Executive Functioning Predicts Academic But Not Social Adjustment to University

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Abstract

Objective: Adjusting well academically and socially has been associated with enhanced academic performance and student retention. The purpose of this study was to examine subthreshold levels of ADHD symptoms such as inattention, hyperactivity, and executive functioning as potential predictors of academic and social adjustment in a healthy sample of university students. **Method:** Participants were 135 undergraduate university students who completed self-report questionnaires. **Results:** Hierarchical regression analyses revealed that metacognition (an aspect of executive function), gender, and age were significant predictors of academic adjustment beyond hyperactivity, inattention, and depression. Depression was the only significant predictor of social adjustment. **Conclusion:** The BASC–College form may identify depression symptoms predictive of social adjustment, but symptoms of inattention or hyperactivity are not sufficiently sensitive to predict academic adjustment. Measures of executive function that include metacognition such as the BRIEF-A may be most promising in identifying skills predictive of academic adjustment. *(J. of Att. Dis. XXXX; XX(X) XX-XX)*

Keywords

executive function, depression, inattention, hyperactivity, college adjustment

The transition from high school into post-secondary presents many academic as well as social challenges to students. There is less structure within the academic context, yet the academic demands are higher. Similarly, although there are many diverse social opportunities (e.g., clubs, interest groups, pub nights, etc.), students are expected to interact on varying levels of formality and familiarity with peers, classmates, professors, and administrative staff. Academic and social adjustment to the post-secondary environment are significant factors in predicting student retention and performance (Credé & Niehorster, 2012). Academic adjustment is associated with academic performance as measured by grade point average (GPA; Credé & Niehorster, 2012) and includes, but is not limited to, the students feeling that they are keeping pace with coursework, their confidence in their academic abilities, the availability of preferred courses at the institution, and the student's belief in the importance of getting a degree (Baker & Siryk, 1989). Social adjustment includes such aspects as the students' satisfaction with the number of friendships they have, participation in extra-curricular activities on campus, confidence in their social skills, and quality of interactions with professors and the opposite sex (Baker & Siryk, 1989). Social adjustment is associated with student retention, second only to attachment to the institution (Credé & Niehorster, 2012). In addition, adapting successfully to academic and social demands of university or college is important as Canadians who have

an educational attainment of at least a bachelor's degree experience lower unemployment rates (Statistics Canada, 2008a), higher earning potential (Statistics Canada, 2008b), and protection against recession (Statistics Canada, 2012) compared with peers with lower educational attainment.

Symptoms of inattention and hyperactivity are well known to affect academic and social functioning in individuals with ADHD (Daley & Birchwood, 2010; Nijmeijer et al., 2008). Subthreshold levels of ADHD symptoms are also detected in healthy samples and normally distributed in the population (Gillberg, 2010). In previous studies, 2% to 8% of university students reported clinically significant levels of ADHD symptoms (Weyandt & DuPaul, 2006), although for a greater proportion of university students, subthreshold symptoms of hyperactivity and inattention may interfere with academic and/or social adjustment. In this study, we use the symptoms of ADHD such as inattention, hyperactivity, and executive function deficits as a reference point to better understand the impact of subthreshold symptoms in healthy adults.

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Academic and Social Adjustment

Adapting well to the academic environment of university is important as certain GPAs are often required for financial aid, entry into specific academic programs or professional schools, and to be competitive in the applicant pool for jobs. Similarly, adjusting well to the social demands of the post-secondary environment may mean that students are benefitting from opportunities to expand social and occupational networks that may be the key to future prospects such as employment or entry into graduate/professional school.

