

Managing Behavioural Academic Self-Esteem Using FuzzyXteem

Fadzilah Siraj^a and Taniza Tajuddin^b

^aComputer Science Department
Faculty of IT
Universiti Utara Malaysia, 06010 Sintok
Kedah, Malaysia

^bUniversiti Teknologi MARA
Peti Surat 187, 08400 Merbok
Kedah

Tel: +604-9284672, Fax: +604-9284753, E-mail: fad173@uum.edu.my.

ABSTRACT

Behavioural Academic Self-Esteem (BASE) has been used with children of preschool, elementary, and junior high school classes, both individually and in groups. In this study, BASE is used to estimate the factor structures and determine the levels of academic self-esteem of the student. The current practice of the existing system using BASE scale may be scored by hand or by computer based on the rigid crisp values to represent rating number one through five. Since BASE requires the ability for estimating the factor structure and also the ability to explain how the conclusion is derived, therefore artificial intelligent techniques that are required to perform BASE must be able to perform estimation and provide reasoning. For this purpose, fuzzy logic and expert system have been integrated in a web-based environment to demonstrate the use of hybrid system on BASE factor structure and levels of academic self-esteem. For each BASE factor, the sub score is provided based on the classifications of Academic Self-Esteem and their respective ranges. In FuzzyXteem, users in particular teachers, counselors, or parent are allowed to measure students' self-esteem at early age using real time computation. FuzzyXteem facilitates user by automatically evaluating BASE factors and helps the user diagnoses their students' levels of academic self-esteem in 3 ratings: low, moderate and high. It is also able to provide explanation and describe how the conclusion can be derived. The system has been successfully tested by the counselors and conforms to the BASE factor rating scale and sub-scores. FuzzyXteem can be used as an aid to decision making in improving a person's self esteem, and indirectly increases an individual for productivity. The same system functions can be applied to business organization for managing and improving the organizations performance.

Keywords

Fuzzy Expert, e-Counseling, Hybrid Intelligent Systems, Behavioural Academic Self-Esteem

1.0 INTRODUCTION

Self-esteem is a widely used concept both in popular language and in psychology. It refers to an individual's sense of his or her value or worth (Huit, 2004), or the extent to which a person values, approves of, appreciates, prizes, or likes him or herself (Blascovich & Tomaka, 1991). The most broad and frequently cited definition of self-esteem within psychology is Rosenberg's (1965), who described it as a favorable or unfavorable attitude toward the self. Self-esteem also can be defined as a generalized positive-negative attitude toward oneself; that is, how positively or negatively, in general an individual thinks and feels about himself. Personality scales of self-esteem often include the word "confidence" in positively worded items such as feeling confident about one's own mental and physical abilities or about being accepted, liked, and admired by others and words relating to positive-negative affect (Mehravian, 2003).

It is difficult to get consensus on a definition of self-esteem but Coopersmith's (1979) statement that self-esteem was "the evaluation which the individual makes and customarily maintains with regard to himself/herself". Frequently self-esteem is seen as a component of a more inclusive construct, typically labeled self-concept or self-perception (Rosenberg, 1979). Self-esteem is generally considered the evaluative component of the self-concept, a broader representation of the self that includes cognitive and behavioural aspects as well as evaluative or affective ones (Blascovich & Tomaka, 1991). While the construct is most often used to refer to a global sense of self-worth, narrower concepts such as self-confidence or body-esteem are used to imply a sense of self-esteem in more specific domains. It is also widely assumed that self-esteem functions as a trait, that is, it is stable across time within individuals.

Branden (1987) claims that all problems, except those that have a biological origin, are related to self-esteem. Children fail at school and why learning blocks hinder achievement seem to have the same root of the problems: low self-esteem (Andres, 1999). If a person has low self

esteem, it leads to an affective unbalance and therefore produces negative effects in academic performance (Oca Rodriguez, 2004).

People who have good self-esteem have a clearly differentiated self-concept. When people know about themselves they can maximize outcomes because they know what they can and cannot do (Franken1994).

Huit (2004) suggested that one way to impact self-esteem is to obey the somewhat outworn cliché of "Know thyself". Oca Rodriguez (2004) supports the idea of helping students develop the more positive attitudes towards self, taking into account one's self esteem and emotional intelligence.

