on average,

not all students will decrease to the same extent. The good news may be that not everyone should experience the same amount of “academic shock” once they enter university. If so, we need this information to readily inform members of the tertiary education community that the typical, astonishing, and demoralizing “academic shock” does not generalize to all students on campus. Students entering tertiary education with excellent grades may be more (i.e., regression to the mean) or less (i.e., Matthew effect) susceptible to experience a strong academic shock. Success breeds success. We also need to investigate if inter-individual differences in the developmental course of academic achievement influence year-to-year likelihood of returning to school (i.e., retention) and their likelihood of graduating in a timely manner. Paying a much closer attention to the developmental story of achievement of each student is required to promote the short-term and long-term academic success of students in tertiary education.

2nd Year Retention: Will They Be back Next Fall?

Returning back the following fall (i.e., retention) and graduating in a timely manner (i.e., after four years) are the epitome of academic success in tertiary education (e.g., Barbera, Berkshire, Boronat, & Kennedy, 2018). Education is a long-term investment for the students and abandoning after the 1st year is a costly decision. On the one hand, tuitions and peripheral fees spent during the 1st year are simply lost forever. As such, the student and his/her family will never experience the anticipated socioeconomic returns of their investment. Let alone initial costs, research has clearly outlined the many long-term economic, health, and social benefits associated with graduating with a tertiary education diploma (e.g., Mackenbach et al., 2015; Smith, Anderson, Salinas, Horvatek, & Baker, 2015). On the other hand, the institutions hosting the students are incurring an important socioeconomic lost when students decide to withdraw from their programs. Many institutions are potentially matriculating more 1st year students

knowing that they will lose many of them along the way. Important resources (e.g., time, money, human resources, and effort) are allocated to support large cohort of 1st year students with the hope of maximizing their academic achievement, learning, and likelihood of retention and graduation. Once students leave, an institution needs to reinvest additional human resources and money in recruitment, admission procedures, and matriculation of the new 1st year students filling out the vacant spot. Institutional reputation, both national and international ranking of universities, and governmental funding are increasingly contingent and compromised when too many students decide to leave an institution along the way.

2nd year retention is a major concern for students, parents, administrators, and governmental agencies with a national average of 19% of American students not pursuing their tertiary education beyond the 1st year in four-year institutions (McFarland et al., 2018). Studies have found that both high school GPA and 1st year GPA significantly predict the likelihood of 2nd year retention, with meta-analytical estimates of .17 and .38, respectively (Westrick, Le, Robbins, Radunzel, & Schmidt, 2015). Although retention rates substantially differ across institutions, these meta-analytical estimates are largely invariant across universities with less and more selective admission policies. Furthermore, the bivariate meta-analytical correlation between cumulative GPA and retention ($r = .44$) has been shown to remain statistically significant ($r = .38$) in meta-analytical path analyses (Robbins et al., 2009) controlling for emotional (e.g., anxiety, stress, self-efficacy), motivational (e.g., study skills, goals, achievement motivation), and social factors (e.g., seeking social support, social involvement).

In the *achievement as a process approach*, I advance that point estimates of academic achievement (e.g., SGPA, 1st year GPA) only reveal a partial glimpse of the predictive value of academic achievement to predict 2nd year retention. Yet, these point estimates are currently the

golden criterion entered in the predictive/analytic models used by service providers to target and reach out at-risk 1st year students (e.g., Attewell, Heil, & Reisel, 2012; Westrick et al., 2015). Based on the assertions that inter-individual differences exist in the developmental trajectory of achievement (principle #1) and that such differences are consequential (principle #2), I advance that more positive changes from high school GPA to 1st semester GPA and from 1st to 2nd semester GPA should increase the likelihood of 2nd year retention *over and above* point estimates of achievement (i.e., high school GPA, 1st SGPA). The next section summarizes findings from a longitudinal study in which these two assertions were put under empirical scrutiny.

Empirical Illustration

Overview. I examined the admission GPA, 1st semester GPA, and 2nd semester GPA of 4212 students enrolled in a Canadian university to estimate their trajectory of academic achievement during the transition from high school to the 1st year at the university. Estimated sample mean and standard deviations are reported in Table S1 (see supplementary file). Mean-level analyses revealed a strong decline in grades from high school to the 1st semester, $d = -0.997$, 95% CI = [-1.061, -0.933], but a small decline from the 1st to the 2nd semester ($d = -0.109$, 95% CI = [-0.169, -0.048]). Rank-order stability was .622 from high school to the 1st semester and .816 from the 1st to the 2nd semester. The rank-order stability coefficients were moderate-to-strong. Consistent with past research, the relative positioning of students in the distribution of grades was quite stable across time. However, the average grades of students strongly decreased during the transition from high school to university. Academic achievement manifested both relative rank-order stability and mean-level normative change.

Trajectory of achievement during the 1st year. We performed a piecewise growth model (e.g., Chou, Yang, Pentz, & Hser, 2004; Curran, Obeidat, & Losardo, 2010) to isolate and

directly test the statistical significance of the change from high school to the 1st semester (slope #1) and from the 1st semester to the 2nd semester (slope #2). A detailed explanation of model specification can be found in the online supplementary file.

Parameter estimates of this model are reported in Table 1 and the predicted values are shown in the first panel of Figure 2. The grades of students significantly decreased from high school to the 1st semester (slope #1). They also significantly decreased from the 1st to the 2nd semester, but to a lesser extent (slope #2). The intercept positively and significantly correlated with slope #1, thus showing that students who entered university with higher admission GPA experienced more positive change (i.e., a smaller decline) during their 1st semester (i.e., Matthew effect). Consistent with principle #1 of our achievement as a process approach, the slopes differed significantly across participants. The achievement trajectory was qualified by a significant amount of inter-individual differences displayed in the second panel of the Figure 2.

Predicting the 2nd year retention. We added a distal binary outcome (0 = not returning in fall of 2nd year; 1 = returning in fall of 2nd year) to our piecewise growth model to examine if inter-individual differences in change in academic achievement from high school to the 1st semester (slope #1) and from the 1st to the 2nd semester (slope #2) significantly predict 2nd year retention (for a similar approach, see Kim, Petscher, Schatschneider, & Foorman, 2010; Tolar, Barth, Fletcher, Francis, & Vaughn, 2014). We tested two separate models to investigate the effects of slope #1 and slope #2 while controlling for inter-individual difference in high school GPA (model 1) and 1st semester GPA (model 2), respectively (e.g., Muthén & Muthén, 2000). A detailed explanation of model specification can be found in the online supplementary file.

As shown in Figure 3, the results of both models revealed that inter-individual differences in the change of academic achievement from high school to the 1st semester (slope #1) and from

the 1st to the 2nd semester (slope #2) significantly predicted 2nd year retention after controlling for point estimate of achievement in high school GPA (model 1) and 1st semester SGPA (model 2). Both models explained 37% of variance in 2nd year retention. The effect size of point estimate of achievement (i.e., intercept) in high school and 1st semester to predict 2nd year retention was small (Model 1 and 2: OR = 1.218, Cohen's d = 0.109). In contrast, the effect size of slope #1 (Model 1: OR = 2.693, Cohen's d = 0.546; Model 2: OR = 2.210, Cohen's d = 0.437) and slope #2 (Model 1: OR = 2.725, Cohen's d = 0.553; Model 2: OR = 2.752, Cohen's d = 0.558) to predict 2nd year retention were quite substantial in both models.

