

CASE STUDY

ENISTEM: Using Emotional Nerve Intelligence in Science, Technology, Engineering and Mathematics

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"The art of being myself is something only I can ever find out" (Singh, 2000)

Abstract

An Emotional Nerve Intelligence module for second year mathematics undergraduates is presented. This is a new concept that extends Emotional Intelligence by including psychotherapy practices used to control nerves (anxiety and stress). This is delivered within a mathematics STEM setting with the aim of releasing the undergraduates' potential. Results show development in self-awareness of the students by capturing pre- and post-comments, and anecdotal observations indicating the success in students developing their ability to think for themselves are also given.

Keywords: Emotional Intelligence, soft skills, curriculum innovation.

1. Introduction

What will the world look like in 2065? The global population is anticipated to exceed 10 billion, nearly every person on the planet will be connected to the internet, a fifth of the world's population will be over the age of 60; and energy, food and water will be a serious challenge – particularly as most of us will be living in (smart) cities. The need for innovation is therefore of critical importance. The Nomura Institute in Japan has gone one step further by stating that we are now living in the Innovation age – the information era has been surpassed. Boosting innovation is therefore crucial at regional, national and global levels – for the planet to survive we will need a new generation of leaders that can innovate. More than ever before, Science, Technology, Engineering and Mathematics (STEM) will play a key role in the 21st century, and it is essential therefore that a new breed of STEM graduates is 'born' – graduates who are not only highly skilled in their STEM discipline but who are also able to tap into their creative, innovative and more artistic sides.

The timing of this paper is perfectly synchronised with the recent Higher Education Green Paper, *Fulfilling our Potential: Teaching Excellence, Social Mobility and Student Choice*, a consultative review published on 6 November, 2015 by the Department for Business, Innovation and Skills (DBIS). The Green Paper states the government's vision for the future of higher education in England, with a wide variety of proposals ranging from raising teaching standards to facilitating a greater focus on graduate employability. Student fees, league tables, graduate destination data and greater demand to develop employability skills – these are just some of the serious challenges facing the University sector. It is therefore no surprise that HEIs (Higher Education Institutions) are exploring various avenues and strategies that will not only increase academic achievement but will also progress students' learning experience to become employable on graduation. If we put ourselves in the shoes of a typical student – we will be graduating with a debt in excess of £30,000.

Employability skills include the soft skills based around communication, and this is of utmost importance for employers to access the highly technical and specialised disciplines in the STEM

(Science, Technology, Engineering, Mathematics) sector. This has been noted upon by Toland (2011) who reflects on the importance of a T-shaped skills set, where the depth of the technical knowledge is enhanced by the horizontal ability to apply knowledge, and this ability is increasingly being seen as of critical importance for the STEM disciplines. This sentiment is also supported by the UK Commission for Employment & Skills UKCES (2010), which highlights an existing and anticipated future demand for the provision of higher level skills for managers and professionals. Considerable strides have been made by HEIs to incorporate development of these soft skills into their courses, with support from government initiatives such as the National HE STEM Programme and also from the professional bodies, in the case of mathematics the IMA (Institute of Mathematics and its Applications). For example, through this support Chadwick et al. (2011; 2012a) developed a novel Business and Industrial Mathematics module for the undergraduate mathematics degree programme at the University of Salford, which aims to develop and assess working practices for mathematicians and tackle such issues as soft skills communication, careers and EI (Emotional Intelligence). A booklet of good practice edited by Chadwick and Singh (2012) details HEI good practice and how to implement it in the area of employability skills in the mathematical sciences, and similarly a more academic study is given by Waldo and Rowlett (2012).

Savoley and Mayer (1990) describe EI as *"the subset of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions"*. In recent years, studies have examined the role of Emotional Intelligence in education. The results of these suggest that low Emotional Intelligence has a relationship to a higher level of unauthorised absences and lateness in secondary school children (Petrides et al., 2004). In both school and HEI students a relationship has been established between academic achievement and ability and Emotional Intelligence by Qualter, Gardner and Whiteley (2007). They further state that EI is essential in the development of students at their HEI through their Personal Development Plan (PDP). Emotional intelligence is in essence the ability to understand and manage emotions - it can be learnt and developed. Self-motivation, communicating effectively, empathizing with others, overcoming challenges and defusing conflict are key attributes of good emotional intelligence.

