

## Assessment of the impact of emotional competencies on academic achievement within engineering and other student cohorts

Mary F. Stewart<sup>†</sup> & Colin U. Chisholm<sup>‡</sup>

Ryerson University, Toronto, Ontario, Canada<sup>†</sup>  
Glasgow Caledonian University, Glasgow, Scotland, United Kingdom<sup>‡</sup>

**ABSTRACT:** Retention of students is an ongoing area of concern globally within engineering programmes. Educational institutions increasingly strive to identify personal attributes or skills that may be predictive of a student's academic success once they make the transition into a university setting. Emotional Intelligence (EI) refers to a set of key emotional and social competencies which may underpin a student's success in their university education. This article reports on a longitudinal study that assessed the relationship between EI competency and academic success for engineering, business and humanities students. The results document statistically small but significant correlations between some EI component scales and academic success that differ between the distinct programme cohorts. The Attentiveness scale skill set was identified as of particular importance for the engineering student cohort.

### INTRODUCTION

Historically, engineering programmes globally have a high level of attrition in the first year of the programme. While some students withdraw because of poor performance, others choose to leave for a variety of other reasons. Typically, these reasons involve not having the skills to cope with the intensity of an engineering programme, not having the skills to deal with their new found independence and associated self management and not engaging with the courses or their peers. Over the past decade educational institutions have undertaken studies in an attempt to identify the personal attributes or skills that are related to student retention. One obvious area of investigation was the student's incoming high school grades (Canada, USA) or A level examination grades (UK). Both academic measures have been shown to have a small but significant correlation, in the range of 0.3, with a student's academic achievement at the end of their first year of study [1][2]. This small value of the correlation assessed for high school incoming grade and for A level examinations suggests that they are not a strong predictor of subsequent academic achievement and that other factors are at play which impact on student achievement at university [2]. This conclusion supports the need to investigate other possible student success assessment tools in order to determine if there are alternative non-cognitive tools that could supplement the academic achievement predictor strength of the cognitive measure of high school entrance grade in Canada, USA and the A-level attainment in the UK.

### EMOTIONAL INTELLIGENCE

Emotional Intelligence (EI) is a term that entered the popular vernacular with the 1995 publication of the book *Emotional Intelligence: Why it can matter more than IQ* by Daniel Goleman [3], and is now a mainstay. This book caught the imagination of the public and brought renewed interest to the area of EI research. Goleman described a person's EI as possessing *abilities such as being able to motivate oneself and persist in the face of frustrations; to control impulse and delay gratification; to regulate one's moods and keep distress from swamping the ability to think; to empathise and to hope* [3]. It appears obvious that such abilities are the individually held capabilities that ensure a person can deal with events and obstacles in one's daily life effectively and successfully; employment related issues in one's working life and lastly, and more pertinent to this study, academic and social demands of a university environment with the associated success measure of academic achievement in one's post secondary educational life.

In the past fifteen years, since EI measurement instruments became formalised, they have been extensively adopted in the private sector as a human resources and professional development tool [4][5]. Companies have long been aware that technical competence is a basic requirement for a contributing employee within their organisation, but other skills are essential for an effective, motivating and successful manager, skills that may be captured within an EI assessment. Similarly, one can theorise that skills possessed by students, that could aid academic achievement in a university programme, may be captured within an EI assessment.

In the 1990s, a prominent America-based EI researcher, Dr Reuven Bar-On, stated: *...emotional-social intelligence is a cross-section of interrelated emotional and social competencies, skills and facilitators that determine how effectively we understand and express ourselves, understand others and relate with them, and cope with daily demands* [6]. The Bar-On EQ-i (Emotional Quotient - Inventory) is *the first scientifically validated and most widely used Emotional Intelligence assessment in the world* [7]. It is a self-reporting measure which assesses five composite scales: Interpersonal, Intrapersonal, Stress Management, Adaptability and General Mood.

#### College Achievement Inventory - Revised (CAI-R)

Dr J.D.A. Parker and his Emotion and Health Research Laboratory (ERHL) at Trent University, Peterborough, Ontario, Canada, have been assessing EQ-i since 1999. They have conducted significant studies on 1) the transition of students from high school to first year university [8]; 2) using EQ-i as an indicator of academic achievement [9]; and 3) using EQ-i to identify students who may be at risk for dropping out and undertaking a student mentoring retention programme [10]. His work has predominantly concentrated on humanities students. The study reported in this article is primarily aimed at engineering students but involves a critical comparison with business and humanities students.