Of particular interest, the effects of slope #1 and slope #2 were both significantly stronger than the effect size of admission GPA (Model 1, $\text{diff}_{\text{slope1/intercept}} = 0.794$, $S.E. = 0.175$, $p < .001$; $\text{diff}_{\text{slope2/intercept}} = 0.812$, $S.E. = 0.239$, $p = .002$) and 1st semester GPA (Model 2, $\text{diff}_{\text{slope1/intercept}} = 0.596$, $S.E. = 0.261$, $p = .022$; $\text{diff}_{\text{slope2/intercept}} = 0.815$, $S.E. = 0.259$, $p = .002$). The effect size of the slopes did not significantly differ (Model 1, $\text{diff}_{\text{slope2/slope1}} = 0.018$, $S.E. = 0.239$, $p = .935$; Model 2, $\text{diff}_{\text{slope2/slope1}} = 0.219$, $S.E. = 0.258$, $p = .395$); they were equally important to predict retention. Overall, change in academic achievement during the 1st and 2nd semester were significant and stronger predictors of 2nd year retention than admission and 1st semester GPA.

Key implications. On average, students experience an “academic shock” during 1st year. They enter with a high school GPA of A-/B+ and they finish their 1st and 2nd semesters with SGPA of B/C+. Changes from high school to the 1st semester and from the 1st to the 2nd semester are statistically significant with strong and small effect size, respectively. Students have not reached the rock bottom after their 1st semester as their grades still decrease during the winter – albeit to a smaller degree.

Consistent with principle #1 of the achievement as a process approach, the amount of academic shock varies across students. The trajectory of an average student (see first panel of Figure 2) is qualified by a significant amount of inter-individual differences (see second panel of Figure 2). Part of this heterogeneity appears attributable to past achievement because the grades of students with higher admission GPA decline to a lesser extent during their 1st year. Students with an admission GPA of A+ (i.e., 10) should expect their grades to drop by only 1.24 points during their 1st year – a significant attenuation compared to the average decline of 2.53 points for those with an average admission GPA (i.e., 7.57). These findings are consistent with a Matthew effect and with the idea that success breeds success (e.g., Marsh & Craven, 2006) and creates academic momentum (e.g., Martin, Wilson, Liem, & Ginns, 2013).

Consistent with principle #2, the trajectory of academic achievement significantly predicts 2nd year retention, over and above the point estimates of academic achievement. The probability of 2nd year retention is higher for the students who experience a small decrease in academic achievement from high school to the 1st semester and from the 1st to the 2nd semester. The effect sizes associated with the developmental story of achievement are consequential and stronger than the effect size associated with the point estimates of achievement (i.e., admission GPA and 1st semester GPA). The developmental story of achievement not only predicts 2nd year retention, but it significantly outperforms the typical predictors. This new piece of information, uncovered by the achievement as a process approach, should be seriously considered by universities to obtain accrued precision to identify students with greater risk of not returning for the 2nd year. Conceiving achievement as a process is needed to complement the typical achievement as an outcome approach currently in use in psychological research and intervention as well as in educational administration, services, and policies.

The 2nd Year at the University

Bouncing Back or Slumping during the Sophomore Year?

Despite the vast resources invested to track and intervene on the experience of 1st year students, the sophomore year appears just as pivotal to promote the long-term academic success of university students (Schaller, 2010). The 1st year is probably a “rite de passage” – a developmental transition that everyone has to go through to learn their way around the unwritten rules of tertiary education. Let alone the multifarious socioeconomic implications, abandoning after the 1st year is *first and foremost* a missed opportunity for subsequent psychosocial and intellectual growth. Despite the limited attention paid to achievement and retention of sophomores, there are just as many students abandoning after their 2nd year; retention is a not a problem limited to the 1st year students (e.g., Allen, Robbins, Casillas, & Oh, 2008; Schaller, 2010). Moreover, many important skills and life lessons still have to be learned during the 2nd year (Graunke & Woosley, 2005; Schaller, 2010). For example, students are introduced to knowledge and skills more specialized toward their major. The capacity of 2nd year students to acquire the specialized knowledge, language, and skills of their respective discipline is important for continuous progress along their chosen academic path. The 2nd year also acts as a transition point during which students explore their interests and make important academic (Galotti, 1999) and career decisions (Guay, Ratelle, Senecal, Larose, & Deschenes, 2006). The sophomore year is a pivotal but under researched developmental period (e.g., Sterling, 2018; Tobolowsky, 2008).

Despite the aforementioned challenges, a majority of sophomores should start *bouncing back* in the 2nd year. In fact, findings from the National Sophomore Survey indicate that 63% of students feel that their 2nd year has been better or much better than their 1st year (e.g., Schreiner, 2010). Their academic achievement may not fully return to the level it was in high school due to

the competitive nature of tertiary education. Yet, a majority of students should start experiencing a bounce back that will potentially curb and eliminate the negative effect of the unpleasant academic shock of the 1st year. Good things may come for some of those who stay.

Evidence of a bounce back effect remains scarce in the literature for at least two reasons. First, researchers have less frequently delved into the specific psychological experience of the 2nd year students (e.g., Nora, Barlow, & Crisp, 2005; Sterling, 2018). As eloquently summarized by Schaller (2010, p. 16), “although the literature on the first-year experience is extensive, major gaps exist with regard to persistence beyond the first year”. The sophomore year has even been described as the “forgotten year” (Tobolowsky, 2008). Second, most psychology research in tertiary education (including our own) has remained vague in defining and characterizing samples of participants. The umbrella term “university students” is typically used to describe samples in which only 1st year students or a mixture of 1st, 2nd, 3rd, and 4th year students are under investigation. Even meta-analysts are often forced to merge all students together (e.g., Richardson et al., 2012), considering that their primary sources rarely split up and compare effect sizes across levels of tertiary education. Although recruiting students across the frosh to the senior years is informative to brush a general portrait of the students’ experience, these studies leave important gaps in our specific understanding of the 2nd year experience.

Research on the grades of 2nd year students has mostly focused on their rank-order stability. Results generally indicate that year-to-year achievement display moderate temporal stability. In a study of 904 Australian university students, Martin and his colleague (2013) reported that the paths between the fall and winter semester GPA (1st year, $\beta = .35$; 2nd year, $\beta = .34$) were significantly stronger than the path from the winter semester of the 1st year and the fall semester of the 2nd year ($\beta = .18$). This finding is interesting because the transition from the 1st to

the 2nd year appears to be a tipping point with a significant amount of inter-individual differences in the developmental story of achievement.

