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Using a Fuzzy Logic-Based Emotional Intelligence Framework for Testing Emotional Literacy of Students in an Outcomes-Based Educational System

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Abstract*: Academic institutions which adopted the Outcomes Based Education (OBE) model have a primary goal to facilitate desired changes within learners rather than solely focusing on standardized testing and course grades. They have been restructuring their curricula, course content and delivery, and assessment strategies to increase knowledge, develop skills and positively influence attitudes, values and judgment in the learners. At the Higher Colleges of Technology (HCT) in the UAE, the OBE model is built around eight graduate outcomes that all programs aim to achieve when students graduate. These graduate outcomes form the set of higher-level outcomes that drives the major specific learning outcomes and the general education specific learning outcomes. It is known that emotional literacy plays an important role in thinking and learning in an OBE model. The HCT colleges are keen to appropriately plan for the changes in learners by initially testing their Emotional Intelligence (E.I.) skills and checking emotional literacy levels and therefore their preparedness to cope with life at university. In fact, running such tests have become an essential tool and an integral part of the recruiting, orientation, and counseling strategies of many individuals and organizations. In this paper, a set of E.I. tests covering four general areas of E.I. is proposed to evaluate the emotional literacy of the new intakes at the HCT colleges. These tests will help identify students who lack experience with non-cognitive capabilities including competencies and skills that may influence their abilities to succeed in coping with educational environmental demands and pressures which are related to the graduate outcomes. Also, these E.I. skills will often be used as parts of rubrics for assessing students' learning and achievements of the learning outcomes. A fuzzy-based emotional intelligence modeling and processing framework is proposed to better model and capture uncertainties in surveys of new intakes, and which will deal well with the complexities of the classification system. This new system is implemented in the orientation of new students at the HCT Dubai Men's College (DMC). The results of the implementation are expected to shed light on the emotional literacy of students and therefore allow DMC to better design and prepare orientation and counseling interventions.

***Keywords*:** outcomes-based education, emotional intelligence, E.I. skills, fuzzy logic, fuzzy based E.I. system, E.I. course.

I. Introduction

Educational institutions have a considerable interest in identifying links between personality traits and academic success. It has long been known that intelligence quotient alone is not the sole, or a particularly good, predictor of success. Factors other than traditional IQ scores can have a positive influence on students' ability to succeed in academics, non-academics and life in general [1]. Research [2] conducted at Sir Sandford Fleming College in Canada show that the majority of reasons why students withdraw from their college were related to emotional and social competencies, rather than academic reasons. For instance, 31 per cent of Fleming students left for personal reasons such as experiencing too much stress and only 17 per cent left for academic reasons.

Learning rarely occurs in isolation and so our ability to accurately perceive how others feel or react may also be an indicator, or at least a contributor, to educational success. Emotional Intelligence (E.I.) is the ability to monitor one's own and other people's emotions, to discriminate between different emotions and label them appropriately and to use emotional information to guide thinking and behavior [3]. This form of intelligence has been the subject of a wide range of studies related to the workplace and in particular leadership qualities. Chen [4] found that in their study, 90% of success in leadership positions was attributable to E.I. It seems sensible then to investigate the influence E.I. has on the well-being of students in educational settings and whether or not this contributes to academic success. Yet, some previous studies in

this field have found limited evidence for a link between high E.I. and academic success. Austin's research [5] showed a limited correlation between high E.I. scores and academic success among medical students. While a study of first year psychology students at a Canadian university [6] found that students that obtained high academic grades at the end of their first year also had a higher E.I. score than students that did academically worse or dropped out. There is certainly enough evidence to investigate further and this is reflected in Yale's School of Management currently testing incoming students for E.I. to see if these traits transfer to success later in the students' academic careers [7].

In fact, the role emotional intelligence or literacy plays in thinking and learning has been established [8-10]. It has been shown that being able to select appropriate emotional strategies and behaviors for a variety of circumstances and situations is important in thinking and learning. When considering learning outcomes (LOs) in general, the outcomes of critical and creative thinking usually constitute an integral part of any set of higher level outcomes in an outcomes-based model (OBE) [11, 12] that academic institutions aim to achieve. It is important to properly test these skills when students join universities and colleges and better orient them towards taking professional development courses to help them further develop these and other skills.

At the Higher Colleges of Technology (HCT) in the United Arab Emirates (UAE), the OBE model is built around eight graduate outcomes that all programs aim to achieve when students graduate. To evaluate the emotional literacy of the new intakes at the HCT colleges, a set of E.I. tests covering four general areas of E.I. is proposed. These tests will help identify students who lack experience with non-cognitive capabilities. A fuzzy-based emotional intelligence modeling and processing framework is proposed to better model and capture uncertainties in surveys of new intakes, and which will deal well with the complexities of the classification system.

This paper is organized as follows. Section 2 is an overview of the emotional intelligence survey and testing techniques with a focus on a four-area competencies EI model. Section 3 presents a proposed fuzzy modeling approach to E.I. and a fuzzy logic-based framework for processing students' E.I. skills. Section 4 is a presentation of the case study and an outcomes-based academic institution. Section 5 shows the online survey design process and the implementation challenges. Section 6 is a highlight of the recommendations and future direction of this study. Finally, Section 7 is the conclusion of this research work.