The ERHL developed an emotional intelligence measure called the College Achievement Inventory (CAI-Revised) [11], and the research group has conducted reliability and validation studies on this CAI-R measure over the past decade involving over 3500 students. It has been determined that it correlates highly with the Bar-On EQ-i [11]. The CAI-R was specifically designed for use with a college and university population and measures five EI scales: Emotional Understanding, Psychological Mindedness, Attentiveness, Emotional Self-Control and an averaged summation scale of Total EI.

The CAI-R manual [11] provides definitions for the basic five EI scales as follows:

1. *Emotional Understanding*, which relates to one's understanding and expression of his/her feelings.
2. *Psychological Mindedness*, which relates to the understanding and awareness of oneself and others.
3. *Attentiveness*, which pertains to one's ability to focus on a task and keep focused, tuning out distracting stimuli and keeping organised.
4. *Emotional Self-Control*, which relates to one's ability over various types of emotional behaviour such as waiting patiently, or engaging in activities quietly when necessary, and, finally,
5. *Total EI (TEI)*, which is an overall indicator of one's EI and is the averaged sum of the scores from the previous four EI scales.

#### METHODOLOGY

Students in three distinct programmes at the home university of one of the authors participated in this longitudinal study, which involved engineering students in seven different disciplines, business students enrolled in an Information Technology Management programme and humanities students enrolled in an Arts and Contemporary Studies programme. The student cohorts completed the CAI-R measure three times during their first three years within their programme; fall of first year; fall of second year; and fall of third year. Table 1 documents the number of study participants by cohort and by year.

In addition, the participating students provided permission for the investigator to access their academic records (specifically their cumulative grade point averages (CGPA) for each year of their undergraduate career).

Table 1: Participants in study by year and cohort.

Year of Study	Engineering Cohort	Business Cohort	Humanities Cohort
1	503	86	112
2	325	35	49
3	297	20	33

#### RESULTS

Tables 2, 3 and 4 document the results of a correlation analysis for all cohorts between the CAI-R assessment results for each study year and the GPA achieved for the same study year and future years from that point in time.

For the engineering student cohort, correlations were found with survey data from all years' assessments. The correlations were between the Attentiveness and Total EI scales and future year academic success. It is of additional interest that for the engineering cohort the correlations appeared in the first year of their programme and consistently grew larger with each consecutive year.

The Attentiveness scale has a correlation value of  $r = 0.18$  ( $p < 0.0001$ ) for year one and moved towards a statistically significant correlation value of  $r = 0.30$  ( $p < 0.0001$ ) in year three. The Attentiveness scale addresses such skills as

keeping focused, completing tasks, keeping organised and time management. The correlation with Total EI, which is general indicator of a student's EI, was initially  $r = 0.14$  ( $p < 0.0001$ ) in year one, which was indicative of a trend in the first year data and this consistently increased in value to a correlation of  $r = 0.24$  ( $p < 0.0001$ ) in year three.

Table 2: Correlation of EI scales and academic achievement for engineering cohort.

	Emotional Understanding	Psychological Mindedness	Attentiveness	Emotional Self-Control	Total EI
Correlation between EI scales and academic achievement for engineering cohort for first year data					
GPA Term 1 N = 481	0.05 (p = 0.20)	0.11 (0.02)	0.07 (0.10)	0.13 ( $<0.0001$ )	0.11 (0.02)
GPA Year 1 N = 449	0.05 (0.27)	0.09 (0.04)	0.11 (0.01)	0.18 ( $<0.0001$ )	0.15 ( $<0.0001$ )
GPA Year 3 N = 306	0.05 (0.36)	0.06 (0.29)	0.18 ( $<0.0001$ )	0.10 (0.08)	0.14 (0.01)
Correlation between EI scales and academic achievement for engineering cohort for second year data					
GPA Year 2 N = 309	0.10 (0.08)	0.01 (0.90)	0.23 ( $<0.0001$ )	0.09 (0.10)	0.18 (0.00)
GPA Year 3 N = 283	0.15 (0.01)	0.01 (0.84)	0.25 ( $<0.0001$ )	0.13 (0.03)	0.22 ( $<0.0001$ )
Correlation between EI scales and academic achievement for engineering cohort for third year data					
GPA Year 3 N = 235	0.18 (0.01)	-0.00 (0.94)	0.30 ( $<0.0001$ )	0.09 (0.16)	0.24 ( $<0.0001$ )

Table 3: Correlation of EI scales and academic achievement for business cohort.