A recent study of Cochran and O’Flaherty (2017) followed the mean-level semester GPA of 398 students during the four-year of their teacher preparation programme. Results of growth curve modeling provided evidence for a model qualified by both linear and quadratic changes. Using the parameter estimates reported by these authors, I created a figure of the predicted values to facilitate interpretation. As shown in Figure S1 (see supplementary file), the semester GPA of students initially decreased during the first two years before increasing in the middle of the 3rd year. Consistent with principle #1 of the achievement as a process approach, variance of the growth terms indicated significant inter-individual differences in the trajectory of achievement. Plus, a significant but small bounce back effect was observed during the 3rd rather than the 2nd year. These results should be interpreted with caution for at least two reasons. First, teachers’ education follows a programmatic curriculum in which students are teaching in real classrooms in their 3rd and 4th years; this learning experience differs from most lecture-based undergraduate programs. Second, no provision was made for retention versus dropouts after the 1st, 2nd, and 3rd year. Including the students who dropped out of school in the four-year growth curve model may have either accentuated or attenuated the amount of a bounce back effect and accelerated or decelerated its occurrence. Therefore, it remains to be determined (a) if a bounce back effect happens, (b) how strong it is, and (c) when exactly does it start occurring.

It is not that uncommon for teachers and service providers to meet sophomore students who are disillusioned and feel abandoned. The psychological experience of 2nd year students has sometimes been described as the “*sophomore slump*” (e.g., Gump, 2007; Kennedy & Lee Upcraft, 2010; Webb & Cotton, 2018) – a period characterized by decreasing grades, academic

satisfaction/interest, and increase thoughts of dropping out (Schreiner & Pattengale, 2000).

However, the 2007 National Sophomore Experience Survey revealed that only 14% of students rated their 2nd year as worse than their 1st year (Schreiner, 2010). Longitudinal studies in two-year colleges have also showed that the academic adjustment of only 10% of students significantly deteriorates (Duchesne, Ratelle, Larose, & Guay, 2007), the career indecision of only 25% of students remains chronically high (Guay et al., 2006), and the self-efficacy of only 30% of students worsened during the 2nd year (Larose, Ratelle, Guay, Senécal, & Harvey, 2006).

The aforementioned longitudinal findings are consistent with the principle that the developmental trajectory of university students is marked by individual differences (principle #1). As such, it appears that the 2nd year experience could provide both *increased opportunities* for exploration, growth, and autonomy (i.e., bounce back effect) and *increased risks* of stagnation, disengagement, and chronic indecision (i.e., slump effect). As a result, the trajectory of academic achievement of students is likely to reflect the co-existence of a “bounce back effect” for many students and a “sophomore slump effect” for other students. Whether the academic trajectory of an average 2nd year student is marked by a “bounce back effect” or a “sophomore slump effect”, and just how strong the dominant effect really is, are questions in need of empirical investigation. As eloquently summarized by Kennedy and Lee Upcraft (2010, p. 39) research “that examines both grade point averages and attrition rates for sophomores, taking into consideration first-year grades, should be conducted”. The next empirical illustration tries to fill this gap. Consistent with the principles that inter-individual differences in the developmental trajectory of achievement are real (principle #1) and consequential (principle #2), students with a stronger bounce back effect in their 2nd year should be more likely to return for

the 3rd year. If so, the implications of our achievement as a process approach are far reaching to predict long-term academic success of university students (principle #3).

Empirical Illustration

Overview. I examined the 3600 students (from the original sample of 4212) who returned for the 2nd year. This time, the unit of analysis was changed to focus on yearly achievement and I analyzed admission GPA, 1st year yearly GPA, and 2nd year yearly GPA. This approach examined the achievement trajectory during the consecutive transitions from high school to the 1st year and from the 1st to the 2nd year. Estimated sample mean and standard deviations are reported in Table S2 in the supplementary file. Mean-level analyses revealed a strong decline in grades from high school to the 1st year ($d = -1.040$, 95% CI = $[-1.089, -0.990]$) and a small increase from the 1st to the 2nd year ($d = 0.033$, 95% CI = $[-0.014, 0.079]$). Rank-order stability was .651 from high school to the 1st year and .779 from the 1st to the 2nd year. Consistent with past research, the relative positioning of students in the distribution was quite stable but the mean-level grades strongly decreased during the transition from high school to university and remained stable during the 2nd year. Achievement manifested both relative rank-order stability and mean-level change.

Trajectory of achievement during the 1st and 2nd years. A piecewise growth model was performed to isolate and directly test the statistical significance of the change in yearly grades from high school to the 1st year (slope #1) and from the 1st to the 2nd year (slope #2). A detailed explanation of model specification can be found in the supplementary file.

Parameter estimates of this model are reported in Table 2 and the predicted values are shown in Figure 3. The grades of students significantly decreased from high school to the 1st year

(slope #1). They significantly increased from the 1st to the 2nd year, but to a small magnitude (slope #2). The intercept positively and significantly correlated with slope #1 (i.e., Matthew effect), thus showing that students who entered university with a higher admission GPA experienced more positive change (i.e., a smaller decline) during their 1st year. Also, the slopes differed significantly across participants, thus showing that achievement trajectory was qualified by a significant amount of inter-individual differences.

Predicting 3rd Year Retention. A distal binary outcome (0 = not returning in fall of 3rd year; 1 = returned in fall of 3rd year) was added to the piecewise growth model to examine if change in achievement from high school to the 1st year (slope #1) and from the 1st to the 2nd year (slope #2) significantly predict 3rd year retention. I tested two separate models to investigate the effects of slope #1 and slope #2 over and above point estimates in high school GPA (model 1) and 1st year GPA (model 2), respectively (see supplementary file for model specifications).

As shown in Figure 5, the results of the two models slightly differed. When controlling for high school GPA (model 1), the change of academic achievement from high school to the 1st year (slope #1) and from the 1st to the 2nd year (slope #2) were both significant predictors of 3rd year retention. When controlling for the 1st year GPA (model 2), only the change from the 1st to the 2nd year (slope #2) significantly predicted 3rd year retention. The effect size of the admission GPA and 1st year GPA (Model 1 and 2: OR = 1.505, Cohen's d = 0.225) on 3rd year retention was small. The effect size of slope #1 was modest but significant when controlling for high school GPA (Model 1: OR = 1.714, Cohen's d = 0.297) and small but non-significant when controlling for 1st year GPA (Model 2: OR = 1.130, Cohen's d = 0.067). In contrast, the effect size of slope #2 was strong and significant when controlling for either high school GPA (Model 1: OR = 4.024, Cohen's d = 0.768) or 1st year GPA (Model 2: OR = 4.050, Cohen's d = 0.771).

Of particular interest, the effect size of slope #2 was significantly stronger than slope #1 in both models (Model 1, $\text{diff}_{\text{slope2/slope1}} = 0.854$, $S.E. = 0.329$, $p = .010$; Model 2, $\text{diff}_{\text{slope2/slope1}} = 1.276$, $S.E. = 0.381$, $p = .001$). The effect size of slope #2 was also significantly stronger than the effect size of point estimates in admission GPA (Model 1, $\text{diff}_{\text{slope2/intercept}} = 0.984$, $S.E. = 0.204$, $p < .001$) and 1st year GPA (Model 2, $\text{diff}_{\text{slope2/intercept}} = 0.988$, $S.E. = 0.206$, $p < .001$). Overall, change in academic achievement during 2nd year was a stronger predictors of 3rd year retention than change during 1st year and point estimates of achievement (i.e., high school, 1st year).