The findings are mixed on how significant the impact is of inattention and hyperactivity on academic and social adjustment in the post-secondary population. In one study, using a sample of 316 students, inattention, as measured by the college form of the Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004), accounted for only 7% of the variance in GPA, while hyperactivity as measured by the same scale accounted for an even smaller 2% of variance in GPA (Schwanz, Palm, & Brallier, 2007). Norwalk, Norvilitis, and MacLean (2009) investigated whether inattention and hyperactivity could predict GPA or academic adjustment for 263 post-secondary students and found neither inattention nor hyperactivity to be a significant predictor of GPA. However, inattention, along with depressive symptoms and gender, was a significant predictor of academic adjustment. With regard to social adjustment, only depressive symptoms were significant predictors. Norvilitis, Sun, and Zhang (2010) replicated the previous study with 147 American and 273 Chinese students and found that inattention was a significant predictor of academic adjustment for both samples. Age was also a significant predictor for the American sample; in the Chinese sample, depression rather than age was a significant predictor of academic adjustment. Hyperactivity was not a significant predictor of academic adjustment or GPA in either of these studies. With regard to social adjustment, only depressive symptoms were a significant predictor for the American sample. In the Chinese sample, inattention, depressive symptoms, and age were all significant predictors of social adjustment.

Executive function (EF) may be a more promising predictor of academic adjustment as EF is broadly referred to as higher order cognitive control processes involved in planning, organizing, and regulating behavior and is identified as one of the key deficits in ADHD (Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). For example, symptoms of inattention and hyperactivity may subside in adulthood (Kolar et al., 2008) and may be less detectable in adults given the few instruments available that are sensitive enough to detect these symptoms in adults. EF, however, continues to develop into adulthood (Romine & Reynolds, 2005) and, therefore, may be a more developmentally appropriate issue to identify and target for assessment and intervention. Moreover, EF is a construct that has been relatively well-defined and measured in adulthood and into old age (Piguet et al., 2002) and implicated in academic performance (Best, Miller, & Naglieri, 2011).

EF is often assessed with either performance-based measures or self-report ratings, although these two methods may not be measuring the same construct (Toplak, West, & Stanovich, 2013). Performance-based measures are highly structured wherein the demands are clear and distractions are limited, a rather artificial situation for most university students. Self-report ratings may provide a better indication of everyday functioning as these reflect how well an individual can plan, pursue, and attain personal goals (Toplak et al., 2013). Roth, Isquith, and Gioia (2005) identified two aspects of EF, behavioral regulation and metacognition, by factor analysis during the development of their self-report rating scale, the Behavior Rating Inventory of Executive Function, Adult Version (BRIEF-A). Behavioral regulation is a composite of several EFs, which includes inhibition of behavior, shifting between tasks, regulation of emotions, and monitoring how one's behavior affects others. Metacognition includes working memory, initiation of behavior, monitoring one's performance on tasks, planning, and organization (Roth et al., 2005).

There is evidence of the impact of EF on university student performance. Rabin, Fogel, and Nutter-Upham (2011) found that several aspects of EF (initiation, planning and organization, inhibition, self-monitoring, working memory, task monitoring, and organization of materials) were associated with academic procrastination, which often has a negative impact on academic achievement. Wingo, Kalkut, Tuminello, Asconape, and Han (2013) investigated this relationship more directly in a study of 77 undergraduate women. The women who reported more problems with metacognition and verbal set shifting aspects of EFs experienced significantly more academic problems. With regard to social adjustment, self-reported behavioral regulation (inhibition, shifting, emotion regulation, and self-monitoring) and depressive symptoms emerged as predictors of relational (or social) problems above and beyond IQ. Problems with behavioral regulation were associated with more relational/social problems; students who reported more depressive symptoms also experienced more relational/social problems. Behavioral regulation also figured prominently in a study of social connection among university students. Here, 276 undergraduate students completed an emotion regulation measure in their freshman year and had a peer complete a report of social functioning in the students' senior year (English, John, Srivastava, & Gross, 2012). Emotion regulation, an aspect of behavioral regulation, during the freshman year, predicted the quality of social connection 4 years later. Based on these studies, the behavioral regulation aspect of EF appears to be more important for social adjustment and functioning than the

metacognition aspect. However, the studies used different measures of EF and investigated different aspects of social adjustment, complicating the interpretation of the findings.