II. Emotional Intelligence interventions and testing

A. Interventions

The link between high levels of E.I. and academic success becomes an academic curiosity with limited practical appeal to educational institutions unless we can intervene with those who have low E.I. scores and boost those scores. More research is needed to specifically demonstrate that E.I. can be successfully increased over the long-term through training and interventions. Nelis [13] did lead a series of workshops where elements of E.I. remained raised 6 months after the interventions and Pool & Qualter's [14] extension of this work was able to develop interventions that successfully raised elements of emotional self-efficacy and some aspects of emotional intelligence ability within a large study group of students. Bond & Manser's work with E.I. interventions with Canadian college students also showed a significant increase in their psychological mindedness (self-awareness and ability to understand to their emotions) after participating in training to increase their E.I. [15]. The Javelina Emotional Intelligence Program developed by Texas A&M University, has yielded positive results in increasing students' overall E.I. scores [16]. This course has demonstrated that many students who complete the program have higher grade point averages and retention levels than students who did not take part [16].

B. Testing

There are many measurement tools available for E.I., with varying levels of complexity, expertise and cost required for proper administration. The Emotional Quotient Inventory (EQ-i) developed by Reuven Bar-On, Emotional and Social Competence Inventory (ESCI) and Mayer, Salovey, Caruso Emotional Intelligence Test (MSCEIT) are the most well know assessments but also relatively difficult to administer due to their high cost [17]. Therefore, for this particular study we have decided to use the self-assessment tool designed by Cartwright and Solloway [18] that was adapted from Goleman's original model of E.I. [19] to measure our first year students' E.I. A fuzzy-based emotional intelligence processing framework will be developed to identify students at most need of E.I. interventions [20]. This framework will effectively filter these students into the most appropriate workshops designed to raise their E.I. scores over the long term, thereby increasing the likelihood of student retention and success.

C. Four area of competencies of E.I. model

Cartwright and Solloway [18] present four areas of competencies used to define the skills and behaviors for emotional intelligence. The four areas are:

- Self-awareness,
- Self-management,
- Social-awareness, and
- Relationship management.

The authors believe that self-awareness lies at the center of the model while self-understanding is critical to effectively developing and managing the other three areas of competencies. In [21], Mostafa and Ahmad showed that collective effort emerges through the intersection of personal intelligence. In fact, the relationship management skills plays an important role in group work and the creation of appropriate atmosphere for collaboration.

To assess E.I. in these four areas, Cartwright and Solloway developed the following questionnaires that work in conjunction with each other:

Q #	***Question: provide a rate on your skill for the following where 0 means no skill and maximum (5 or 10) means skillful.***	***# Grade***
1	I understand and know myself	/10
2	I know my values and beliefs	/5
3	I have self-confidence in all situations	/5
4	I understand and use integrity at all times	/5
5	I understand my own personal power and its impact on others	/5
6	I am comfortable in my own skin	/5
7	I know what motivates me	/5
Total Grade		/40

Table 1. Self-awareness.

Q #	*Question: provide a rate on your skill for the following where 0 means no skill and maximum (5 or 10) means skillful.*	*Number Grade*
1	I understand and use self-coaching techniques	/5
2	I understand and use the differences between self-esteem and self-respect	/5
3	I am able to become an effective role model	/5
4	I can manage personal change effectively	/5
5	I set personal goals and take actions towards them	/5
6	I practice positive thinking	/5
7	I can work effectively with my intuition	/5
Total Grade		/35

Table 2. Self-management.

Q #	*Question: provide a rate on your skill for the following where 0 means no skill and maximum (5 or 10) means skillful.*	*Number Grade*
1	I recognize and value differences and similarities between people	/5
2	I recognize and value differences and similarities between cultures	/5
3	I recognize and value differences and similarities between perspectives	/5
4	I recognize and use empathy effectively	/5
5	I can understand and enter someone else's world	/5
6	I can establish rapport with others including with others including Pacing and leading rapport	/5
7	I can establish rapport with others including with others including mirroring their behavior	/5
8	I can establish rapport with others including with others including initiating conversations	/5
9	I can establish rapport with others including with others including recognizing and using the differences between introvert and extrovert behaviors effectively	/5
10	I recognize and understand organizational values, behaviors and beliefs	/5
Total Grade		/50

Table 3. Social-awareness.

Q #	*Question: provide a rate on your skill for the following where 0 means no skill and maximum (5 or 10) means skillful.*	*Number Grade*
1	I actively seek solutions and solve problems by resolving conflicts	/5
2	I actively seek solutions and solve problems by negotiation and mediation	/5
3	I actively seek solutions and solve problems by seeking win-win solutions	/5
4	I actively seek solutions and solve problems by agreeing to disagree	/5
5	I actively seek solutions and solve problems by knowing when to fight and when to walk away	/5
6	I actively help others to be more assertive	/5
7	I can establish and build long-term relationships	/5
8	I recognize what drives and motivates others	/5
9	I can develop and maintain openness, trust and honesty	/5
10	I can act as change catalyst	/5
11	I can collaborate and work in a team	/5
12	I can set and achieve goals	/5
Total Grade		/60

Table 4. Relationship management.

III. Fuzzy-based framework

A. Dealing with uncertainties in assessment of E.I. skills

The proposed emotional intelligence testing model which has been proposed in Faouzi Bouslama et.al [22] is organized and structured around the four quadrants of competencies introduced in the previous section. New students when they join university or a college are expected to follow a systematic process to improve their emotional literacy by building their skills and competencies of E.I. The first two steps in the learning process are for students to explore, through the selected surveys, and self-assess their skills followed by an identification and self-awareness phase identifying their strengths and weaknesses.