Key Implications. Students experience an achievement shock during the 1st year but their achievement stabilizes and slightly improves during the 2nd year. This finding provides evidence for a small yet statistically significant “bounce back effect”. The achievement trajectory differs significantly across students (principle #1) and, more importantly, these differences are consequential (principle #2). Positive change in grades from the 1st to the 2nd year is a significant and unique predictor of 3rd year retention. The effect sizes is strong and even stronger than the effect size of the point estimates of academic achievement (i.e., high school and 1st year). Those with a stronger bouncing back during the 2nd year are significantly more likely to continue their tertiary education the subsequent fall.

The added value of our achievement as a process approach are far reaching (principle #3) because they extend beyond the 1st year. Retention is typically envisioned as problem circumscribed to 1st year students. In this sample, 15% of the students who started their 2nd year did not return to start their 3rd year. The academic struggles and retention problem of sophomores is just as worrisome as those of the frosh students (e.g., Sterling, 2018). Sophomores are equally in need of targeted interventions that could transform their 2nd year of tertiary education into a “bouncing back” rather than “a slumping” experience. Academic achievement is a development

story with important consequences beyond the 1st year. The developmental trajectory of achievement not only predicts 3rd year retention, but it significantly outperforms the typical predictors (e.g., Westrick et al., 2015) used to identify at risk students. Monitoring the achievement progress from the 1st to the 2nd year is required to obtain accrued precision in our effort to target students likely not to return for their 3rd year. The new pieces of information, uncovered by the achievement as a process approach, should be used to raise awareness about the importance of bouncing back during the 2nd year for long-term academic success.

The Four Years at the University

Inasmuch as sophomores have been under-researched in psychological science (Tobolowsky, 2008), it is fair to assert that even less attention has been dedicated to students during their 3rd and 4th year of tertiary education research. The lack of attention dedicated to the later years is troublesome insofar as students face increasing and time-bound pressure to prepare for a competitive, globalized, and ever-changing job market. With improved access and growing enrollment in undergraduate education, admission to graduate school has also become more demanding (Brubacher, 2017). Results of a recent study with 12,318 students revealed that approximately 14% of all students entering a public four-year institution abandoned after earning at least 75% of the credits needed to graduate (Mabel & Britton, 2018). In other words, one-third of all dropouts happened in the later years of tertiary education. Late departure is more widespread than expected but perhaps not that surprising given the lack of research, policy, and intervention effort specifically dedicated to junior and senior students.

Timely graduation is also of paramount importance for administrators, policy makers, parents, and students themselves (DesJardins, Ahlburg, & McCall, 2002). Most students entering 4-year institutions do not graduate within the customary four years need to complete the

requirements of their program. In a study of 3072 students recruited across fifteen 4-year institutions, only 33% earned a timely diploma immediately after their fourth year (Allen & Robbins, 2010). Taking an extra year to graduate can be costly for the institutions, the students, and their families because it results in increased tuition and cost of living fees and a full-year loss in post-graduation incomes.

Despite the potential benefits of timely graduation, limited research has examined how the experience of students during their four years at the university can influence the time taken to complete their degree. Of particular importance, it appears that academic achievement during the first year has the largest direct effect (over and above motivation, major congruence, high school achievement, and many students' characteristics) on timely graduation (Allen & Robbins, 2010). Similarly, results of a large study of 12,069 first-year students (Yue & Fu, 2017) revealed that academic achievement during the years at the university is the strongest predictor, accounting for 46% of the 55% of explained variance in timely graduation, over and above both time-invariant predictors (e.g., gender, first generation status, high school GPA) and time varying predictors (e.g., enrollment intensity, major change).

In the final empirical illustration, I explored the developmental course of achievement across all four years of tertiary education. Here again, the consequence of inter-individual differences in the developmental course of academic achievement should be far reaching (principle #3). More precisely, it was hypothesized that continued improvement in achievement during the 2nd, 3rd, and 4th year should help students graduate in four years (i.e., timely graduation) over and above their level of achievement in high school and during the 1st year.

Empirical Illustration

Overview. I examined the 3136 students (out of the original sample of 4212) who returned for the 3rd year using yearly GPA as the unit of analysis. The admission GPA and the yearly average of grades obtained each year were analyzed to focus on the entire duration of a four-year program. Estimated sample mean and standard deviations are reported in Table S3 (see supplementary file). Mean-level analyses revealed a strong decline in grades from high school to the 1st year ($d = -1.030$, 95% CI = $[-1.083, -0.978]$) and a small yearly increase starting during the 2nd year: from the 1st to the 2nd year ($d = 0.106$, 95% CI = $[0.057, 0.156]$), from 2nd to the 3rd year ($d = 0.075$, 95% CI = $[0.026, 0.125]$), and from the 3rd to the 4th year ($d = 0.141$, 95% CI = $[0.091, 0.191]$). Rank-order stability was .637 from high school to the 1st year and .758, .770, and .801 in each of the subsequent years. The rank-order stability coefficients were moderate-to-strong. The average grades of students strongly decreased during the transition from high school to university but progressively increased from the 2nd year to the 4th year. Overall, academic achievement manifested both relative rank-order stability and mean-level change.

Trajectory of achievement across 4 years. A piecewise growth curve model was performed in order to isolate and directly test the statistical significance of the change from high school to the 1st year (slope #1) and from the 2nd to the 4th year (slope #2). A detailed explanation of model specification can be found in the supplementary file.

Parameter estimates of this model are reported in Table 3 and the predicted values are shown in Figure 6. The grades of students significantly decreased by 1.60 points from high school to the 1st year (slope #1) before increasing by 0.18 point each year during the 2nd, 3rd, and 4th year (slope #2). Slope #1 and slope #2 significantly differed across participants. Finally, the intercept positively and significantly correlated with slope #1 (i.e., Matthew effect), thus showing that the students who entered university with a higher admission GPA experienced

more positive change (i.e., a smaller decline) during their 1st year. However, this trend reverted to a small negative correlation between the intercept and slope #2, suggesting that people with higher admission GPA experienced smaller increase in their grades beyond the 1st year.

Predicting Timely Graduation. A distal binary outcome (0 = not graduating after 4th year; 1 = diploma awarded after 4th year) was added to the piecewise growth model to examine if change in academic achievement from high school to the 1st year (slope #1) and from the 2nd to the 4th year (slope #2) significantly predict timely graduation. We tested two separate models to investigate the effects of slope #1 and slope #2 over and above high school GPA (model 1) and 1st year GPA (model 2), respectively (see supplementary file for model specifications).