Based on previous findings, inattention, hyperactivity, depressive symptoms, and demographic variables predict an estimated 20% to 34% of the variance in academic adjustment (Norvilitis et al., 2010; Norwalk et al., 2009), yet a large proportion of variance in adjustment is unexplained. Similarly, models with the same variables explained 15% to 32% of the variance in social adjustment. There is evidence that EF may be implicated in academic as well as social adjustment. However, the few, small and diverse samples limit what can be concluded from the results of previous studies.

In the current study, we extend previous research on academic and social adjustment by considering whether EFs, specifically, metacognition and behavioral regulation, predict student reports of academic and social adjustment to university in a Canadian sample of primarily first-year students.

We predicted that symptoms of inattention and hyperactivity would significantly and negatively predict academic adjustment above and beyond the covariates age, gender, and depressive symptoms. In addition, we expected that deficits in metacognition would significantly and negatively predict academic adjustment above and beyond inattention, hyperactivity, and the covariates of age, gender, and depressive symptoms.

We also expected that inattention and hyperactivity would be significantly and negatively predictive of social adjustment above and beyond the covariates age, gender, and depressive symptoms. Deficits in behavioral regulation were expected to significantly and negatively predict social adjustment above and beyond inattention, hyperactivity, and the covariates.

Method

Participants

Participants included 135 university students, of which 93 (68.9%) were females and 42 (31.1%) were males. Participants ranged in age from 17 to 25 years, with a mean of 19.3 years. Most students were in their first year (51.9%) and were pursuing an arts and social sciences degree (61.5%) or a science degree (16.3%). Based on self-reports, the largest ethnic group was East Asian (31.1%). Within the sample, 19 participants reported a mental health issue, of which 2 participants reported a diagnosis of ADHD and 8 participants reported a diagnosis of depression (see Table 1 for participant demographic characteristics).

Procedure

Participants were recruited from introductory psychology classes and were compensated with course credit. Participants were given a written version of informed consent and instructions. Once consent was given, a verbal account of the instructions and a paper package containing the questionnaires were given to the participants. Participation occurred in groups of four to eight students in a standard testing room in the psychology department. The questionnaires typically took approximately 60 min to complete.

Outcome Variables

Academic adjustment. Academic adjustment was measured by the Student Adaptation to College Questionnaire (SACQ; Baker & Siryk, 1989). Items were rated on a 9-point Likert-type scale, which ranged from *doesn't apply to me at all* to *applies very closely to me* (e.g., "I have been keeping up to date on my academic work"). Higher scores indicated better adjustment and adaptation. The theoretical range of scores on the Academic Adjustment Scale was 60 to 207, with *t* scores ranging from 25 to 75. For the purposes of the present study, *t* scores were used. Cronbach's alpha for the Academic Adjustment Scale ranged from .78 to .90 across 10 post-secondary institutions over a 7-year span ($N > 1,850$). The Academic Adjustment Scale was significantly correlated with GPA for all four administrations of the SACQ during norm development (Baker & Siryk, 1989).

Social adjustment. Social adjustment was also measured by the SACQ (e.g., "I feel that I have enough social skills to get along well in the college setting"). The theoretical range of scores on the Social Adjustment Scale was 20 to 180, with *t* scores ranging from 25 to 75. For the purposes of the present study, *t* scores were used. Cronbach's alpha for the Social Adjustment Scale ranged from .83 to .91, depending on which institution was sampled.

