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An Analysis of an Assessment Model for Participation in Online Forums

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Abstract. Existing online forum software support limited assessment features. This paper presents an analysis of an assessment model which has been implemented in online discussion forum software. The assessment model is aimed to automate the assessment of students' participation in online discussion forums. The model is formulated based on four different participation indicators and educators' feedback. The model was tested by a group of students who used the online forum to complete a project. Pearson product-moment correlations were calculated using the scores (performance indicator scores) generated by the model and the actual scores given by five educators. The performance indicator scores generated using the assessment formula was highly correlated with the actual grades assigned by the educators. The results suggest that the assessment model is reliable and can be used to evaluate students' participation in online discussion forums.

Keywords: information systems, online discussion forums, students assessment, online participation, performance indicator.

1. Introduction

Students' discussion on learning-related issues in online discussion forums is common. Pendergast noted that a successful online discussion forum requires the following mechanisms: a collection of stimulating discussion topics, a sound technique to implement them, and a consistent way to assess student participation [1]. Assessing students' participation in online discussion forums is important as students will contribute more readily and meaningfully to online discussion when they knew that the discussion is assessed [2]. Assessment criteria for online forums can serve as a clear guideline to students for the expected quality of thinking and discussion, and as means of aligning teaching and learning behaviors and goals [3, 4]. This is because there are more opportunities for students to engage in online discussions that utilise the higher level cognitive skills such as analysis, synthesis and evaluation – rather than face-to-face, especially when the learners read and

interpret postings, as well as formulate and articulate their own opinions. However, high levels of participation without focus and coherence could create confusion and information overload for other students [5].

The assessment criteria found in the literature include students performance based on total number of students' postings, total message length, keyword contribution [6], content analysis using Henri's Analytical Model [7], and Garrison and Anderson's Practical Inquiry Model of Cognitive Presence [8]. Existing online discussion forums do not have feature to automate the assessment of students' participation in online forums. Most of the assessments of students' participation in online discussion forums are performed manually by educators. To ease the work of educators, an assessment formula has been developed and incorporated into online forum software. This paper presents the results and reliability of the assessment formula. The formula has been tested in a real life learning context, and the results show that the assessment formula is reliable in measuring students' contributions to the forum software.

2. Current Online Assessment Criteria

There are two (2) approaches for assessing constructed response materials such as online discussions. They are holistic scoring and analytic scoring [9]. In the holistic scoring approach, students' response is scored as a whole. Discussions posted by a student are collected and educators evaluate and assign a single score. Initial criteria are established prior to scoring, and these criteria are taken as a whole. An example of the criteria used (such as research depth, feedback to other students, regular input, citing examples from professional practice, and demonstrating leadership qualities) for holistic scoring is presented in Table 1 [10]. Some learning management systems support viewing of individual student's postings in each forum. This is reflected for example, in myLMS where instructors can click on a student's name to display all messages posted by the student in online learning participation interface; and in Blackboard Learning Management System, where instructors can view online messages sorted by the creator of the message. Assessment of participation in online forums using holistic approach can only be performed once the discussion is over. Students have no knowledge about their online discussion performance while the discussion is going on.

On the other hand, analytic scoring is more detailed where the assessment is done across multi dimensions of performance rather than based on overall impression (holistic scoring). Individual criterion is established using a point allocation method. Points are allocated to each student discussion based on the criteria. The sum of the score gives the student an overall score. The advantage of the analytic scoring method is that it helps to identify the students' strengths and weaknesses. However, using this approach for assessment is time consuming and it focuses on different aspects or

dimensions which may result in overlooking the overall quality of discussion and communication of ideas.

Table 1. Sample criteria for Holistic scoring (source:[10])

1.0 – 2.0 points • Posted main topic information. • Replied to one other student posting. • No depth of presentation, no research base, opinion only. • Information posted only one time or several posts at one time. • Comments were barely related to main discussion question and/or other student posting. • No constructive comments to help class discussion. • All posts made within 24 hours of assignment due date.
3.0 – 4.0 points • Posted main topic information and one response on same day. • Several posts, but all on same day. • Time between posting indicated student had read and considered substantial number of student postings before responding. • Replied to other student postings and provided relevant responses and constructive feedback to the students. • Enhance quality of discussion (that is illustrated a point with examples, suggested new perspectives on issues, asked questions that helped further discussion, cited current news events, etcetera.). • Referred to other research, gave examples, and evoked follow-up responses from other students.
5.0 Points • Demonstrated leadership in discussions. • Posted regularly during the week. • Replied to main topic. Substantially enhanced quality of discussion (that is illustrated a point with examples, suggested new perspectives on issues, asked questions that helped further discussion, cited current news events, etcetera.). • Replied to several other student postings on a regular basis and provided relevant responses and constructive feedback to student postings. • Time between posting indicated student had read and considered substantial number of student postings before responding. • Referred to other research, gave examples, and evoked follow-up responses from other students.