	Emotional Understanding	Psychological Mindedness	Attentiveness	Emotional Self-Control	Total EI
Correlation between EI scales and academic achievement for business cohort for first year data					
GPA Term 1 N = 84	0.018 (0.87)	0.04 (0.69)	-0.00 (0.98)	0.12 (0.25)	0.06 (0.59)
GPA Year 1 N = 83	0.052 (0.64)	0.10 (0.35)	-0.07 (0.54)	0.09 (0.41)	0.03 (0.78)
GPA Year 3 N = 60	0.09 (0.47)	-0.01 (0.96)	0.03 (0.82)	0.27 (0.04)	0.17 (0.19)
Correlation between EI scales and academic achievement for business cohort for second year data					
GPA Year 2 N = 33	0.13 (0.46)	0.02 (0.91)	0.14 (0.41)	0.25 (0.15)	0.21 (0.22)
GPA Year 3 N = 33	0.07 (0.70)	-0.06 (0.73)	0.11 (0.53)	0.09 (0.62)	0.11 (0.53)
Correlation between EI scales and academic achievement success for business cohort for third year data					
GPA Year 3 N = 18	0.22 (0.36)	-0.16 (0.49)	0.17 (0.46)	-0.17 (0.46)	0.11 (0.64)

Table 4: Correlation of EI scales and academic achievement for humanities cohort.

	Emotional Understanding	Psychological Mindedness	Attentiveness	Emotional Self-Control	Total EI
Correlation between EI scales and academic achievement for humanities cohort for first year data					
GPA Term 1 N = 109	0.17 (0.08)	0.29 ( $<0.0001$ )	0.06 (0.57)	0.07 (0.45)	0.13 (0.19)
GPA Year 1 N = 100	0.18 (0.07)	0.17 (0.08)	0.14 (0.16)	0.21 (0.04)	0.23 (0.02)
GPA Year 3 N = 69	0.14 (0.24)	0.12 (0.32)	-0.05 (0.69)	0.08 (0.50)	0.08 (0.53)
Correlation between EI scales and academic achievement for humanities cohort for second year data					
GPA Year 2 N = 47	0.06 (0.59)	0.04 (0.77)	0.14 (0.36)	0.22 (0.14)	0.17 (0.25)
GPA Year 3 N = 40	0.20 (0.21)	0.31 (0.05)	0.05 (0.78)	0.25 (0.17)	0.21 (0.20)
Correlation between EI scales and academic achievement for humanities cohort for third year data					
GPA Year 3 N = 31	-0.04 (0.82)	-0.14 (0.42)	0.20 (0.25)	0.20 (0.25)	0.13 (0.45)

The results for the business student cohort are distinctively different from the engineering students. The only scale for which there was a notable significant correlation was for the third year GPA achievement based on first year survey data. The scale was Emotional Self-Control with  $r = 0.27$  ( $p = 0.02$ ). Emotional Self-Control assesses the ability to wait patiently or to listen and remain quiet, as required by the situation. However, this correlation is not borne out in subsequent years.

The results for the humanities cohort are distinctive, yet again, from both the engineering and the business cohort results. A significant correlation between the Psychological Mindedness scale and academic achievement was found within the first term of their programme studies  $r = 0.29$  ( $p < 0.0001$ ). It then reappeared based on the second period EI assessment data and was correlated with the academic achievement in third year,  $r = 0.31$  ( $p = 0.05$ ).

In addition, there was a correlation based on first year survey data between the Emotional Self-Control and overall Total EI scales and academic achievement but this pattern did not continue through subsequent years' assessments. The Emotional Self-Control scales had appeared with a significant correlation within the business student cohort and the Total EI scale appeared with a significant correlation within the engineering students. However, the Psychological Mindedness scale only appeared as a significant correlation with the humanities group.