Predictor Variables

Behavioral regulation. The BRIEF-A (Roth et al., 2005) is a self-report questionnaire, which measures EF with nine subscales: Inhibit, Shift, Emotional Control, Self-Monitoring, Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Material. The scores for the Inhibit, Shift, Emotional Control, and Self-Monitor subscales were combined to form the Behavioral Regulation Index (BRI). Each item had three possible responses (1 = *never*, 2 = *sometimes*, 3 = *often*; for example, "I have emotional outbursts for little reason"), such that the BRI had a theoretical range of 30 to 90. *T* scores ranged from 35 to 95 on the BRI, with *t* scores of 65 or higher indicating clinically significant levels of executive dysfunction. For the purpose of this study, *t* scores were used. The BRI had high internal consistency (Cronbach's α = .93) and high test–retest reliability ($r = .93$).

Table 1. Participant Demographic Characteristics.

	n (%)
Gender	
Male	42 (31.1)
Female	93 (68.9)
Age (years)	
17-19	88 (65.2)
20-22	36 (26.7)
23-25	11 (8.1)
Ethnicity	
East Asian	42 (31.1)
Caucasian	29 (21.5)
South Asian	17 (12.6)
European	13 (9.6)
Other/multiple[a]	34 (25.2)
Academic program	
Arts and social sciences	83 (61.5)
Sciences	22 (16.3)
Other[b]	23 (17.0)
Multiple[c]	7 (5.2)
Academic progress	
Year 1	70 (51.9)
Year 2	33 (24.4)
Year 3	23 (17.0)
Year 4+	9 (6.7)

[a]This category included individuals who identified themselves as representing more than one ethnicity (e.g., European and Asian), as well as those individuals who identified themselves as Southeast Asian (n = 6), First Nations (n = 2), or Middle Eastern (n = 1).
[b]This category included health science (n = 8), business (n = 7), applied science (n = 3), communications, art and technology (n = 2), education (n = 2), and undecided (n = 1).
[c]This category included individuals declared as double majors.

Metacognition. Included in the BRIEF-A was the Metacognition Index (MI; Roth et al., 2005), which was a scale composed of the Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials subscales (e.g., "I need to be reminded to begin a task even when I am willing"). The MI had a theoretical range of 40 to 120, and t scores on the MI ranged from 36 to 95. Again, t scores more than 65 indicated clinically significant levels of EF. For the purposes of this study, t scores on the MI were used. The MI had high internal consistency (Cronbach's α = .94), and high test–retest reliability (r = .93).

Inattention. The BASC-2 (Reynolds & Kamphaus, 2004) is a self-report questionnaire of behavior. Some items had *true* or *false* response sets, whereas the other items used a 4-point Likert-type scale to rate the frequency of behaviors, ranging from *never* to *almost always* (e.g., "I have attention problems" and "I have trouble paying attention to lectures"). The theoretical range of raw scores on the clinical Attention Problems Scale was 0 to 27, and t scores ranged from 33 to

87. On all clinical scales on the BASC-2, t scores ranging from 60 to 69 indicated "at risk" levels of dysfunction, while t scores greater than 70 indicated clinically significant levels of attention problems. The Attention Problems Scale had high internal consistency (Cronbach's α = .83) and moderate test–retest reliability (r = .84).

Hyperactivity. Included on the college form of the BASC-2 was the clinical Hyperactivity Scale (Reynolds & Kamphaus, 2004; for example, "I often do things without thinking" and "I feel like I have to get up and move around"). The theoretical range of raw scores on the Hyperactivity Scale was 0 to 18, and t scores ranged from 33 to 94. The Hyperactivity Scale had moderate internal consistency (Cronbach's α = .74) and moderate test–retest reliability (r = .82).

Covariates

Depression. A depression subscale was available on the college form of the BASC-2 (Reynolds & Kamphaus, 2004; for example, "I just don't care anymore" and "I feel like my life is getting worse and worse"). The theoretical range of raw scores on the Depression scale was 0 to 30, and t scores ranged from 40 to 95. The Depression scale had high internal consistency (Cronbach's α = .88) and moderate test–retest reliability (.86).