The results of the two models are presented in Figure 7. When controlling for either high school GPA (model 1) or 1st year GPA (model 2), the change of academic achievement from high school to the 1st year (slope #1) and from the 2nd to the 4th year (slope #2) were both significant predictors of timely graduation. The effect sizes of admission GPA and 1st year GPA (Model 1: OR = 1.386, Cohen's d = 0.180; Model 2: OR = 1.428, Cohen's d = 0.196) on timely graduation were small. The effect size of slope #1 was moderate when controlling for high school GPA (Model 1: OR = 2.158, Cohen's d = 0.424) and small when controlling for 1st year GPA (Model 2: OR = 1.426, Cohen's d = 0.196). In contrast, the effect size of slope #2 was strong and significant when controlling for high school GPA (Model 1: OR = 6.120, Cohen's d = 0.999) or 1st year GPA (Model 2: OR = 6.142, Cohen's d = 1.00). Of particular interest, the effect size of slope #2 was significantly stronger than slope #1 in both models (Model 1, $\text{diff}_{\text{slope2/slope1}} = 1.042$, $S.E. = 0.215$, $p < .001$; Model 2, $\text{diff}_{\text{slope2/slope1}} = 1.460$, $S.E. = 0.243$, $p < .001$). The effect size of slope #2 was also significantly stronger than the effect size of admission GPA (Model 1, $\text{diff}_{\text{slope2/intercept}} = 1.485$, $S.E. = 0.156$, $p < .001$) and 1st year GPA (Model 2, $\text{diff}_{\text{slope2/intercept}} = 1.485$, $S.E. = 0.156$, $p < .001$).

slope2/intercept = 1.495, $S.E. = 0.153$, $p < .001$). Overall, change in academic achievement during the 2nd, 3rd, and 4th year was a stronger predictor of timely graduation than point estimates of achievement and change from high school to the 1st year.

Key Implications. Students experience an “achievement shock” during the 1st year, followed by continued improvement in grades during the 2nd, 3rd, and the 4th years. The academic achievement of an average student is characterized by a bounce back effect starting during the 2nd year. However, this bounce back effect (improvement of 0.55 points from the 2nd to the 4th year) does not erase the initial achievement shock (decrease of 1.60 points) experienced during the 1st year. Furthermore, not everyone experience this bounce back effect considering that the four-year trajectory of achievement significantly differs across students (principle #1).

The implications of our achievement as a process approach are consequential (principle #2) and far reaching (principle #3) because the developmental story of achievement is a significant and a better predictor of timely graduation. More precisely, students who experience a steeper improvement in achievement after the 1st year are more likely to finish their course-load and graduate within four years. The trajectory of achievement not only significantly predicts timely graduation but it also outperforms the typical point estimates of achievement (Allen & Robbins, 2010). Researchers, service providers, and administrators need to allocate resources to better understand the psychosocial characteristics of the students whose achievement bounces back after the academic shock of the 1st year. This knowledge would help identify and intervene one the prime factors leading up to gradual and continuous improvements in academic achievement. Improvement from the 2nd to the 4th year is key for long-term academic success. Monitoring the achievement progress throughout the four years is required to obtain accrued precision in our effort to identify students with greater risk of delayed graduation. Conceiving

achievement as a process is needed to inform research, intervention, and policy because the implications are far reaching and generalize across frosh, sophomore, junior, and senior students.

Broader Implications of the Achievement as a Process Approach

As shown across three empirical illustrations, academic achievement is a developmental story with far reaching importance for the long-term success of students. Reconceptualising achievement as a process has many implications for the management, services, policies, and research agenda of many people working to promote the success of students. In this section, six broader implications stemming from the achievement as a process approach are delineated.

Changing the Focus of our Monitoring Systems

First, the results of our empirical illustrations suggest that universities need to reconsider how they monitor the grades of students. Most universities identify at-risk students based on their admission GPA and grades earned during the 1st semester (or 1st year). However, my findings showed that these typical predictors are outperformed by changes in grades. Therefore, systems that track the *development of grades over time* are needed to help curbing school dropout after the 1st year. Changes in achievement could be incorporated into a refined predictive model to switch from a static to a dynamic progress-based monitoring system.

The achievement as a process approach highlights the importance of early detection of at-risk students. In most universities, the grades of students are monitored only after the 1st semester. Therefore, we know very little about the developmental story of the grades earned within the 1st semester. Research is needed to examine if the academic shock is mostly attributable to extremely poor results on the first set of midterm exams. To do so, administrators could enforce the idea that midterm grades should be rapidly and systematically logged into a

learning management system with built-in analytics. Creating an automated monitoring system capable of estimating *the change between high school GPA and results on the midterm exams* (rather than just the results from the midterms) would facilitate detection of students as soon as the first signs of difficulties start appearing. Early interventions, right after the first midterms, may help students to prepare for their final exams and curb their academic shock sooner rather than later. Such a progress-based monitoring system – based on change rather than a point estimate of achievement – would offer the infrastructure to scale-up early intervention efforts.

Studying the Predictors of Academic Achievement Change

Second, we need to differentiate the predictors of point estimates of achievement (e.g., yearly GPA) from the predictors of change in achievement. Individual differences in achievement and individual differences in trajectory of achievement operate at two distinct but potentially related levels of analysis (e.g., Mehl & Conner, 2012). Assuming that each set of outcomes is predicted by the exact same predictors appears improbable just as much as advancing that point estimate and trajectories are predicted by an entirely different network of predictors (e.g., Dalal et al., 2014; Kljajic & Gaudreau, 2018); both similarities and differences are to be expected and need to be uncovered. Psychological, educational, and even organizational sciences have accumulated vast knowledge explaining individual differences in achievement (e.g., Credé & Kuncel, 2008; Credé, Roch, & Kieszczynka, 2010; Hattie, 2009; Richardson et al., 2012; Schneider & Preckel, 2017). Far less attention has been allocated to identify why achievement changes over time – and differentially changes for different individuals.

Two lines of systematic inquiry are required to move forward the achievement as a process approach. On the one hand, researchers may start by examining if known correlates of individual differences in achievement also predict individual differences in the trajectory of

achievement. Studies like these can be found with students in elementary and secondary schools (e.g., Fu, Chen, Wang, & Yang, 2016; Mok, McInerney, Zhu, & Or, 2014; Murayama, Pekrun, Lichtenfeld, & vom Hofe, 2013; Suarez-Orozco et al., 2010). Such investigations will shed light into whether known predictors generalize across levels of analysis. On the other hand, researchers may venture into theory elaboration to specifically understand what accounts for individual differences in achievement trajectories. Such investigations will identify new mechanisms that uniquely explicate achievement trajectories without necessarily predicting individual differences in achievement. Both lines of inquiry, once integrated into a unified t , will foster a novel understanding of what predict point estimate without predicting achievement trajectory (and vice versa). Such an understanding will help identify risk and protective factors to be included in interventions specifically designed to reduce individual differences in achievement, buffer the decreases in achievement during the 1st year, boost the bounce back effect of the 2nd year, or all of the above.