## DISCUSSION

As stated previously, within the engineering programme cohort correlations between the Attentiveness and Total EI scales and future year academic success were noted from year one. The correlation with the Attentiveness scale grew stronger with each consecutive year of study and ended up at a statistically significant correlation value of  $r = 0.30$  ( $p < 0.0001$ ) in year three. This is a very interesting result to the first author who had theorised that the Attentiveness scale skills of keeping focused, completing tasks, keeping organised and time management would strongly support academic achievement within the time intensive and assignment demanding engineering programme.

There was only one scale that appeared to have a significant correlation with academic success for the business student cohort. The Emotional Self-Control scale appears as a correlation parameter when compared with third year academic success as correlated with the first EI scale assessment conducted in the fall (autumn) of the first year. However, this correlation is not borne out in subsequent years and, hence, is determined to be spurious. The results for the humanities cohort are distinctive from those of both the engineering and the business cohorts. Three scales were determined to be of significance for the humanities students but none established a pattern that was continued between EI scales assessment periods. The Emotional Self-Control scale and the overall Total EI scale have correlations (Emotional Self-Control:  $r = 0.21$ ,  $p = 0.04$ ; Total EI:  $r = 0.23$ ,  $p = 0.02$ ) for the first year academic success based on first assessment EI data. But no pattern was developed or repeated in later years of programme study.

Psychological Mindedness is a scale which was determined, with statistical significance, to be higher for females than males, in this study. It should also be noted that the humanities cohort was comprised of 73% women, while the engineering cohort was 13% female and the business cohort was 18% female. Therefore, this fact may be having an impact on the correlation analysis.

Previous studies on CAI-R scale correlation with academic success concluded that *successful students had significantly higher scores on the emotional understanding, psychological mindedness and attentiveness scales* [10]. This study supports the attentiveness scale correlation conclusion, but only for the engineering cohort. However, this study does not appear to support any correlation with the emotional understanding scale, since this scale was not significantly correlated within any assessment period for any of the three cohorts. A consistent longitudinal pattern was not established for a relationship between any cohort with respect to psychological mindedness and academic success.

Previous studies conducted on student EI assessment and correlation with academic achievement have had mixed results. Several studies have reported no significant correlation between EI scales and academic achievement [12][13], while other studies have noted significant correlation between these variables [9][11][14][15].

One specific study that investigated the role of EI in student academic success determined that *students with high levels of drive strength, time management, commitment ethic, and stress management, tend to be more successful in their academic achievement* [14]. It is of interest to note that the drive strength, commitment ethic and time management scales used in that study are from the Nelson and Low EDEIS (Exploring and Developing Emotional Intelligence Skills) assessment measure [14]. These three specific scales address similar traits as those identified in the definition of the Attentiveness scale, which was assessed in the study reported in this article. Therefore, corroboration is provided to the conclusion that a skill set, as addressed within the attentiveness scale, is of significant importance to academic achievement.

## CONCLUSIONS

There is no consistent pattern of strong significant correlation between EI scales and academic success within university programmes in previous studies or in this current study. However, there appears to be a trend of positive relationships

between specific non-cognitive skills and academic success. The authors further believe that *Emotional Intelligence covers a non technical skill set that is of importance in developing engineering graduates who have a positive and successful experience in completing their academic programmes, and underpins the students sustainable success in their professional career development in the context of a global society* [16].

Therefore, there is a need for active *development of more soft skills as well as the need for new pedagogical approaches to accomplish this development* in the instruction of engineering students [17]. For EI competence to be successfully achieved, educators need to be prepared to introduce and sustain EI development activities, as well as EI assessment metrics from the undergraduate through to the postgraduate level, such that graduates enter their professional careers having an established EI skill set alongside their discipline knowledge [16].

In order to create a learning environment that is more conducive to the development of EI skills, a more student centred approach must be adopted within engineering schools. This could be achieved by using an approach, such as the life-place learning model that utilises a mixture of facilitation, mentoring and coaching to support an individual's learning programme and *softer skill* development [16].