Age and gender. Age and gender were shown to be potentially important factors in academic and social adjustment in previous studies (Best et al., 2011; Norvilitis et al., 2010; Norwalk et al., 2009; Romine & Reynolds, 2005). As such, both age and gender (male = 0, female = 1) were included as covariates in the regression models for academic and social adjustment.

Results

All data analyses were performed using SPSS Statistics, Version 19. Seven participants were excluded from the analyses because they were too old or young for the norms of the BASC-2. One participant was excluded because he or she failed to provide a birthdate and indicated he or she did not wish to be contacted to verify data. Four participants were excluded because they exceeded the cutoff for acceptable validity scores on the BRIEF-A or the BASC-2. Thus, the analyses were run on data from 135 participants. Once the above participants were removed, the remaining data were checked for outliers. Several potential outliers on the variables included in the regression models were detected; however, influence statistics indicated that no outlier had undue influence on either the academic or social model. Therefore, no data were excluded as outliers.

Table 2 presents descriptive statistics of all continuous variables. The mean t scores for both academic adjustment

Table 2. Means and Standard Deviations of All Continuous Variables.

Continuous variables	M	SD	Actual range	Theoretical range
Social Adjustment	40.55	.63	25-58	25-75
Academic Adjustment	45.94	.90	25-75	25-75
Behavioral Regulation Index	51.69	.81	36-82	35-95
Metacognition Index	54.13	.88	37-82	36-95
Attention Problems	47.48	.73	33-74	33-87
Hyperactivity	46.66	.80	33-74	33-94
Depression Symptoms	48.33	.65	40-76	40-95

Note. T scores are used for all variables.

and social adjustment were lower than the average of the norm samples (50T) but were within 1 standard deviation (Baker & Siryk, 1989). Participants scored slightly higher on the MI than the BRI, although both variables had similar ranges and standard deviations. The means for both the BRI and MI were well below the clinically significant cutoffs of 65T, although there were 13 and 21 participants who scored above 65T, respectively. The means for Attention Problems, Hyperactivity, and Depressive Symptoms were all well below the clinical cutoff of 70T, as would be expected of a non-clinical sample. Two participants scored above the clinically significant cutoff, and 15 participants scored above the "at risk" cutoff on the Attention Problems scale. For the Hyperactivity scale, 4 participants scored above the clinically significant cutoff and 15 participants scored above the "at risk" cutoff. One of the two participants who reported a diagnosis of ADHD exceeded the at-risk cutoff for inattention and hyperactivity. For the Depressive Symptoms scale, 2 participants scored above the clinical cutoff and 14 participants scored in the "at risk" range; 3 of these participants reported a formal diagnosis of depression.

Academic Adjustment Model

To address the first hypothesis, a hierarchical ordinary least squares regression analysis was performed. Table 3 presents intercorrelations among all variables included in both the academic and social adjustment models. Spearman's rho correlations were used for those variables that violated the assumption of bivariate normality (age, depression, inattention, and hyperactivity). The intercorrelations are presented to give an impression of the overall relationships between variables; the significance of these correlations was not tested. For the first regression model with academic adjustment as the outcome variable, Block 1 included gender, age, and depressive symptoms; Block 2 added measures of inattention and hyperactivity; and Block 3 added a measure of metacognition. All assumptions for ordinary least squares regression were supported, indicating that this statistical method is appropriate for this data set.