Studying the Consequences of Academic Achievement Change

Third, we need to specify the psychological consequences of the academic shock experienced by 1st year university students and the slumping effect experienced by some sophomores. My empirical illustrations showed, for example, that the academic shock matters as it predicts 2nd year retention. What is left to clarify is the precise psychological mechanisms through which the academic shock translates into dropout.

Psychological science is in a privileged position to explicate how within-person changes in academic achievement can lead to long-term academic success. Several theories (e.g., Carver & Scheier, 1998; Higgins, 1987; Weiner, 2010) work under the assumption that discrepancy between past and actual states and discrepancy between current and desired states both play a

central role in the regulation of behaviors and emotions (for reviews, see Harkin et al., 2016; Kelly, Mansell, & Wood, 2015). Students enter university with performance expectancies largely derived from their past achievement. They think they will succeed and receive high marks but most of them soon realize that keeping the same level of achievement may be unattainable and unrealistic. Discrepancy between past/desired and actual performance will likely result in negative emotions and search for causal explanations. Depending on their causal attributions, students will experience less or more detrimental emotional states likely to influence their self-efficacy and subsequent effort, which will either facilitate or hinder their subsequent performance (e.g., Weiner, 2010). Depending on their implicit theories, they will also maintain or reconsider their beliefs about their capacity to improve, bounce back, and eventually succeed in the pursuit of their academic goals (e.g., Yeager & Dweck, 2012). Intervention studies designed to change causal attributions and mindset of students have been found to play a causal role in increasing subsequent achievement and the likelihood of retention (e.g., Lazowski & Hulleman, 2016; Silverman & Cohen, 2014). The academic shock, that typifies the 1st year of tertiary education, needs to be revisited in light of sound psychological theories capable of delineating the precise mechanisms through which more positive changes in academic achievement lead to long-term academic success of university students.

Future research could also explore what goes in the mind and the heart of students when they experience significant declines in their academic achievement at different points in their undergraduate lives. The decision to persevere or to withdraw from tertiary education is not solely attributable to changes in academic achievement (e.g., Alarcon & Edwards, 2013; Robbins et al., 2009). There is something missing in our theoretical understanding of why and how the academic shock of the 1st year increases the likelihood of school dropout. I contend that the

relationship is neither direct nor magic. The development of academic achievement is part of a complex psychological system in which the novel school-related experiences of university students reciprocate with their already existing but evolving identity, needs, goals, motives, beliefs about the self and the world, social connectedness, and emotional experiences. The changing, reciprocal, transactional, and potentially recurrent patterns experienced by students during the transition create new “relational meaning” (i.e., the relation between me and school) through which they reconsider their school satisfaction and intention to persevere; it changes their narratives (e.g., Silverman & Cohen, 2014; Yeager & Walton, 2011). A stronger academic shock should proportionally create a narrative entrenched with doubts, fears, worries, and anger. In contrast, a smaller academic shock should proportionally act to build and reinforce a narrative in which identity, goals, motives, beliefs, and feelings are linked to an overall positive experience of being a university student. A closer attention to the narrative attached with the development of academic achievement would help understand how and why decrease and increase in grades respectively relate to decreased and increased rates of long-term success.

Intervening at Various Points in the Development of Academic Achievement

Fourth, current interventions disproportionately target 1st year students to facilitate their transition into tertiary education and curb the retention problem. However, as shown in our empirical illustrations, dropping out of university is not limited to 1st year students. On the one hand, 2nd year students with a stronger bouncing back effect – in contrast to a slumping experience – are more likely to return beyond their 2nd year. On the other hand, a steeper improvement in academic achievement during the sophomore up to the senior years maximizes the likelihood that students graduate in a timely manner. Researchers, administrators, and service providers should seriously consider widening the availability and scope of services offered to

students beyond the 1st year in order to promote their long-term academic success (Hunter et al., 2009). Rather than criticizing the current intervention model – which has been implemented with wholeheartedly good intentions – I would rather highlight that the achievement as a process approach offers a springboard to identify multiple windows of opportunity for interventions.

Positioning the trajectory of achievement as the primary outcome of interventions would open up a new way of picturing the importance of timing in our work with university students. Different timing of an intervention may create different types of effect in the developmental course of academic achievement. Although timing matters, it is rarely taken into consideration in the design and evaluation of psychological interventions in tertiary education. Intervening before or as soon as possible during the 1st semester may offer the best possible chance of minimizing the academic shock of 1st year students. Such *primary prevention initiatives* could indeed improve the performance of students during their initial set of midterm exams, thus offering the best possible chances of minimizing the drop between their admission GPA and 1st semester GPA. Not all institutions have the resources and infrastructure to intervene before or immediately after students start their courses. Not all students will be willing to participate in interventions before experiencing their first signs of difficulties. When such early interventions are not possible, launching *secondary prevention initiatives* after the first set of midterms may help students better prepare for their final exams, thus also minimizing the drop between admission GPA and 1st semester GPA. Taken together, the fall of the 1st year offers two naturally conducive windows of opportunity to intervene. Students randomized (i.e., experimental trials) or participating (i.e., quasi-experiment) in early initiatives may end up with a smoothened academic shock likely to increase retention.

The typical intervention model not only disproportionally targets 1st year students, but it also overly focuses on the 1st semester. Treating achievement as a developmental story has widespread practical implications because I advance that students receiving no intervention during the 1st semester are not necessarily doomed for long-term academic failure. The winter term of the 1st year offers a third window of opportunity for early *tertiary prevention initiatives*. Immediately after the 1st semester, administrators and service providers have access to the grades from the 1st semester. As such, they often launch targeted interventions with students who have failed several courses or did not attain minimal academic requirements (e.g., probation). We contend that students with “good grades” but a strong achievement shock should also be reached out for targeted interventions. A student may have earned a B+ average (a full point above the population average on campus) in the fall but nonetheless feel distressed and disillusioned after having experienced a 15% drop compared to his/her high school average. Intervening with such students during the 2nd semester could potentially help to buffer subsequent achievement decline and perhaps even accelerate the arrival of a bounce back effect.

The sophomore year is another critical turning point (e.g., Schaller, 2010; Webb & Cotton, 2018). However, those who return often receive limited support because academic difficulties and retention problems are often perceived as being specific to 1st year students. Nonetheless, 2nd year students are often mentally underprepared for the new challenges of transitioning from a general curriculum to the specific language, knowledge, and skills of their major. Based on the achievement as a process approach, I contend that the 2nd year offers yet another window of opportunity for both universal and targeted interventions. Intervening during the 2nd year could increase the number of students experiencing a bounce back effect and decrease the number of students experiencing a slumping effect. 2nd year interventions could not

only improve the academic achievement of students, but it could potentially increase the rates of 3rd year retention and timely graduation after four years.

By conceiving academic achievement as a dynamic process, the achievement as a process approach provides the needed rationale to revisit *when and with whom* we should intervene to promote long-term success of students. Different types of intervention delivered at different points in time could also yield a different amount of desirable outcomes. Therefore, a systematic research agenda – one paying attention to potential time $\times$ types of intervention effects (e.g., Ishitani, 2016; Pan, Guo, Alikonis, & Bai, 2008) – should be put in place to take advantage of the many windows of opportunity to offer different promotion, prevention, and intervention programs to frosh, sophomore, junior, and senior students.