Several studies have reported that the introduction of EI skill development and application into a first year course had positive results. One study reported on an intervention programme to assist students previously identified *at risk* (based on their EI skills upon entry to university) and determined that there was a marked increase in retention of these *at risk* students [10]. Another study reported that a course focused on developing EI skills gave the students some necessary competencies that helped them cope with the transition from high school to university and also improved retention rates [18].

This current study identified several EI scales that have positive correlation with student success, specifically Attentiveness, Emotional Self-Control and total EI. Incorporating EI skill awareness within courses in all three programmes would be a positive approach to assisting our students to develop and succeed in their university studies.

## REFERENCES

1. Geiser, S. and Santelices, M.V., Validity of high-school grades in predicting student success beyond the freshman year: high-school record vs. standardized tests as indicators of four-year college outcomes. *Research and Occasional Papers Series: CSHE 6.07*, University of California, Berkeley (2007).
2. Peers, I.S. and Johnston, M., Influence of learning context on the relationship between A-level attainment and final degree performance: a meta-analytic review. *British J. of Educational Psychology*, 64, 1-18 (1994).
3. Goleman, D., *Emotional Intelligence: Why It Can Matter More Than IQ*. New York: Bantam Books (1995).
4. Boyatzis, R.E., Baker, A., Leonard, D., Rhee, K. and Thompson, L., *Will It Make a Difference: Assessing a Value-Based, Outcome Oriented, Competency-Based Professional Program*. In: Boyatzis, R.E., Cowen, S.S. and Kolb, D.A. (Eds), *Innovating in Professional Education: Steps on a Journey from Teaching to Learning*. San Francisco: Jossey Bass (1995).
5. Rosete, D. and Ciarrochi, J., Emotional intelligence and its relationship to workplace performance outcomes of leadership effectiveness. *Leadership & Organization Development J.*, 26, 5, 388-399 (2005).
6. EQ-i Training and Instruction Manual. Multi-Health Services (MHS), Toronto, Canada (2006).
7. Multi-Health Services (MHS), Toronto, Canada (2012), 21 May 2012, <http://www.mhs.com/product.aspx?gr=io&prod=eqi&id=overview>
8. Parker, J.D.A., Summerfeldt, L., Hogan, M. and Majeski, S., Emotional Intelligence and academic success: examining the transition from high school to university. *Personality and Individual Difference*, 36, 163-172 (2003).
9. Parker, J.D.A., Duffy, J., Wood, L., Bond, B. and Hogan, M., Academic achievement and Emotional Intelligence. Predicting the successful transition from high school to university. *J. of First Year Experience and Studies in Transition*, 17, 67-78 (2005).
10. Wood, L.M., Parker, J.D.A., Rowbotham, A., Taylor, R.N. and Easterbrook, J.M., Teaching Emotional Intelligence: a mentoring program for students at-risk of academic failure. Presented at annual meeting of Canadian Psychological Association, Calgary, A.B., Canada (2006).
11. Parker, J.D.A., Wood L.M. and Bond, B.J., College Achievement Inventory (CAI): Technical Manual. Peterborough, Ontario, Canada: Emotion & Health Research Laboratory (2005).
12. Newsome, S. and Day, A.L., Assessing the predictive validity of emotional intelligence. *Personality and Individual Differences*, 29, 6, 1005-1016 (2000).
13. Radford, M., Emotional Intelligence as a Predictor of Nursing Student Success. PhD Dissertation, Union University, USA (2010).
14. Vela, R.H., The Role of Emotional Intelligence in the Academic Achievement of First Year College Students. PhD Dissertation, Texas A&M University, USA (2003).
15. Walker, M.E., Emotional Intelligence and Academic Success in College. PhD Dissertation, University of Utah, USA (2006).
16. Stewart, M.F., Chisholm, C. and Harris, M., Engineering student learning and emotional competencies. *Proc. IEEE Transforming Engng. Educ. Conf.*, Dublin, Ireland (2010).

17. Joyner, F., Mann, D. and Harris, T., Engineering as a social activity: preparing engineers to thrive in the changing world of work. *J. of American Engng. Educ.*, 3, **1**, 67-82 (2012).
18. Schutte, N.S. and Malouff, J.M., Incorporating emotional skills in a college transition course enhances student retention. *J. of the First-Year Experience and Students in Transition*, 14, 7-21 (2002).