The overall model of academic adjustment was found to be statistically significant, $R^2 = .37$, $F(6,128) = 12.59$, $p < .001$. The first step in the model, containing gender, age, and depression as predictor variables, explained a statistically significant proportion of variance in academic adjustment, $\Delta R^2 = .27$, $F(3,128) = 16.43$, $p < .001$. Inattention and hyperactivity were added in the second step and accounted for an additional 5.1% of the variance in academic adjustment, $\Delta R^2 = .051$, $F(2, 128) = 4.88$, $p = .009$. Metacognition was added in the third step and accounted for an additional 4.7% of the variance, $\Delta R^2 = .047$, $F(1, 128) = 9.49$, $p = .003$. T tests revealed that metacognition had a statistically significant negative regression coefficient ($\beta = -.31$, $t_{128} = -3.08$, $p = .003$). Controlling for the effect of gender, age, depressive symptoms, inattention, and hyperactivity, a 1 standard deviation unit change in metacognition would result in a .31 standard deviation decrease in academic adjustment; the greater the reported deficits in metacognition, the more reported difficulty with academic adjustment. Gender and age also had statistically significant, although positive, regression coefficients (gender: $\beta = .22$, $t_{128} = 3.05$, $p = .003$; age: $\beta = .21$, $t_{128} = 2.89$, $p = .005$). All other predictors (depression, inattention, and hyperactivity) were not significant. Table 4 presents a summary of the final model for academic adjustment.

In summary, although the step that included inattention and hyperactivity explained a significant proportion of variance above and beyond the covariates, neither variable was an independent predictor of academic adjustment. However, metacognition, as predicted, was a significant predictor of academic adjustment and independently explained a significant proportion of the variance above and beyond the covariates. A post hoc power analysis indicated that this analysis had a power of .93 to detect a medium effect size ($R^2 = .15$) with an alpha level of .05, 6 predictors, and a sample size of 135 students.

Social Adjustment Model

To address the second hypothesis, a hierarchical ordinary least squares regression analysis was conducted. Table 3 presents the intercorrelations for this analysis. Intercorrelations were reported to depict the overall relationships between variables. For the second regression model with social adjustment as the outcome variable, Blocks 1 and 2 were the same as with the academic adjustment regression model; Block 3 added a measure of behavioral regulation. All assumptions for ordinary least squares regression were supported, indicating that this statistical method is appropriate for this data set.

A hierarchical ordinary least squares regression analysis revealed that the overall model of social adjustment was statistically significant, $R^2 = .21$, $F(6, 128) = 5.73$, $p < .001$. The first step of the model containing gender, age, and depression as predictor variables explained a statistically

Table 3. Correlations Between All Variables.

	1	2	3	4	5	6	7	8	9
1. Gender	1.00	.12[a]	−.08[a]	.02[a]	−.04[a]	.05	−.12	.29	.07
2. Age		1.00	−.19[a]	−.13[a]	−.12[a]	−.19[a]	−.21[a]	.32[a]	.10[a]
3. Depressive Symptoms			1.00	.44[a]	.24[a]	.63[a]	.45[a]	−.39[a]	−.43[a]
4. Attention Problems				1.00	.57[a]	.62[a]	.62[a]	−.40[a]	−.26[a]
5. Hyperactivity					1.00	.51[a]	.38[a]	−.20[a]	−.14[a]
6. Behavioral Regulation						1.00	.60	−.31	−.39
7. Metacognition							1.00	−.50	−.36
8. Academic Adjustment								1.00	.47
9. Social Adjustment									1.00

Note. N = 135.
[a]Spearman's rho correlation.

Table 4. Summary of Hierarchical Regression Analysis Predicting Academic Adjustment.

Variable	β	ΔR^2
Block 1		.27**
Gender	.22*	
Age	.21*	
Depressive Symptoms	−.14	
Block 2		.05*
Inattention	−.11	
Hyperactivity	.07	
Block 3		.05*
Metacognition	−.31*	
Total R^2		.37**

Note. N = 135.
*p < .01. **p < .001.

Table 5. Summary of Hierarchical Regression Analysis Predicting Social Adjustment.