Toward a Multilevel Organizational and Historical Approach to Academic Success

My empirical illustrations reported the case of one Canadian university with data collected in 2006. This is indeed limitative. Institutions differ on many potentially important organizational factors: Access policies, selectivity criteria, grading policies, number of students enrolled, student-faculty ratio, research funding, enrollment in graduate school, admission GPA, etc. As such, researchers should focus on the students from each university – like I did in the current empirical illustrations – just as much as they should investigate the generalizable features of all students within a larger network of institutions. The achievement as a process approach appears promising to extend multilevel models of retention (e.g., Chen, 2012; Oseguera & Rhee, 2009; Titus, 2004). Adding a developmental component could further our understanding of how student-level and institutional-level factors interact to predict student-level and institution-level achievement outcomes. For example, it would be interesting to investigate whether universities with better student-faculty ratio are better equipped to tone down the academic shock of 1st year

students and to accelerate the bounce back effect during 2nd year. Similarly, it would be important to expand on previous multilevel research (e.g., Titus, 2004) to determine if students in selective universities (i.e., higher admission GPA) experience a greater, comparable, or lower achievement shock during their 1st year. Retention and graduation rates fluctuate across institutions. As such, a multilevel extension of the achievement as a process approach would offer a theoretical roadmap to investigate which predictors of retention and timely graduation generalize across institutions with different organizational characteristics.

Psychological science generally studies the person during one specific historical period. Universities are storing a gigantesque amount of data describing the developmental course of academic achievement from countless students across many cohorts since many decades. Institutions and their students have significantly evolved across the history of tertiary education (Brubacher, 2017). Many of the potentially important organizational factors – that currently varies across institutions – have also changed across the course of history. Institutions of the 1990s differed from our current tertiary education institutions on many potentially important organizational factors. For example, universities have witnessed a significantly growth and diversification in enrollment. Historical changes in student-faculty ratio, increases in tuition fees, and grade inflation in high school may or may not have contributed at aggravating the achievement shock of 1st year students and the sophomore slump of 2nd year students. Future research could delve into some of these fascinating questions in order to understand which of the social, economic, and cultural changes – within which our educational system operates – have successfully or unsuccessfully promoted students' access and retention in tertiary education.

Institutions are competing to attract the best students and to help them graduate. As a result, the tertiary education community often overinvests in institutional retention rather than

sharing the wisdom of their successful initiatives to promote retention throughout the network of institutions. In a study conducted in the United States, Allen and his colleagues (2008) found that 38% of non-returning students were transfers rather than real dropouts. Like most research on retention (Robbins et al., 2004), my empirical illustrations did not account for institution transfers. Unfortunately, universities and colleges in Canada do not share and keep track of transfers across institutions. Not all students are admitted in the city and school of their choice. Securing good grades during the 1st year may facilitate the transfer of very successful students into the school of their choice. As a result, some frosh students with a small achievement shock may decide to pursue their education in a new school and would therefore end up being mistakenly categorized as 2nd year dropouts. A truly multilevel organizational model of academic success will require that the Canadian higher education sector imitates the United States by creating a National Student Clearinghouse to track the enrollment, transfers, and degree attainment of students across the country.

Rewarding Students Based on Progress rather than Cumulative Achievement

Recent years have seen the appearance of a movement to promote personal growth in education (A. J. Martin, 2015). Theory-driven research on incremental/growth mindset (Yeager & Dweck, 2012), personal best goals (Martin & Elliot, 2016), self-improvement goals (Elliot, Murayama, Kobeisy, & Lichtenfeld, 2015), internal scheme of reference to define and evaluate self-concept (Marsh, Xu, & Martin, 2012), academic momentum (Martin et al., 2013), and personal goal progress (Wiese, 2007) are just a few leading examples of the many growth-related ideas in our contemporary psychological science. All of these constructs have in common a *within-person perspective* in which achievement is defined using some internal/personal

standards. The achievement as a process approach – which focuses on the developmental story of academic achievement – contributes to the current zeitgeist.

Organizational, cognitive, and educational researchers are also paying more attention to alternate ways of defining and measuring achievement. In organizational sciences, researchers have recently highlighted the need to differentiate typical (i.e., average across time and performance episodes) and episodic achievement which fluctuates across tasks, time of the day, and day of the week (e.g., Beal et al., 2005; Dalal et al., 2014). Specific research programs have emerged to identify the characteristics of happy/productive versus unhappy/unproductive days in the lives of workers (e.g., Bakker & Daniels, 2013). In cognitive sciences, researchers reiterated the need to make a clear distinction between performance and learning (Soderstrom & Bjork, 2015). On the one hand, performance represents the level of achievement achieved by a person soon after or while being taught something relatively new. Scores on exams – which form the basis upon which we calculate achievement in education – are a good example of what cognitive researchers would call performance. On the other hand, learning represents the long-term retention and capacity to reuse the knowledge and skills in different contexts. Scores on an unexpected pop-test two weeks after a real exam would be a good example of a task measuring learning (e.g., delayed memory). This differentiation is more than semantic quibbling because performance and learning are related but distinct outcomes potentially caused and influenced by both similar and dissimilar cognitive processes and psychosocial factors (e.g., Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Murayama & Elliot, 2011).

On a related note, educational researchers and policy makers are now expressing a growing interest toward learning outcomes (Shavelson, Zlatkin-Troitschanskaia, & Mariño, 2018). Between their 1st and 4th year, university students are expected to acquire and accumulate

knowledge and skills such as creative thinking, critical thinking, and problem solving. The capacity to use knowledge and skills should naturally improve throughout tertiary education and prepare students to enter graduate school or the job market. Earning good grades is seen as an insufficient demonstration of learning insofar as students must also demonstrate improvements in knowledge and skills at the end of their tertiary education. This particular focus on mastery, improvement, and learning – which requires a focus on the developmental story of the student – appears consistent with the achievement as a process approach put forward in this article.

Conclusion

Universities invest considerable resources to optimize learning, achievement, and long-term success of their students. The countless hours and four years spent by university students have a long-lasting impact on their personal and professional competencies. Repositioning the academic achievement as a developmental process has numerous implications to improve the services and even the rewards offered to our students. Curbing the academic shock of 1st year students and helping them to bounce back in their 2nd year has the potential to improve retention and timely graduation.

Three general principles were delineated and illustrated with empirical data with the ultimate goal of steering theory elaboration, research, and interventions in novel directions. From Babe Ruth to Aaron Judge and Henry Ford to Bill Gates, our society has entertained a long-held admiration for individuals who perform significantly better than others. Even today, rank-ordering remains the yardstick upon which athletes, students, and employees are assessed and held accountable. Knowing that someone performs better than others is insufficient to help us understand and intervene on the processes by which achievement builds over time and fluctuates across contexts and situations. As a society, we know too little about the episodic ups and downs

and long-term developmental trajectories of human achievement. In this article, I favored a developmental definition of success that centers on learning, improvement, and personal progress. The implications of the achievement as a process approach are far reaching – not limited to tertiary education – as they could easily be applied across many areas of psychological science (e.g., development of expertise, aging, learning) and related fields (e.g., K-12 education, sport, work, arts).