In this study, self esteem instrument known as Behavioural Academic Self-Esteem (BASE) is used to measure children's academic self-esteem by using direct observation of their classroom behaviours. This paper presents the use of Fuzzy Logic and Expert System techniques for the psychology testing process for Behavioural Academic Self-Esteem (BASE). The current practice of the existing system using BASE scale may be scored by hand or by computer based on the rigid crisp values to represent rating number one through five. Since BASE requires the ability for estimating the factor structure and also the ability to explain how the conclusion is derived, therefore artificial intelligent techniques that are required to perform BASE must be able to perform estimation and provide reasoning. For this purpose, fuzzy logic and expert system have been integrated in a web-based environment to demonstrate the use of hybrid system on BASE factor structure and levels of academic self-esteem. For each BASE factor, the sub score is provided based on the classifications of Academic Self-Esteem and their respective ranges. In FuzzyXteem, users in particular teachers, counselors, or parent are allowed to measure students' self-esteem at early age using real time computation. FuzzyXteem facilitates user by automatically evaluating BASE factors and helps the user diagnoses their students' levels of academic self-esteem in 3 ratings: low, moderate and high. FuzzyXteem is also able to provide explanation and describe how the conclusion can be derived.

2.0 Behavioural Academic Self-Esteem (BASE)

BASE was founded on Coopersmith's (1967) theory and research. BASE has been used with children of preschool, elementary, and junior high school classes, both individually and in groups. BASE may be used for identifying students' levels of academic self-esteem, evaluating factors that affect the academic self-esteem, providing a rationale for intervening in the academic lives of students who need motivational stimulation, assessing how programs affect student motivation, supplementing information from clinical psycho-educational studies of children, and encouraging discussions about self-esteem in parent-teacher conferences (Gilberts, 1992).

Coopersmith demonstrated that children with high levels of self-esteem were active, exploratory, and persistent. He found that these children had usually experienced a great deal of care and affection in their early lives, and their parents' rule setting and disciplinary practices provided a clear social structure. The children displayed traits of self-confidence and social attractiveness, usually succeeded in their efforts yet coped well with failure, and demonstrated verbal behaviour appropriate to that social setting.

A number of researches have designed rating scales to assess self-esteem of children in the classroom setting. Some of the published devices include the Florida Key, developed by Purkey & Cage (1973), which identifies four factors of self-esteem, such as relating, asserting, investing, and coping; and the Behavioural Rating Form (RBF) by Coopersmith (1967), which is used to infer the self-esteem of subjects from observer ratings.

Several studies have been conducted using BASE and the following discuss the BASE Rating Scale results. BASE, a self-esteem rating scale that measures academic self-esteem by using direct observation of students' classroom behaviours, was completed on each student four weeks after initial program implementation by each student's respective homeroom teacher and again seven months following program implementation. The instrument addresses five factors found most revealing of children's self-esteem as seen in their academic performance, and identifies low-self-esteem students by using the total BASE score. In addition, 16 student academic self-esteem behaviours determined to be most indicative of students with high academic self-esteem are rated by an observer according to behaviour frequency.

BASE was developed to infer self-esteem from observations of behaviour; to validly and reliably measure self-esteem at early ages; to establish measures situationally specific to the classroom; and to establish construct and predictive validity related to common measures of school success. Five BASE factor structure questions involved are Student Initiative, Social Attention, Success/Failure, Social Attraction, and Self Confidence. Each item deals with separate behaviours. Table 1 shows the item or question and its behaviours.

Table 1: *BASE Questions and its Behaviours*

BASE Factor 1: Student Initiative	
1.	This child is willing to undertake new tasks.
2.	This child is able to make decisions regarding things that affect him or her, e.g. establishing goals, making choices regarding "likes" and "dislikes" or academic interests.
3.	This child shows self-direction and independence in activities.
4.	This child initiates new ideas relative to classroom activities and projects.

5	This child asks questions when she or he does not understand.
6	This child adapts easily to changes in procedures.
<i>BASE Factor 2: Social Attention</i>	
7	This child is quite in class, speaks in turn, and talks appropriately.
8	This child talks appropriately about his or her school accomplishments.
9	This child cooperates with other children.
<i>BASE Factor 3: Success - Failure</i>	
10	This child deals with mistakes or failures easily and comfortably.
11	This child takes criticism or corrections in stride without overreacting.
<i>BASE Factor 4: Social Attraction</i>	
12	This child's company is sought by peers.
13	This child acts as a leader in group situations with peers.
14	This child is quite in class, speaks in turn, and talks appropriately.
<i>BASE Factor 5: Self-Confidence</i>	
15	This child refers to himself or herself in generally positive terms.
16	This child appreciates his or her work, work products, and activities.