Variable	β	ΔR^2
Block 1		.19**
Gender	.06	
Age	−.05	
Depressive Symptoms	−.30*	
Step 2		.01
Inattention	.00	
Hyperactivity	.03	
Step 3		.02
Behavioral Regulation	−.22	
Total R^2		.21**

Note. N = 135.
*p < .01. **p < .001.

significant proportion of variance in social adjustment, $\Delta R^2 = .19$, $F(3, 128) = 10.18$, $p < .001$. Inattention and hyperactivity were added in the second step and did not account for a statistically significant amount of additional variance, $\Delta R^2 = .0060$, $F(2, 128) = .48$, $p = .62$. Behavioral regulation was added in the third step and also did not account for a statistically significant amount of additional variance, $\Delta R^2 = .017$, $F(1, 128) = 2.71$, $p = .10$. *T* tests revealed only depressive symptoms had a statistically significant negative regression coefficient (depressive symptoms: $\beta = −.30$, $t_{128} = −2.76$, $p = .007$). Controlling for the effect of gender, age, inattention, hyperactivity, and behavioral regulation, a 1 standard deviation unit change in depressive symptoms would result in a .30 standard deviation decrease in social adjustment. Table 5 presents a summary of the final model for social adjustment.

For the social adjustment model, our hypothesis was not supported; the steps that included inattention and hyperactivity or behavioral regulation did not explain significant additional variance beyond the covariates of age, gender, and depressive symptoms. These variables were not significant

independent predictors. Only the depressive symptoms variable was an independent predictor of social adjustment above all other variables in the model. A post hoc power analysis indicates that the social adjustment model analysis had the same power (.93) as the academic adjustment model to detect a medium effect size ($R^2 = .15$) with an alpha level of .05, 6 predictors, and a sample size of 135 students.

Discussion

In the current study, we used the symptoms of inattention, hyperactivity, and EF deficits known to affect academic and social functioning in persons with ADHD as a reference point to better understand the impact of subthreshold symptoms in healthy adults on academic and social adjustment to university. We found that the metacognition domain of EF as indexed by the BRIEF-A was an important predictor of academic adjustment. This predictor explained an additional 4.7% of the variance beyond inattention, hyperactivity, depression symptoms, gender, and age, an improvement over previous models that did not

include a measure of EF. Both depressive symptoms and inattention were significant independent predictors of academic adjustment before metacognition was entered in the last block of the model. The lack of significance of inattention and depressive symptoms after metacognition was introduced to the model suggests that the variance in academic adjustment explained by inattention and depressive symptoms overlapped considerably with the variance explained by EF. Nevertheless, variance inflation factor statistics indicated that multicollinearity between these variables was not an issue although metacognition was highly correlated to inattention (r_s = .62) and depression (r_s = .45). Thus, metacognition was a better explanation of the variance in academic adjustment than inattention or depressive symptoms. The significance of EF as a predictor of academic adjustment is well-documented in research with children and individuals with ADHD (Best et al., 2011; Daley & Birchwood, 2010; Langberg, Dvorsky, & Evans, 2013). The current study extends these findings to the general population of university students and suggests that the EF abilities to initiate tasks, effectively use working memory, plan and organize work, self-monitor tasks, and organize materials subsumed under the domain of metacognition continue to have a significant impact on academic adjustment. In the university setting, the high academic demands coupled with a lack of external structure may be especially taxing for students with difficulties in EF. The BRIEF-A may be a particularly useful tool for university students who are able to self-report on their EF. The role of EF deficits in academic adjustment for university students diagnosed with ADHD and related disorders known to be associated with EF deficits warrant future study.

The model including depressive symptoms explained a significant 21% of the variance in social adjustment, above and beyond behavioral regulation, inattention, hyperactivity, age, and gender. However, this was not an improvement over previous predictor models.

These results are consistent with previous findings (Norvilitis et al., 2010; Norwalk et al., 2009) and provide additional evidence that depressive symptoms but not inattention or hyperactivity predict social adjustment for university students attending a Canadian University. The lack of significance of the behavioral regulation domain of EF is surprising given previous positive research findings (English et al., 2012; Wingo et al., 2013). However, the possibility remains that behavioral regulation, which includes inhibition, shifting, emotional control, and self-monitoring, is too broad a concept to reveal a meaningful relationship with social adjustment. Focusing instead on more specific aspects of behavioral regulation such as emotion regulation that may be most related to depression and other emotional problems may be more informative and represents a valuable point of inquiry for future studies. In addition, the role of depression symptoms specifically in social adjustment to

university in both students with and without a diagnosed mood disorder would warrant a longitudinal study.