The numerical results of the responses collected from the students' surveys contain an accuracy that it is not much needed. In fact, it becomes a burden if this accuracy is kept as it is. As an example, consider the following statement that states that the student "Ahmed is 0.356789 assertive" and "Ahmed is 0.567892 globally-aware". These are very accurate statements. However, do we need this much of accuracy to process the variables of emotional intelligence? It is clear that in this case, this amount of accuracy is a burden and does little to help understand Ahmed's position. The students' counselor and the student service coordinator will probably agree that the meanings of the above statements are just "Ahmed is less than average assertive" and "Ahmed is average as a globally aware person."

Here instead of modeling these emotional intelligence variables by classic crisp concepts, the words "less than average assertive" and "average globally-aware person" are represented as fuzzy sets. Fuzzy sets [23] are known to provide enough accuracy to properly understand the statement while making it easy to reduce complexities in modeling the system. However, it is important to know the context in which fuzzy statements are defined. A student living in Dubai is certainly

more globally aware than a student in other parts of the country. Therefore, the context of a statement and its use has to be known and preserved when moving from statements using numbers to statements using words [24].

In his seminal papers in 1975, Zadeh [25], [26] introduced the concept of a linguistic variable and its application to approximate reasoning. These linguistic variables are defined over a respective universe of discourses and each domain contains a set of linguistic terms labeled fuzzy sets. By using fuzzy operations upon these linguistic variables, it is possible to have an adequate formalism for fuzzy inferences and fuzzy modeling which constitutes an appropriate solution to model the E.I. system. The fuzzy logic and modeling has been very successful in dealing with similar nonlinear and complex systems such as in control and decision-making [27-33]. The following sections shows how the fuzzy modeling and reasoning logic are used to model and process E.I.

B. Using fuzzy linguistic variables to model E.I. skills

Figures 1-4 show the fuzzy modeling of the linguistic variables "self-awareness", "self-management", "social awareness", and "relationship management" all defined over their respective universe of discourses with linguistic terms labeled as "Low", "Average", and "High".

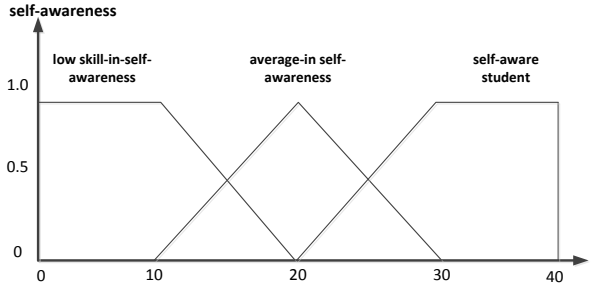


Figure 1. Self-awareness linguistic variable.

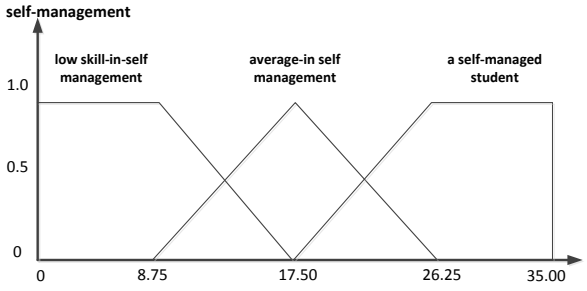


Figure 2. Self-management linguistic variable.

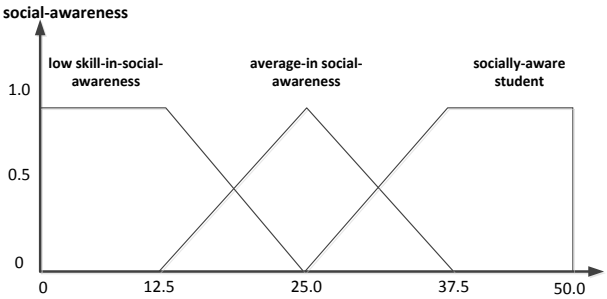


Figure 3. Social-awareness linguistic variable.

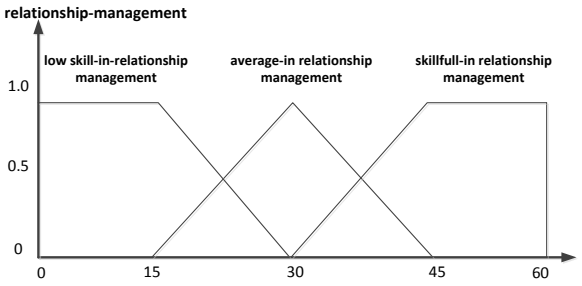


Figure 4. Relationship-management linguistic variable.

Once the new students are assessed for their E.I. skills, they are counseled into a professional development E.I. course having five modules. Similarly to the input variables, the E.I. course is also modeled as a linguistic variable as shown in Figure 5.

- Module 1: Getting to know yourself and identifying your current level of emotional intelligence
- Module 2: Accepting your own emotions and feelings and their impact on yourself and others,
- Module 3: Using your emotional intelligence to improve your own behavior,
- Module 4: Recognizing and interpreting the emotional behaviors of others, and
- Module 5: Using your emotional intelligence to manage and improve your relationships with others.