3.0 FuzzyXteem SYSTEM

BASE is used in this study to estimate the factor structures and determine the levels of academic self-esteem of the student. Since BASE requires the ability for estimating the factor structure and also the ability to explain how the conclusion is derived, therefore artificial intelligent techniques that are required to perform BASE must be able to estimate and provide reasoning. For this purpose, fuzzy logic and expert system have been integrated in a web-based environment to demonstrate the use of hybrid system, on BASE factor structure and levels of academic self-esteem.

The fuzzy logic technique is used to estimate the BASE factor structure scores (Jusso, 1999) and to determine the levels of academic self-esteem of the student, while the expert system is used to provide an explanation to the users. The purpose of developing the web-based application system is to provide a comprehensive information and in an interactive and user-friendly manner to the users through the Internet. Since the advance computing techniques were not being applied much to e-counselling services, this factor contribute to the uniqueness of the system in terms of its features and approaches used.

The first phase of the system involves the estimation of the BASE factor structure score using fuzzy logic. The fuzzy logic deals with vagueness, uncertainty and to reduce the rigidity of the existing BASE factor rating

scale and sub score system. The single and hierarchical inference structures are used in this study to handle the two attributes and more than two attributes to the system at a time respectively. The second phase of the system involves the expert system technique to deal with the explanation facility. Fuzzy logic and expert system are applied due to the ability of each technology in handling the uncertainty and ambiguity of human knowledge differently, and each technology has been placed in knowledge engineering. They are no longer compete, rather they are complemented each other. A synergy of expert systems with fuzzy logic improves adaptability, and the speed of knowledge-based systems.

The internal structure of the fuzzy expert advisory for e-counselling comprises of two main phases. There are input screen in entry phase, and solution recommendation phase. By clicking the "Counselling System" button on the main menu user interface for the system, the input screen in entry phase will appear. The system interface is organised based on the five BASE factor structure and interacts with the user through a user interface to obtain the inputs starting from Factor 1: Student Initiative to Factor 5: Self-Confidence. The questions will be asked based on the BASE rating scale standard question consists of sixteen items. The system questions are extracted from the factor analysis of the items reflected Coopersmith's (1981) theory of self-esteem. It emphasized the traits pertinent to children's self-esteem as revealed in their academic performance. This is the source of the term *academic self-esteem*.

Users may make ratings at their own convenience or may refer to 'Guide to Answer Question' for help. First, the user is required to give the input to the system by sliding the corresponding value using the slider bar or by inputting the value for Student Initiative BASE Factor 1 through Self-Confidence of BASE Factor 5. The input value of Question 1 through Question 16 is representing 5 rating scale of fuzzy labels or linguistic value such as *never, seldom, sometimes, usually, and always*. These values are later used in fuzzy rules for the inferences. The numerical ranges are represented in a form of percentage. The system uses a fuzzy knowledge base consisting of a database of information necessary for providing expert advice, and its design was adopted from Saini *et al.* (2002).

The proposed system provides the users particularly teachers, counselors, or parents to measure students' self-esteem at early ages, evaluate factors that affect academic self-esteem, encouraging discussions about self-esteem in parent-teacher conferences, and to establish construct and predictive validity related to common measures of school success. The strategy of incorporating e-counselling capabilities is to provide the schools in the development of information systems that will establish effective linkages with the parents (users) or other channel partners involved in counselling activities. As a result, the proposed system allows the users especially the teachers, counselors, parents, or other observers to obtain

the counselling advisory services through web. Apart from estimating the BASE structure and identifying the academic self-esteem, the system can be used as part of portal development for schools and community as a whole.