The analysis of students' contributions to online discussion forums in analytic scoring approach includes looking at the frequency/patterns of interaction (for example, counting messages and participation rates), message length and message content analysis. The number of messages posted by a student could be considered as a participation indicator since it shows the number of times the student reads and responds in writing to others' postings [11, 12]. For instance, Cheung and Hew associated the degree of learners' participation in online discussions to the quantity of message posted by the learners [13]. The messages of a particular minimum length are used as one assessment criterion by some instructors [12]. Knowlton emphasized on the importance of giving a minimum length for messages since it takes some length to construct perspectives that can become the basis of knowledge [14]. The minimum length requirement assures that students are spending time to become engaged in the discussion. However, a message should not be too long as it may be overlooked by the student participants because of the length [15]. Previous studies have found a positive relationship between the amount of time students spend reading messages and engaged in virtual dialogue with their classmates and their achievement of course objectives [16]. Therefore, students' effort in the online discussion forums could be reflected by the amount of words they post to the system. The message length is measured by counting all the words in the student's messages. The total number of messages and message length do not give insight into the quality of the contributions made by each participant to the online discussion forum. Some learning management systems support online learning participation where the total number of messages for individual student in each forum is displayed and updated instantly. However, display of the total message length posted by an individual student in online forums is rather rare.

Wu and Chen adopted the idea of term weighting in information retrieval to assign weights to keywords [6]. Usage of keywords was taken as an indicator for the learning quality. A keyword is defined as a simple, non-recursive noun phrase or a base noun phrase. The unique noun phrases extracted from all class messages are defined as the class concept base. The importance of a keyword is measured by its frequency. The more frequently a keyword is used, the more important it is. However, if a keyword is used by more students, it becomes less important in terms of differentiating one student's contributions to the class concept base compared to others. The usage of more specific keywords does not necessarily result in high quality work. However, this method may be used to indicate if a student is bringing in new concepts, and not merely repeating the existing ones. Wu and Chen explored the use of message length, message count and keyword contribution to evaluate students' performance in online forums. The results of the experiment showed that the combination of all three measures performed better than any of the individual three measures.

Another way to measure effective participation is utilizing Bloom's Taxonomy of educational objectives to interpret discourse contributed by students [17]. The taxonomy identifies six (6) educational objectives, listed in

order of cognitive complexity, namely, knowledge, comprehension, application, analysis, synthesis and evaluation. Knowledge in the taxonomy involves the psychological process of remembering information. Comprehension involves the lowest level of understanding where the students know what is being communicated and can use it in its immediate context. Application consists of the application of abstractions (ideas, principles, generalized methods and theories) to particular concrete situations. Analysis is demonstrated through the students' discrimination of information and ability to compare and differentiate. Synthesis requires the combination of information to find solutions to unfamiliar problems, or in the production of an original work. Evaluation is evidenced through the students' ability to formulate value judgments about theories and methods for a given purpose. Bloom's six major categories were changed from noun to verb forms to add relevance for 21st century [17]. The lowest level of the original, knowledge was renamed and became remembering. Comprehension and synthesis were re-titled to understanding and creating. To determine the effectiveness of a student's participation in online discussions, an educator manually categorizes messages according to Bloom's taxonomy of cognitive objectives by reading the text messages. Effective discussions address higher order thinking skills in Bloom's hierarchy by engaging students in applying theories, distinguishing between facts and opinions, evaluating responses of other students, providing opposing viewpoints as well as feedback on other discussion posts. Knowlton quoted that for a durable discussion, students are required to interact with one another at higher levels of learning, that is, 'analysis', 'synthesis', and 'evaluation' [14]. However, Bloom's taxonomy is not designed for online assessment. Message categories such as 'questioning', 'suggesting' and 'acknowledging' are not listed in the Bloom's taxonomy. As such, Bloom's taxonomy may not be comprehensive enough to be used as criteria for online assessment. Educators who apply Bloom's taxonomy in online assessment may have to list down other message categories that are posted by students, and then decide on the suitable assessment criteria to use before grading.