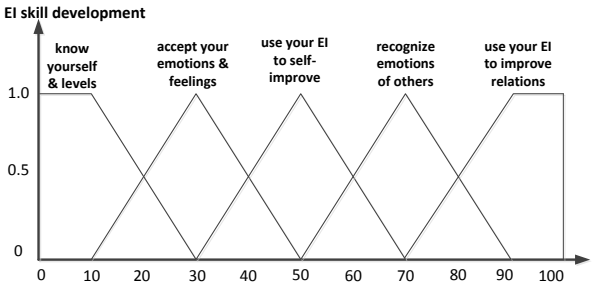


Figure 5. EI course linguistic variable.

The proposed E.I. fuzzy model is a simplified representation of relevant aspects of the behavior of the real emotional intelligence system. It is expected to help student services in obtaining a better understanding of the new students' soft skills, thus allowing them to orient and support them with appropriate professional development. This E.I. model which uses the fuzzy logic formalism of fuzzy logic consists of a set of rules with an "if – then" structure as shown in Figure 6.

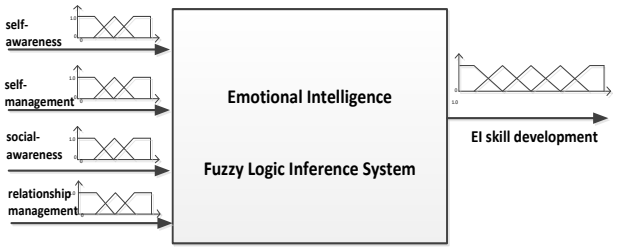


Figure 6. E.I. fuzzy inference system.

The fuzzy rule base is made of rules having the inputs from the four areas for competencies and the output representing the five developmental levels of the E.I. course as shown in Table 5:

Input 1- **self-awareness**	***Input 2-*** **self-management**	***Input 3-*** **social awareness**	**Input 4-** **relationship management**	***Output-*** **EI skill development**
LOW	ANYTHING	ANYTHING	ANYTHING	know yourself
AVERAGE				know yourself
HIGH				accept your emotions
AVERAGE	LOW	LOW	LOW	know yourself
	AVERAGE			accept your emotions
	HIGH			accept your emotions
AVERAGE	LOW	AVERAGE	LOW	know yourself
	AVERAGE			accept your emotions
	HIGH			use your EI to improve
AVERAGE	AVERAGE	AVERAGE	LOW	use your EI to improve
			AVERAGE	use your EI to improve
			HIGH	recognize emotions of others
HIGH	AVERAGE	AVERAGE	LOW	recognize emotions of others
			AVERAGE	recognize emotions of others
			HIGH	improve relationships
HIGH	HIGH	HIGH	LOW	recognize emotions of others
			AVERAGE	improve relationships
			HIGH	improve relationships

Table 5. Fuzzy rule base.

C. Building and simulating the EI fuzzy system

Using the Mathworks [34] fuzzy logic toolbox on Matlab, the emotional intelligence fuzzy system described in the previous sections is built using the available graphical user interface tools. The simulation is conducted using the min-max inference and the centroid defuzzification technique.

Figures 7 to 9 depict the simulation results for three different students' profiles. In Figure 7, the results of a student who has low skills in all of the four area of interest. Since the self-awareness area constitutes a critical soft skill and the student is weak in this area, the E.I. fuzzy system suggests that the student be enrolled in a module for knowing yourself. In fact, by increasing a student's level of self-awareness he or she will have the ability to focus on his or her self-management, and in a later phase be able to increase his or her levels of relationship management and social awareness.

In Figure 8, the results of assessment of the EI skills shows a student with some self-awareness and some self-management skills but weak in social and relationship management skills. Here, the fuzzy system suggests a module to accepting ones emotions and feelings. In this case, the new student has already some skills that should help him of her acquire other core skills. This type of students usually belong to a category of those in a rather developmental stage of the high-level learning outcomes. There are expected to move faster in the process of changes and acquisition of emotional skills.

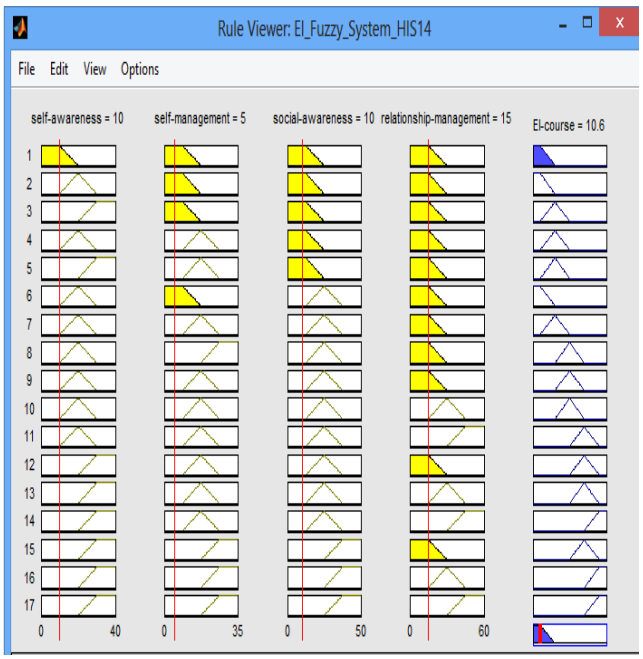


Figure 7. Simulating a student having low EI skills.