FuzzyXteem for e-Counselling has been developed using hybrid intelligent system that integrates fuzzy logic and expert system (see also Holden *et al.*, 1999; Hostkotte, 2000; Lam *et al.*, 1999; Marcos, 2004). Due to their capabilities and advantages, this system offers an automated fuzzy expert system in dealing with uncertainty and vague information for BASE. The purpose is to estimate the BASE factor structure and determine the levels of academic self-esteem which obtained from the inputs given by the users. The system facilitates the user by handling the consultation session in order to determine the levels of academic self-esteem. A set of questions will be asked through graphical user interface and assists the user in diagnosing stage based on the given inputs to infer such a conclusion. The consultation and explanation performed by the fuzzy logic and expert system also involved in dealing with the natural and uncertainty data. This study focuses on the system design and development of using hybrid technology and the employment of fuzzy expert system in counselling domain.

Fuzzy Expert Advisory for e-Counselling is a web based application that has been developed using Micromedia Dreamweaver Version 4.0, Microsoft's Active Server Pages (ASP - server-side web scripting), VB Script, and Java Script that caters the inference engine, working memory and graphical user interface (GUI) development. The knowledge base is stored in MS Access as system database. As an expert system, the Advisory system for e-Counselling using Fuzzy Expert can provide explanation to the user regarding its conclusion of classifications either high self-esteem, moderate self-esteem, or low self-esteem based on the factor that has been diagnosed.

Fuzzy Expert system is constructed using 4 major components, which are knowledge base, working memory, inference engine and user interface. Since this system also employs fuzzy logic therefore the inference engine has been subdivided into 3 components: which are fuzzification, fuzzy inference and defuzzification. The general architecture of FuzzyXteem is as shown in Fig 1.

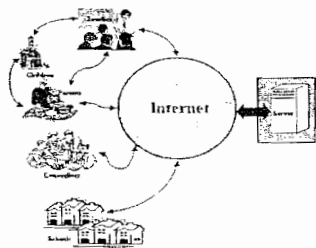


Figure 1: General architecture of FuzzyXteem

4.0 RESULTS

FuzzyXteem system is a web-based application that runs online and enables the users, particularly the teachers/users to determine the level of academic self-esteem of their students or children. The system is started by asking the user to slide their rating number that they believe is the best estimate of that behavior frequency noted in the classroom. This is performed based on the user interface for each factor i.e. Factor 1 through Factor 5. By pressing the 'Click' button the corresponding label and Confidence Value will be displayed. The information gathered is then used by the system to infer the conclusion.

Then, fuzzification will be invoked where the real value given by user will be transformed into linguistic values. Each question will have five linguistic labels of *never*, *seldom*, *sometimes*, *usually* and *always*. While, for the output, it has three linguistic labels: *low self-esteem*, *moderate self-esteem* and *high self-esteem*. The input interface to the system and the Confidence Value for the system is as illustrated in Fig 2.

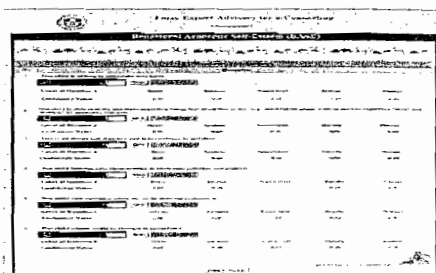


Figure 2: Input Interface and Confidence Value

Fuzzy Associative Memory (FAM) was then constructed and exhibited in Fig. 3. The FAM table stores the confidence values that will be used for calculating the scores for each factor which is produced the output for this system. The fuzzy operator used is AND operator. Therefore the minimum value from the two inputs will be considered as confidence value for fuzzy output variable.

EAM for Behavioral Academic Self-Esteem (BASE)					
Question	Low	Medium	High	Very High	Very Low
Gender	0.00	0.00	0.00	0.00	0.00
Age	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Year	0.00	0.00	0.00	0.00	0.00
Level	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Confidence Value	0.00	0.00	0.00	0.00	0.00
Conclusion	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Advice	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Output	0.00	0.00	0.00	0.00	0.00
Label of Output	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Confidence Value	0.00	0.00	0.00	0.00	0.00

Figure 3: Fuzzification Result (Phase 1), Defuzzification Result of Output 1, and Fuzzification Result (Phase 2)

The fuzzy value produces by fuzzy inference will be transformed again into real value. This computation is performed using Centre of Area (COA) the calculated output of Social Attention of BASE is calculated as 88.13.