Henri proposed a model for analyzing the process of learning. Messages are broken into thematic units of meaning which are then analyzed along the model [7]. Henri's Analytical Model has five (5) dimensions. The five (5) dimensions, participative, social, interactive, cognitive and meta-cognitive, are detailed out in Table 2[7]. The model allows analysis of a range of aspects of an online discussion: the level of participation in the form of usage statistics, the nature of the interaction between contributors, and an indication of the learning process through an analysis of the cognitive activity evident in the message content. For the participative dimension, data can be further categorized as overall data, learner and educator participation data. Interactivity in the interactive dimension can be further broken into explicit interaction, direct response, direct commentary, implicit interaction, indirect response, indirect commentary, and independent statement. Elementary clarification, in-depth clarification, inference, judgment and strategies are the categories under cognitive skills. In the elaboration of the metacognitive

model, Henri made a theoretical distinction between metacognitive knowledge and metacognitive skills. Metacognitive knowledge is declarative knowledge concerning the person, the task, and the strategies. Metacognitive skills refer to procedural knowledge relating to evaluation, planning, regulation and self-awareness.

McLoughlin and Luca found Henri's content analysis model applicable to a teacher-centered discussion model, however they felt that it is unsuitable for a constructivist student-centered discussion model [18]. This suggests that the model is difficult to be implemented in a less structured online discussions environment. Aspects of this model have been taken up and expanded upon by others interested in comparing the level of critical thinking between face to face seminars and computer conferences [19]. Newman et al. developed ten (10) paired indicators of critical versus uncritical thinking in their model [19]. The ten indicators are: relevance, importance, novelty, bringing outside knowledge or experience, clarity, linking ideas or interpretation, justification, critical assessment, practical utility, and width of understanding. Each of the ten indicators has its own list of paired opposites. "Relevant statements" versus "Irrelevant statements or diversions" is a case in point.

Table 2. Henri's Analytical Framework (Source:[7])

Dimension	Definition	Indicators
Participative	Compilation of the number of messages or statements transmitted by one person or group	Number of messages Number of statements
Social	Statement or part of statement not related to formal content of subject matter	Self-introduction Verbal support "I'm feeling great…."
Interactive	Chain of connected messages	"In response to ……" "As we said earlier…"
Cognitive	Statement exhibiting knowledge and skills related to learning process	Ask questions Making inferences Formulating hypotheses
Metacognitive	Statement related to general knowledge and skills and showing awareness, self-control, and self-regulation of learning	"I understand…." "I wonder….."

Another approach for analyzing the process of learning is the Practical Inquiry Model of Cognitive Presence [8]. The goal of this model is to judge

the nature and quality of critical reflection and disclosure in a collaborative community of inquiry. The practical inquiry model includes four phases, namely trigger, exploration, integration, and resolution, in describing cognitive presence in an educational context generally. Table 3 provides the descriptors and indicators that correspond to each phase of the practical inquiry process. In this model, a message is the unit which is analyzed along the four phases. Two heuristics, “code up” and “code down”, were developed to resolve contradictory categorization. “Code down” (i.e. select the earlier phase of the model) is used if the phase the message is reflected is not clear, while “code up” (i.e. select the later phase) is used if there is clear evidence of multiple phases in the message. This is justified as higher levels of critical thinking such as integration and resolution borrow characteristics and processes from the two previous phases. Corich et al. used this model to assess the quality of forum contribution for students participating in a first year undergraduate degree course [20].

Table 3. Practical Inquiry Descriptors and Indicators (Source:[8])

Phase	Descriptor	Indicator
Trigger event	Evocative	Recognize problem
		Puzzlement
Exploration	Inquisitive	Divergence
		Information Exchange
		Suggestions
		Brainstorming
		Intuitive leaps
Integration	Tentative	Convergence
		Synthesis
		Solutions
Resolution	Committed	Apply
		Test
		Defend

Dringus and Ellis developed a meaningful and usable schema for categorizing and describing contributions in online discussion forums [21]. The tool, named Scale for Forums / Online Discussion Assessment (SCAFFOLD), is built upon a range of participation indicators identified in the literature. Dringus and Ellis summarized all the participation indicators identified in a table format and developed a list of 19 participation indicators as depicted in Table 4 [21]. SCAFFOLD was used by faculty and students to rate the 13 postings contained in a discrete segment of a masters-level discussion forum in a multimedia systems course [22]. The results of the evaluation showed that SCAFFOLD could be used for developing and conveying feedback on Internet forums. A principal component factor analysis was conducted and three components were identified in the data reduction analysis that tracked closely to the Mezirow’s classification of learning across three dimensions of reflection [23].The dimensions are