2. An Emotional Intelligence module for mathematics 2013/14

Although the incorporation of soft skills within the curriculum for HE STEM disciplines including mathematics is well under way in the UK, and student ability in this area is generally being attributed to good EI, there is little curriculum development on the use of EI in STEM courses. With this in mind, and using his skills and experiences as a psychotherapist and from his time in industry as an engineering manager, as well as working for the IMA, Singh developed an EI module specifically aimed at Mathematics (and STEM) undergraduates for raising employability skills. In this module, Singh emphasised those aspects of EI useful for mathematicians. These were identified from his work in the HEI mathematics community over the past 6 years, and from the CBI report (2010), where employers surveyed identified generic 'employability skills' as a non-discipline specific priority for business when recruiting graduates and indicated that STEM graduates in particular were not 'demonstrating' these at recruitment. These generic skills as defined by the CBI include self-management, team working, communication and literacy. At Salford, there is a dedicated module for the development of these generic skills. Having a dedicated module enables the trailing of new practices, which can then be developed and integrated into other modules. Examples include the development of teamwork and modelling which were first trialled in this module and are now integrated into many modules in the degree programme. Emotional Intelligence was trialled in a component of this module in 2013/14 by Singh and Chadwick (2015) with particular emphasis on the following module student outcomes:

- Develop a self-awareness of the inner self
- Learn to engage in self reflection

This component was run over one full day per week over a period of 3 weeks, and consisted of three sessions of group work each lasting four hours, as well as coursework, further study and examination making up 40 hours. The group sessions were held them in flat rooms, with the lecture room set up with chairs in a circle for a class size of 20, creating a room more traditionally associated with counselling studies.

The method of assessment for the EI component was structured around a 20 minute class test (20%); one coursework assignment (40%) and a reflective journal (40%). The class test assignment was themed around the students writing their own obituary – the purpose of which was to engage the students to develop their self-awareness and self-reflection, as well as developing their ability to articulate thoughts and ideas in a small period of time. The coursework assignment was titled ‘Conversation with Self’, where students were tasked with engaging with themselves through written ‘self-conversation’ - this is a technique from Gestalt therapy given in Perls (1973), an existential/experiential form of psychotherapy that emphasizes personal responsibility, and that focuses upon the individual's experience in the present moment. The final assessment was a reflective journal – designed to capture the learning process the student has been through over the past three weeks; again developing the student's ability to engage in self-reflection. As Emotional Intelligence is a soft (rather than hard) skill, the marking was more akin to arts rather than sciences (i.e. no actual ‘correct’ answer).

2.1 Results and observations

Each week the attendance numbers increased – week one saw 12 students attending; week two saw 14 students and the final week saw a full house of 20 students. The module evaluation feedback had very positive feedback from the staff and students, although this evidence is qualitative. However, a longitudinal study shall be attempted later to see the impact of this module to actual student grades versus predicted grades – and to see if the module has had any major impact, as well as looking in the future to student destination data. To give an indication of the feedback, one positive and one negative comment is given below:

‘This was an excellent module – I would definitely choose to do this module if it were an option in my final year’

‘Can’t understand why we had to do this module – I signed up for a maths degree – not feelings and emotions’.

As the module was held over a short space of time, it is difficult to assess long term impact evaluation - however Singh did devise an *Emotional Shift Measurement* ie pre-entry question and a post exit question to assess what shift or change had occurred in the students in terms of developing emotional intelligence. The students were asked at the beginning of the first lecture and again at the very end of the module the following question:

"Who am I?"

Abstracts from the following selection student responses illustrate that there was a positive shift in developing emotional intelligence:

Student 'A':

Who am I – statement written at first lecture: *I am 20 years old. Currently in the second year of my maths degree. I am a football enthusiast. I eat, sleep, drink and think football.*

Who am I – statement written at end of module: *I am a confident, motivated person. I'm not afraid to speak up when something affects my religious morals. I have realised that emotions are meant to be controlled, not blocked out. I have a better understanding of my inner emotions and how to cope with them.*

Student 'B':

Who am I – statement written at first lecture: *I'm (age), born and raised in (country). I speak French. I have been living in Manchester for almost 4 years.*

Who am I – statement written at end of module: *I am easily distracted. I am a positive person, I am a friendly person who enjoys meeting new people. I take my university studies seriously.*

Student 'C':

Who am I – statement written at first lecture: *I am 21 years old. In the future I am wanting to be a maths teacher. I enjoy drawing and baking cakes, but don't have much time to enjoy these pleasures. I also enjoy doing exercise but only sport based.*