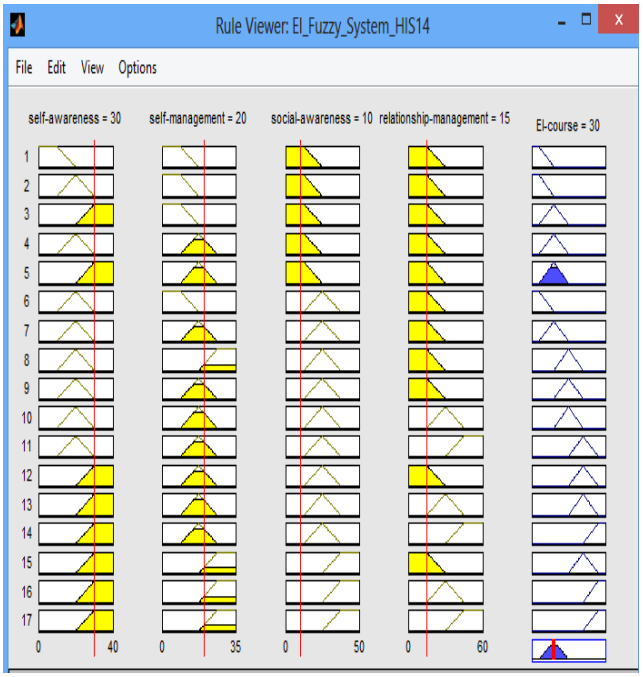


Figure 8. Simulating a student who is self-aware.

In Figure 9, the assessment results are for a student who exhibits emotional developmental skills at all levels. Here, the fussy system recommends that this student skip the first two orientation modules and be assigned to the module on recognizing and interpreting the emotional behaviors of others. These kinds of new students already exhibit the critical and thinking ability that allow them to better cope with student life and ultimately succeed.

Figure 9. Simulating a student with average EI skills but requiring more relationship management experience.

IV. Case Study: Dubai Men's College

The Dubai Men's College (DMC) is one of the 17 federally funded higher colleges of technology (HCT) in the United Arab Emirates (UAE). DMC offers programmes that lead to the Bachelor degrees and also Diploma in various areas of studies including Business, CIS, and Engineering. The HCT colleges adopted a learning model that is outcomes-based where the educational institution identified eight graduate outcomes (GOs) that needs to be achieved (HCT Catalogue 2014-2015) [35]:

- Communication and Information Literacy
- Critical and Creative Thinking
- Global Awareness and Citizenship
- Technological Literacy
- Self-Management and Independent Learning
- Teamwork and Leadership
- Vocational Competencies
- Mathematical Literacy

At HCT, the education approach is a hybrid one where the outcomes based education (OBE) [36] model is used as a process that involves the restructuring of curriculum, assessment and reporting practices to reflect the achievement of the high order learning and mastery along with the accumulation of course credits [37]. The primary aim of OBE at HCT is to facilitate desired changes within the local learners, by increasing their knowledge, helping them develop skills and positively influencing their attitudes, values and judgment, respectively.

Figure 10 shows a holistic view of the OBE model at HCT where the curricula and programs are put into place to achieve the eight graduate goals. Some stduents who lack English and math skills are placed in Foundations programs, however, those who pass the entrance exams are directly placed in the various Bachelor programs.

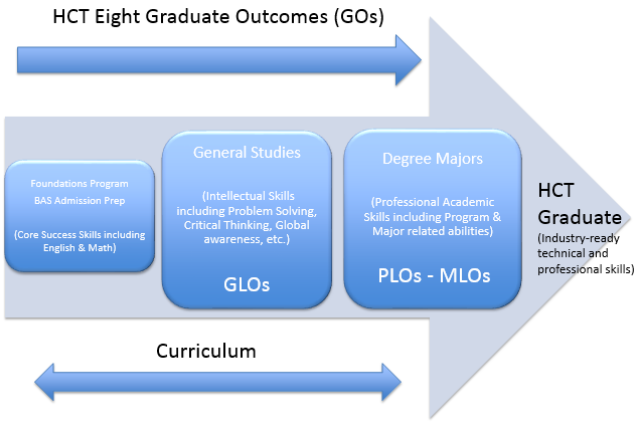


Figure 10. OBE Model at HCT.

Through all the various stages of the education at HCT, there is a an emphasis on process learning, and a concentration on what students learn and what they achieve rather than focusing on standardised testing of basic skills.

Starting from the Foundations Studies Programme, students are prepared in order to meet the Bachelor degree admission [35]. The General Education Studies complement the core courses by challenging students to reflect and develop holistically and by providing them with continual learning by doing opportunities that broaden their global perspective, critical thinking, problem-solving and information synthesis skills [35]. As a result, all the learning processes and experiences from the Foundations to the Majors contribute to the achievement of the eight graduate outcomes as shown in Figure 10.

In fact, the notion of outcomes originates in the Bloom's taxonomies [38]. Bloom's mastery learning or Bloom taxonomies for educational objectives emerged in the 1950s and helped to determine whether learners had attained acceptable standards compared to desired learning outcomes. Bloom's mastery learning theory was based on the premise that with sufficient opportunities and support from an appropriate learning environment, most learners are successful in their learning tasks. Figure 11 depicts the six levels of the Bloom taxonomies which shows where in the cognitive dimensions students usually start with remembering and understanding, and then acquire new skills that will allow them to demonstrate higher cognitive skills including evaluation and creation of work.