The result of the Social Attention of BASE and the label is as illustrated in Fig. 4. The explanation section provides the corresponding result based on the label. How facility will keep track the questions asked together with the certainty factors.

Expert systems use knowledge, facts, and reasoning techniques to solve problems that normally require the abilities of human experts. Expert system imitates the expert's reasoning processes to solve specific problems or narrow problem area efficiently and effectively.

EAM for Behavioral Academic Self-Esteem (BASE)					
Question	Low	Medium	High	Very High	Very Low
Gender	0.00	0.00	0.00	0.00	0.00
Age	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Year	0.00	0.00	0.00	0.00	0.00
Level	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Confidence Value	0.00	0.00	0.00	0.00	0.00
Conclusion	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Advice	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Output	0.00	0.00	0.00	0.00	0.00
Label of Output	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Confidence Value	0.00	0.00	0.00	0.00	0.00

Figure 4: Inference Result

In this advisory system for e-counselling, the knowledge base consisting of a database of information necessary for providing expert advice and provide the how conclusion is derived and it is stored in DBExpert file. Fig. 5 shows the fuzzy expert advisory for e-counselling explanation and how the conclusion is reached together with the confidence value. The explanation is obtained based on the defuzzified crisp value as for this case the Social Attention.

Output			
Question	Low	Medium	High
Gender	0.00	0.00	0.00
Age	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Year	0.00	0.00	0.00
Level	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Confidence Value	0.00	0.00	0.00
Conclusion	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Advice	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Output	0.00	0.00	0.00
Label of Output	Low Self-Esteem	Low Self-Esteem	Low Self-Esteem
Confidence Value	0.00	0.00	0.00

Figure 5: Explanation Window of Fuzzy Expert Advisory System

5.0 CONCLUSION

This study focuses on the software development using hybrid AI technology and the employment of fuzzy expert system in counselling domain. Fuzzy expert systems model imprecise information, capturing expertise similar to the way it is represented in the expert mind, and thus improve cognitive modelling of the problem. FuzzyXteem for e-Counselling offers computerized fuzzy expert system and in line with the current technology, the web environment is preferred (Sampson, 2002) in implementing the artificial intelligence techniques in e-counselling as well as in psychology domain. This web-based application has been developed to estimate the BASE factor structures and determine the levels of academic self-esteem of the student.

The system helps the user by managing the consultation session in order to obtain the score for a particular factor. A set of questions will be asked through graphical user interface and helps user diagnose their given options to infer such a conclusion. The consultation performed by the expert system also involved fuzzy logic when dealing with the natural and uncertainty data. In addition, fuzzy expert advisory provides explanation and explain how a diagnosis is reached for a particular case. The results showed that the fuzzy expert prototype system presented in this paper provides reliable and accurate results after several test cases have been run. The system performance was successfully tested and produced the results that were equal to an expert's judgment, thus accomplishing the objectives. The system that has been produced, conform to the BASE factor rating scale and sub-scores.

The results obtained provide the information of measuring student's academic self-esteem at early ages. The explanation part in the system may be used to evaluate factors that affect the academic self-esteem, encouraging discussions about self-esteem in parent-teacher conference, and to establish construct and predictive validity related to common measures of school success. Since this study focuses on the software development using hybrid AI technology and the employment of fuzzy expert system in counselling

domain, therefore it emphasize on data acquisition, type of questions and mapping of uncertainty into fuzzy values, which consists of labels and confidence values. This involves the determination of membership function graph that requires the knowledge from counselling expert. This mapping process is very crucial in this study since if incorrect membership function graph was chosen, the final value yields from the fuzzy logic system is also incorrect. After several testing has been done, it is realized the fuzzy logic drawbacks are in the aspects of the rules of the fuzzy logic, which apply in this counselling domain have to be determined by the expert experiences. It is difficult to make analysis of determination of a system designed according to the fuzzy logic. That is, it cannot be estimated how the system reacts beforehand. As the membership functions are determined according to the trial and error learning, they take a long time.

Nevertheless, the system has been successfully tested and conforms to the BASE factor rating scale and sub-scores. As self esteem leads to self-confidence and that a person may perform well because his attitude toward self is positive (Amato, 1997). FuzzyXteem can be used as an aid to decision making in improving a person's self esteem, and indirectly increases an individual for productivity. The same system functions can be applied to business organization for managing and improving the organizations performance.

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