Limitations

A limitation of this study was the lack of an objective measure of academic adjustment such as GPA. We focused on academic adjustment because it is a comprehensive measure including questions on academic performance. Another issue with the self-report on adjustment is the social desirability bias due to the relative transparency of the hypotheses in this study. Almost a 10th of the sample was flagged for "faking good" on a validity scale of the BASC-2; however, the items contributing to the validity scale were unrelated to the scales used in the study, and only two participants reached the "extreme caution" cutoff. Even so, using other reports on behavior may have provided more objective measures of adjustment and functioning. Future research would benefit from a multi-method approach considering GPA as one of several academic outcome measures and including other informants on student behavior.

The use of a convenience sample of students enrolled in an introductory psychology class resulted in an over-representation of arts and social sciences students. This may reduce the generalizability of the findings to the general university population at large. More research is needed with a broader university population as well as colleges and other post-secondary settings.

The design of the study does not permit us to address causal relationships between the study variables. Future research could investigate whether identifying and addressing EF or depressive symptoms would affect academic or social adjustment over time.

Conclusion

In this study, we examined subthreshold levels of ADHD symptoms in a healthy sample of students in a Canadian University. We found that self-ratings on the BRIEF-A EF domain of metacognition was a better predictor of academic adjustment than specific symptoms of inattention or hyperactivity measured on the BASC–College form. The model containing the metacognition predictor from the BRIEF-A explained 37% of the variance in academic adjustment, an improvement over previous models that did not include a measure of EF. Self-reported depressive symptoms were the best predictors of social adjustment.

The findings suggest that specific measures of EF such as the BRIEF-A may be most promising in identifying skills of metacognition (i.e., initiating tasks, effectively using working memory, planning and organizing one's work, self-monitoring tasks, and organizing one's materials) that are predictive of a university student's academic adjustment in the first few years. Moreover, the findings caution against

relying on symptoms of inattention or hyperactivity derived from a broad-based measure such as the BASC–College form as these would not be sufficiently sensitive to predict academic or social adjustment. However, the BASC–College form would be helpful in identifying depression symptoms that are predictive of social adjustment.

It is important to note that although the variables in the current study explained 37% of the variance on academic and 21% of the variance on social adjustment, there is much variance that is left unexplained. Thus, other factors, possibly social and emotional factors (Pritchard & Wilson, 2003), need to be explored. One likely candidate is emotion regulation, which is thought to underlie the presentation of multiple emotional and behavioral problems across the life span (Weiss, Thomson, & Chan, 2014).

Identifying and assessing issues that impede student adjustment are a first step in addressing student retention and success in the critical first few years. The use of broad based as well as specific measures of behaviors that interfere with adjustment would help institutions identify students who may benefit from organizational, interpersonal, or technological supports. Freshman transition courses have been shown to enhance student retention and graduation rates as well as improve student self-efficacy (Cambridge-Williams, Winsler, Kitsantas, & Bernard, 2013-2014). Transition courses designed to improve EF or coping with depression symptoms may be particularly beneficial. For example, there is evidence that training EF in individuals with ADHD leads to improvements in EF (Horowitz-Kraus, 2015; Tamm, Nakonezny, & Hughes, 2014).

Student performance and retention in university are associated with how well students adjust to academic and social life (Credé & Niehorster, 2012), and, in turn, student retention and performance influence the institution's rankings and financial viability (Delen, 2011). Thus, the identification of factors that impede or promote student adjustment to university stands to benefit both the students and their post-secondary institutions.

Declaration of Conflicting Interests

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