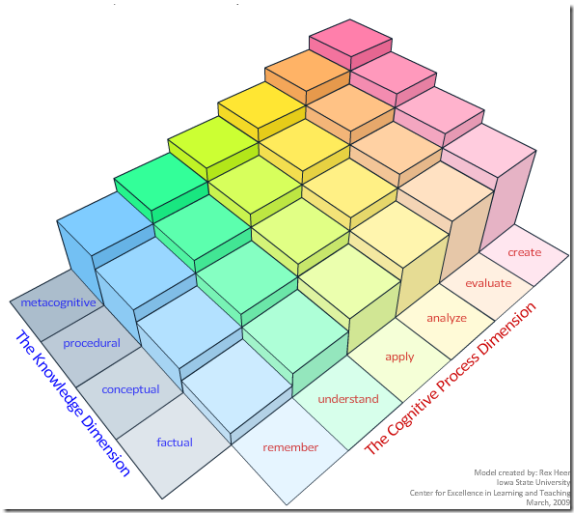


Figure 11. The six levels of Bloom Taxonomy.

To better orient the new students when they are joining Dubai Men's College, and to better provide them with appropriate training to facilitate the desired changes in them, there is a need to assess their emotional intelligence skills. The latter forms an integral part of the aimed graduate outcomes such as self-awareness, self-management and global awareness, and therefore contribute to the successful implementation of the outcomes-based educational model.

V. Assessing the E.I. of new students at DMC

The fuzzy-based E.I. system is used to test the abilities of newly joined HCT students at DMC first in recognizing their own fellings and those in others, second their abilities for motivating themselves and for managing their emotions well with others, and finally their abilities for managing their relationships. The four area of competetncies as presented by Cartwright and Solloway are used where the self-awareness competency lies at the center of the E.I. The new students are later oriented to various courses that attempt to increase their level of self-awareness to help them improve their abilities to manage themselves and increase their levels of social awareness.

A. Designing online anonymous surveys for the HCT Dubai new students

Before conducting the survey, the researchers sought the approval of the HCT Dubai Research Ethics Committee which considered this research of utmost importance to teaching and learning and meet the standards of the committee. The conducted survey was meant to identify the average of E.I. at DMC among Year 1 Bachelor students. The survey hypothesizes that E.I. plays a very important role in a learner's educational journey. The data gathered will allow the researchers to design intervention strategies to improve the average of E.I. among DMC students.

For this purpose, online anonymous questionnaire was created in line with the Ethics Committee recommendations. Figure 12 depicts views of the questions of the online surveys. This survey is used to test samples of Year 1 students in various sections including those in the Faculty of Computer and Information Science (CIS), and students in other areas of studies.

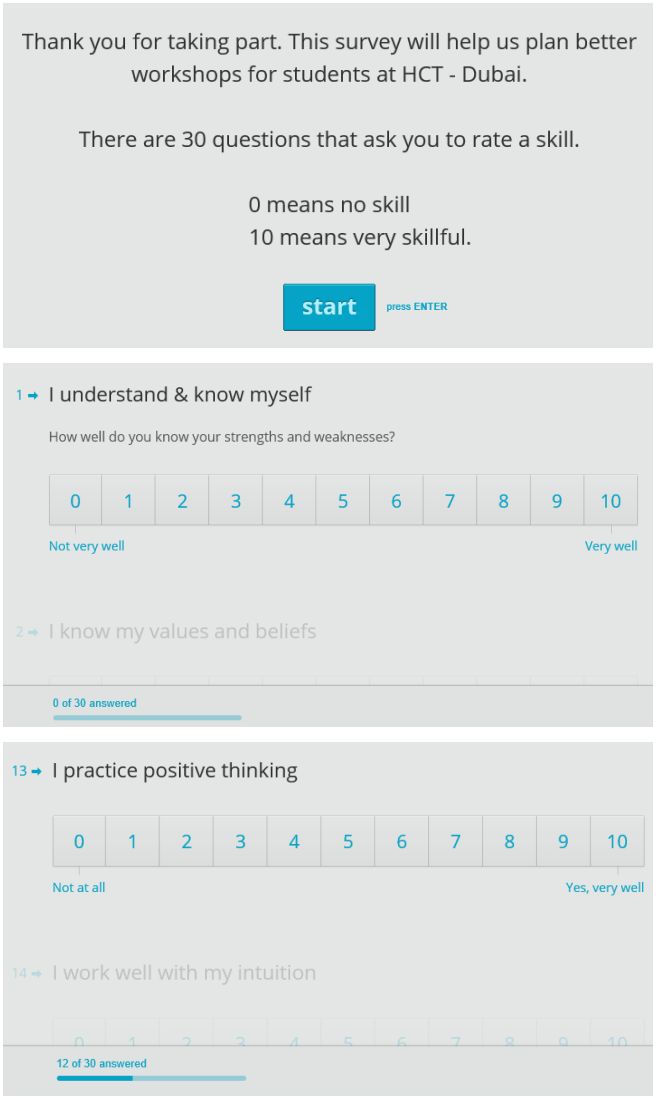


Figure 12. Views of the online E.I. anonymous survey for Year 1 Bachelor students at Dubai Men's College.

This study is in fact an important step towards creating more effective learners at HCT Dubai as emphasized by the HCT Dubai Research Ethics Committee. However, the committee noticed that considering the English language level of HCT Dubai student population in Year 1, there are some items in the online questionnaire that can pose difficulties to the students. The committee recommends that if these are simplified, the findings will be more reliable.