Who am I – statement written at end of module: *Kind of torn between where I want to be in a few years, life is going too fast and I'm not ready to grow up. The responsibility commitment is a scary thought, but it's going to happen regardless of how I feel about it. I have a short attention span so I zone out a lot and try to get myself back in the room – especially in lectures.*

Student 'D':

Who am I – statement written at first lecture: *Blue eyes. 6ft 1 in. Terribly dressed. Massive Man City fan. Good friend.*

Who am I – statement written at end of module: *Confident – apparently cocky. Good listener. Love football. Know what I want to do in life. Like giving compliments. Like watching other people learn. Love family. Ambitious. Approachable.*

The above abstracts do evidence a shift in maturity and emotional intelligence – each student (statement) has shown a heightened level of self-awareness following the completion of the module, highlighting both strengths and areas of self-improvement for themselves. Each student has evidenced in their statements a deeper understanding of their inner self.

3. Emotional Nerve Intelligence (2014/15)

This is an on-going trial and based on the first year experiences and feedback, new changes were made to the module in 2014/15. Singh developed this module as *Emotional Nerve Intelligence*, as he believes that important attributes for student and workplace success not only require self-awareness in emotional intelligence but also understanding and controlling exam nerves, anxiety and stress. This development particularly focuses on learning outcomes:

- Learn to cope with stress
- Develop strategies to overcome challenges
- Learn to defuse conflict

The changes made for this academic year included three particular points discussed below.

1. Singh's current research has led him to look at the links between emotional intelligence and dealing with nerves, and how a human being can cultivate being in a state of optimal performance. This current research led Singh to examine the module and incorporate some body work and meditation within the teaching framework of the 2014/15 module. These new interventions were very well received by the students, with several students commenting how the body work interventions had empowered them to alleviate stress and anxiety.

The idea was that these initial Emotional Intelligence Nerve activities then help the students become more responsive and take initiative in follow-on discipline focused activities which were:

2. A discipline focussed team project assessment was introduced which was centred on a real life industrial mathematics topic. Students were tasked with identifying a company which uses mathematics in its operations; to coordinate a company visit and to give a group presentation. Student feedback was extremely positive and Chadwick observed a greater maturity developing in his students following this project including the development of leadership and teamwork skills.
3. Introducing more specific mathematics careers talks, using the maths careers website (mathscareers, 2016). There was very positive feedback from the students, as this intervention was an enabler for students to understand the wide variety of career choices with a maths degree.

Anecdotally Chadwick has reported a personal change in a majority of students following the completion of the module – of which some students have made significant steps forward in conquering fears such as speaking with more confidence in lectures, being more engaged in lectures, and students not being struck by exam anxiety.

3.1 Reflections and Future Developments

The student comments demonstrate clear *Emotional Shift Measurement* in self-awareness. In terms of managing nerves, anecdotally a change is perceived. Also, the students responded well to the follow-up activities. However, these are again anecdotal rather than evidential. So Chadwick and Singh are now examining the evaluation tools to provide clearer evidence in assessing the shift of students' emotional nerve intelligence, before and after the module, and this is an on-going development. This module is aimed at second and final year students, and the self-awareness, reflection and stress-relief techniques developed in the initial assessments prepared them to take on teamwork and self-motivation challenges in the latter discipline focussed industrial mathematics assessments. The assessments move the students along the path towards thinking for themselves and acting on their own initiative. The initial course content is generic, but then directs towards discipline-focussed issues towards the end. Singh is currently developing a further 'Advanced Emotional Nerve Intelligence' module aimed at MSc students with a further assessment that develops and brings out the students' ability to innovate in an applied mathematics problem.

Teaching Emotional Intelligence in HEIs is still a fairly new area, particularly within the STEM subjects. It is highly likely that this is the first time an Emotional Intelligence module has been delivered within a taught Mathematics/STEM degree in the United Kingdom. This module impacts on student experience, both in terms of raising student employability skills, but perhaps more crucially, developing a skill set within students which will equip them for an increased quality of life and self-confidence, which ever career they choose to follow. One particular area for future

development not looked at here is the use of these techniques to help students with learning difficulties achieve their potential.

“And now here is my secret, a very simple secret: It is only with the heart that one can see rightly; what is essential is invisible to the eye”. (de Saint-Exupéry, 1943)

4. Acknowledgements

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