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Table 1

Results of Growth Models of Academic Achievement from High School, 1st Semester, and 2nd Semester of 1st Year University Students

	<u>Linear and Quadratic Growth</u>		<u>Piecewise Growth</u>	
	Estimate	S.E.	Estimate	S.E.
Fixed Effect				
Intercept	7.569**	0.022	7.569**	0.022
Slope #1	-2.527**	0.042	-1.763**	0.025
Slope #2	0.764**	0.018	-0.230**	0.020
Covariance				
Intercept with slope #1	0.533**	0.022	0.765**	0.042
Variance				
Intercept	1.232**	0.041	1.091**	0.044
Slope #1	0.299**	0.021	1.129**	0.069
Slope #2 ^a	0.000	0.000	0.000	0.000
Residual variance				
Equal across the three time	0.945**	0.023	0.862**	0.024
Model fit				
	$\chi^2 = 321.73$, $df = 2$, $p < .001$;		$\chi^2 = 63.88$, $df = 2$, $p < .001$;	
	CFI = .936, TLI = .904,		.001; CFI = .988, TLI =	
	SRMR = .163, AIC = 44559,		.981, SRMR = .056, AIC	
	BIC = 44604		= 44252, BIC = 44296	

Note. N = 4212. ** $p < .01$. In both model, the intercept is high school GPA. In the linear and quadratic model, slope #1 = linear, slope #2 = quadratic. In the piecewise growth, slope #1 = change between high school and 1st semester, slope #2 = change between 1st and 2nd semester. ^a Fixed at zero to ensure model identification but freely estimated and statistically significant (0.201, S.E. = 0.075, $p < .05$) in complementary analyses reported in the supplementary file.

Table 2

Results of Growth Models of Academic Achievement from High School, 1st Year, and 2nd Year of University Students Returning for the 2nd Year

	<u>Linear and Quadratic Growth</u>		<u>Piecewise Growth</u>	
	Estimate	S.E.	Estimate	S.E.
Fixed Effect				
Intercept	7.672**	0.023	7.672**	0.023
Slope #1	-2.534**	0.039	-1.669**	0.023
Slope #2	0.865**	0.018	0.062**	0.021
Covariance				
Intercept with slope #1	0.246**	0.022	0.520**	0.041
Variance				
Intercept	1.314**	0.042	1.082**	0.046
Slope #1	0.287**	0.020	0.663**	0.056
Slope #2 ^a	0.000	0.000	0.000	0.000
Residual variance				
Equal across the three time	0.741**	0.023	0.807**	0.024
Model fit				
	$\chi^2 = 125.04, df = 2, p < .001;$		$\chi^2 = 141.25, df = 2, p <$	
	CFI = .967, TLI = .951,		.001; CFI = .963, TLI =	
	SRMR = .132, AIC = 59225,		.944, SRMR = .082, AIC =	
	BIC = 59429		59227, BIC = 59431	

Note. $N = 3600$. ** $p < .01$. In both model, the intercept is high school GPA. In the linear and quadratic model, slope #1 = linear, slope #2 = quadratic. In the piecewise growth, slope #1 = change between high school and 1st year, slope #2 = change between 1st and 2nd year. ^aFixed at zero to ensure model identification but freely estimated and statistically significant (0.353, $S.E.$ = 0.066, $p < .05$) in complementary analyses reported in the supplementary file.

Table 3

Results of Growth Models of Academic Achievement across High School and Four Years at the University for Students Returning for the 3rd Year

	<u>Linear and Quadratic Growth</u>		<u>Piecewise Growth</u>	
	Estimate	S.E.	Estimate	S.E.
Fixed Effect				
Intercept	7.548**	0.024	7.738**	0.024
Slope #1	-1.235**	0.021	-1.604**	0.023
Slope #2	0.267**	0.005	0.182**	0.010
Covariance				
Intercept with slope #1	0.346**	0.033	0.270**	0.038
Intercept with slope #2	-0.083**	0.007	-0.071**	0.013
Slope #1 with slope #2	-0.037**	0.010	-0.047**	0.015
Variance				
Intercept	1.120**	0.045	1.180**	0.044
Slope #1	0.246**	0.043	0.622**	0.052
Slope #2	0.009**	0.002	0.169**	0.012
Residual variance				
Equal across the five time	0.851**	0.021	0.642**	0.020
Model fit				
	$\chi^2 = 1197.35, df = 10, p < .001$; CFI = .815, TLI = .815, SRMR = .163, AIC = 70088, BIC = 70354		$\chi^2 = 90.91, df = 10, p < .001$; CFI = .987, TLI = .987, SRMR = .042, AIC = 68603, BIC = 68869	

Note. $N = 3136$. ** $p < .01$. In both model, the intercept is high school GPA. In the linear and quadratic model, slope #1 = linear, slope #2 = quadratic. In the piecewise growth, slope #1 = change between high school and 1st year, slope #2 = change in the 2nd, 3rd, and 4th year.

Figure 1. Panel A: Yearly grade point average of two prototypical students graduating with the same cumulative grade point average. Panel B: Grades in the five courses of two prototypical students finishing a semester with the same semester grade point average (SGPA)

Figure 2. Panel A: Estimated academic achievement trajectory from high school (HS), 1st semester (Y1S1), and 2nd semester (Y1S2) of 1st Year University Students. Panel B: Estimated individual academic achievement trajectory of 500 randomly selected students. SGPA = Semester Grade Point Average. $N = 4212$.

Figure 3. Changes in academic achievement predict 2nd year retention after controlling for admission GPA (model 1) and 1st semester GPA (model 2). Control variables are in grey. Parameters are unstandardized. OR = Odds ratio. $N = 4212$. 2nd year retention equals 85.5%. $^{**} p < .01$. $^* p < .05$.

Figure 4. Estimated achievement trajectory from high school (HS), 1st year, and 2nd year of university students returning for the 2nd year. YGPA = Yearly Grade Point Average. $N = 3600$.

Figure 5. Changes in academic achievement predict 3rd year retention after controlling for admission GPA (model 1) and 1st year GPA (model 2). Control variables are in grey. Parameters are unstandardized. OR = Odds ratio. $N = 3600$ returning in 2nd year, of which 84.9% returned in 3rd year. $** p < .01$. $* p < .05$.

Figure 6. Estimated achievement trajectory across high school and four years at the university for students returning for the 3rd year. YGPA = Yearly Grade Point Average. $N = 3136$.

Figure 7. Changes in academic achievement predict graduation after the 4th year while controlling for admission GPA (model 1) and 1st year GPA (model 2). Control variables are in grey. Parameters are unstandardized. OR = Odds ratio. $N = 3136$ returning in 3rd year, of which 47.4% graduated in four years. $^{**} p < .01$. $^* p < .05$.