The researchers are planning to conduct the online questionnaires in the Spring Semester of 2015 at DMC while providing clarifications on the meaning of the questions in the surveys to help students better respond, and therefore to be able to have reliable testing data. However, as the precise quantitative results are to be processed by the E.I. fuzzy framework, it becomes obvious that in this case this amount of

accuracy is a burden rather than a semantic help. Instead, when moving from statements using numbers to statements using words, the fuzzification process using fuzzy sets of Figures 1-4 allows to better model the uncertainties in the E.I. input variables while providing as much accuracy as needed to properly understand the statement or the level of a student's E.I.

VI. Recommendations and future work

This research project is expected to result in three plans of actions at the HCT colleges. Firstly, it will provide an effective method to assess HCT new students' E.I. levels and therefore their emotional literacy. Knowing these levels will be a great help to orient students towards appropriate E.I. courses. The development of the emotional intelligence in these new intakes will help them develop critical and creative thinking and learning. As a consequence, the students will be better prepared to demonstrate achievements in course learning outcomes.

Secondly, this research work will offer a systematic method to provide customized interventions for students based on their original E.I. levels. The Emirati students will be automatically assessed for their E.I. skills and based on the results of these tests, they will be provided with a personalized plan of action. The latter involves particular courses to follow in order to improve the emotional literacy of each freshman.

Finally, this research work will result in raising students' E.I. which in turn should increase their likelihood of success in college and the workplace. By increasing a freshman's E.I., it is expected that the student will have more skills to select appropriate emotional strategies and behaviors for a variety of circumstances and situations. This in turn will create efficient team players and collaborators among students.

The long-term success of this project greatly depends on the effectiveness of the interventions; therefore, the researchers' next step is to decide on the appropriate activities for each module. The works conducted at the Texas A&M University (Javelina Emotional Intelligence Program) and at Sir Sandford Fleming College are natural resources to explore. Additionally, we would have to seek the expertise of our English Language Department to decide if the Cartwright and Solloway questionnaire would provide more accurate results if it was administered in Arabic, our students' native language.

VII. Conclusions

This paper presented a new approach to evaluate emotional intelligence skills of new intakes of students. It was shown how important it is to nurture and develop emotional intelligence skills such as those in thinking and learning and the role they play in an outcomes-based educational model. At the Higher Colleges of Technology in the United Arab Emirates, the OBE model is built around eight graduate outcomes that all programs aim to achieve when students graduate. To evaluate the emotional literacy of the new intakes at the HCT colleges, a set of E.I. tests covering four general areas of E.I. was proposed. These tests will help identify students who lack experience with non-cognitive capabilities. A fuzzy-based emotional intelligence modeling and processing framework was proposed to better model and capture uncertainties in surveys of new intakes, and the framework is expected to provide as much accuracy as needed to understand statements of students' E.I. levels while defocusing on quantitative expressions of measurements. The fuzzy linguistic variables and fuzzy logic were used to appropriately capture the uncertainties and complexities of modeling the emotional intelligence skills and assessment results of the students. The E.I. fuzzy-based system is expected to provide the HCT Dubai colleges with a suitable tool to automatically and systematically evaluate Year 1 students on their emotional literacy, and better orient them and help them succeed in their academic and personal lives. In addition, by increasing the emotional literacy levels of the students, it is expected that the desired changes with these learners is facilitated and the graduate outcomes are achieved.

References

[1] A. Duckworth, C. Peterson, M. Matthews & D. Kelly. "Grit: Perseverance and Passion for Long-term Goals." *Journal of Personality and Social Psychology."* vol. 92(6), pp. 1087-101, Jun. 2007.

[2] B. Bond & R. Manser. "Emotional Intelligence Interventions to Increase Student Success. Toronto." Higher Education Quality Council of Ontario 2009.

[3] A. Coleman, *A Dictionary of Psychology (3 ed.)*. Oxford: Oxford University Press, p. 248, 2008.

[4] W. Chen, R. Jacobs & L. Spencer. "Calculating the Competencies of Stars." in *Working with Emotional Intelligence*, Primera edición. D. Goleman, New York: Bantam Books, pp. 377-380, 1998.

[5] W. Austin, P. Evans, R. Goldwater & V. Potter, A Preliminary Study of Emotional Intelligence, Empathy and Exam Performance in First Year Medical Students, *Personality and Individual Differences*, vol. 39(8), pp. 1395-405, Dec. 2005.

[6] J. D. A. Parker, E. J. Austin, M. J. Hogan, L. M. Wood & B. J. Bond. "Alexithymia and academic success: examining the transition from high school to university". *Personality and Individual Differences*, vol. 38(6), 1257–1267, Apr. 2005.

[7] M. Francesca Di., Want an MBA From Yale? You're Going to Need Emotional Intelligence., Bloomberg Business Week. 15, May 2013.

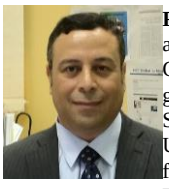
[8] J. Mayer and P. Salovey, 'What is Emotional Intelligence?' in P Salovey and D Sluyter (eds.) *Emotional Intelligence and Emotional Development*, New York: Basic Books, pp. 3-31, 2001.

[9] R. Bocchino, *Emotional Literacy; to Be a Different Kind of Smart*, California: Corwin Press, 1999.

[10] C. Corrie, Becoming Emotionally Intelligent, Australia: Hawker Brownlow Education, 2004.

[11] K. Donnelly, 'Australia's adoption of outcomes based education: A critique,' *Issues In Educational Research*, vol. 17, 2007.
[12] R. G. Berlach and K McNaught, "Outcomes based education? Rethinking the provision of compulsory education in Western Australia," *Issues In Educational Research*, vol.17, 2007.
[13] D. Nelis, J. Quoidbach, M. Mikolajczak & M. Hansenne. "Increasing emotional intelligence: (How) is it possible?" *Personality and Individual Differences, vol. 47(1)*, pp. 36-41, Jul, 2009.
[14] L. Pool & P. Qualter. "Improving Emotional Intelligence and Emotional Self-efficacy through a Teaching Intervention for University Students." Learning and Individual Differences vol. 22(3) pp. 306-12, Jun, 2012.
[15] B. Bond & R. Manser. Emotional Intelligence Interventions to Increase Student Success. Toronto: Higher Education Quality Council of Ontario 2009.
[16] G. R. Low & D. B. Nelson, D. B. "Emotional intelligence and college success: A research-based assessment and intervention model." Paper submitted to the Center for Education Development & Evaluation Research (CEDER), 2006, Kingsville, TX. 2006.
[17] S. Jensen, C. Kohn, R. Rilea, R. Hannon & G. Howells. *Emotional Intelligence: A Literature Review*. University of the Pacific Department of Psychology, 2007.
[18] A. Cartwright & A. Solloway. "Emotional Intelligence: Activities for developing you and your business", GOWER, Report available at www.ashgate.com/pdf/SamplePages/Emotional_Intelligence_Cartwright_Solloway_Intro.pdf, 2007.
[19] D. Goleman. Emotional Intelligence: Why It Can Matter More than IQ. New York: Bantam, 1996.
[20] R. A. Fabes, N. Eisenberg, "Regulatory control and adults' stress-related responses to daily life events." Journal of Personality and Social Psycology, vol. 73(5) pp. 1107-1117, Nov, 1997.
[21] S. S. Gunasekaran, S. A. Mostafa, and M.. S. Ahmad, Personal and Extended Intelligence in Collective Emergence, Journal of Network and Innovative Computing (JNIC), pp. Volume 2, 140-148, 2014.
[22] F. Bouslama, M. Housley and A. Steele, "A Fuzzy Logic-Based Emotional Intelligence Framework for Evaluating and Orienting New Students at HCT Dubai Colleges" in Proc. of 2014 International Conference on Hybrid Intelligent Systems (HIS), 978-1-4799-7633-1/14/$31.00 2014 IEEE, Kuwait, Dec 14-16, pp. 85-90, 2014.
[23] L. A Zadeh, Fuzzy sets, Information and Control, Vol. 8(3), pp. 338-353, Jun, 1965.
[24] Moraga, Claudio, "Introduction to Fuzzy Logic", Elec. Energ., No. 2, vol. 18, pp. 319-328, Aug, 2005.
[25] L. A Zadeh, "The concept of a linguistic variable and its application to approximate." Information Sciences, No. 8, pp. 301-357, 1975.
[26] L. A. Zadeh, The concept of a linguistic variable and its application to approximate. 9, Information Sciences, pp. 43-80, 1975.
[27] E. H. Mamdani, "Applications of fuzzy algorithms for control of a simple dynamic plant." Proc. IEE, vol. 121, pp. 1585-1588, 1974.
[28] S. Yasunobu, and et al., Fuzzy control for automatic train operation system, Proc. 4th IFAC/IFIP/IFRS Int. Conf. on Transportation Systems, pp. 39-45, 1983.
[29] F. Bouslama, and A. Ichikawa, Fuzzy control rules and their natural control laws., Fuzzy Sets and Systems, Vol. 48, pp. 65-86, 1992.
[30] F. Bouslama, and A. Ichikawa, Application of fuzzy controllers to stability analysis, Fuzzy Sets and Systems, Vol. 49, pp. 103-120, 1992.
[31] P. Melin, and O. Castillo, A review on type-2 fuzzy logic applications in clustering, classification and pattern recognition, Appli. Soft Comput. 21, pp. 568-577, 2014.
[32] Y. Maldonado, O. Castillo, and P. Melin, A multi-objective optimization of type-2 fuzzy control speed, Appli. Soft Comput. 24, pp. 1164-1174, 2014.
[33] K. Tahir, M. Doumi, C. Belfedal, T. Allaoui, A. G. Aissaoui and A. Miloudi , A New Approach Fuzzy-MRAS Speed Sensorless Sliding mode Control for Interior Permanent-Magnet Machine Drive, Journal of Network and Innovative Computing(JNIC), pp. vol. 2, 158-165, 2014.
[34] Mathworks, "Matlab and the Fuzzy Logic Toolbox," [Online]. Available: www.mathworks.com.
[35] HCT, HCT Catalogue 2014-2015, Higher Colleges of Tecnology, UAE, 2015.
[36] W. Spady, Outcome-Based Education: Critical Isues and Answers. Arlington Virginia: American Association of Schol Administrators. ISBN 0876521839, 1994.
[37] B. Tucker, Literature Review: Outcomes-focused Education in Universities. Learning Support Network, Curtin University of Technology. Retrieved October 19, 2004, from lsn.curtin.edu.au/outcomes/docs/LitReview.pdf.
[38] B. S. Bloom, M. D. Engelhart, E. J. Furst, W. H. Krathwohl, D. R. Hill, Taxonomy of educational objectives: *The classification of educational goals*. Handbook I: Cognitive domain. New York: David McKay Company, 1956.

Author Biographies



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