content, process, and premise level. Content level reflection entails acquiring facts and building skills. Participation indicators grouped under content level are 'broadened', 'originality', 'problem', 'questioning', 'comprehensive', 'evaluative' and 'synthesis'. Process level reflection entails developing problem solving ability. Participation indicators grouped under this level are 'closure', 'resolution', 'solutions', 'summarizing', and 'analysis'. Premise level reflection, which is the most cognitively demanding learning dimension, entails an analysis and evaluation of the value and relevance of the subject matter. Participation indicators grouped under the premise level are 'acknowledging', 'clarification', 'reflective', 'social', and 'resources'. Participation indicators such as "error free" and 'topical' did not correlate with other indicators. Some of the indicators listed in the instrument could be combined as suggested in the study. SCAFFOLD can be used to categorize and describe messages but it does not evaluate the content of a message. Evaluating the quality of contents posted for discussions is difficult since it may vary from one educator to another. In this study, the authors explored the possibility of using SCAFFOLD as one of the participation indicators for students' participation in online forums.

Table 4. SCAFFOLD (Source:[21])

No.	The Contribution
1	Acknowledging: responded to another contribution
2	Analysis: provided analysis of the problem being discussed
3	Broadened: increased the scope of the discussion
4	Clarification: supplied or sought clarification as needed in responses
5	Closure: helped lead to a conclusion on a topic
6	Comprehensive: was complete, but not overly lengthy
7	Error Free: contained accurate information
8	Evaluative: was evaluative, assessing the meaningfulness or validity of ideas being shared
9	Originality: contained new ideas or approaches to the topic
10	Problem: identified a worthy problem related to the topic
11	Questioning: raised thoughtful questions about the topic
12	Reflective: interjected personal commentary or experiences
13	Resolution: promoted cooperation to resolve issues of debate or disagreement
14	Resources: exchanged useful resources with others such as links or citations
15	Social: conversational or social in nature
16	Solutions: suggested meaningful solutions
17	Summarizing: summarized the topic discussion overall
18	Synthesis: contained well formed, clear, connected, and synthesized ideas
19	Topical: was on topic

All the models identified earlier (Bloom's model, Henri's Analytical model and Practical Inquiry Model of Cognitive Presence) involve reading and classifying messages of the online discussion forums in an electronic copy or in a print copy by educators. The limitation of the models is the difficulty for instructors to make consistent judgments. Inconsistent judgments happen due to the complexity of the instrument (too few categories for Bloom's model; too many categories or codes for Henri's model and Practical Inquiry Model of Cognitive Presence; and lack of mutual exclusiveness among these models), and the use of an inappropriate unit of analysis (anything other than the sentence in the online discourse) [24]. Although the models can provide useful data for exploring the way in which participants are contributing to an online discussion forum, the large volume of postings makes it difficult for educators to process and analyze data into meaningful information.

3. The Gap

Existing online discussion forums do not automate the assessment of students' participation in these forums. Most of the assessments on students' participation in online discussion forums are performed manually. Some online discussion forums support view feature for total number of messages of individual student in each online forum and the total messages of each forum. There has been no implementation of total messages length for individual student in online forums. Some forum software support viewing of individual student's messages for each forum. With this feature, educators read and grade students' messages using assessment criteria stated in different framework or model such as Henri's framework, Bloom's Taxonomy, or the Practical Inquiry Model of Cognitive Presence. For example, a proprietary discussion forum software system named ANGEL allows the educator to view and grade individual entries to the forum or grade a student's aggregate contributions [1]. ANGEL produces an output in HTML format and can be used for further analysis. To accurately assess students' work using the ANGEL discussion forum, an instructor has to read all the discussions, and grading the online discussions could take more than 50% of the instructors' time for each online class [25]. Wu and Chen investigated the use of keyword, message count and message length to evaluate students' contribution to online forums. They found the significant of combining the three different variables in computing students' online participation [6]. Assessment of students' contributions using keyword approach is performed when the discussion is over. As such, no ongoing feedback is given to the students on their online participation. Students have no knowledge related to their online discussion performance for ongoing improvement. Another issue is that abbreviated words are often found in messages, which can make the keyword contribution difficult to be applied in online discussion forums.

4. An Assessment Formula

To facilitate assessment of students' participation and ease the tasks of educators, an assessment formula was developed and incorporated into online forum software. The formula is used to calculate the score for students' participation based on four (4) different participation indicators and educators' feedback gathered from a survey [26]. The objective of the survey is to elicit the requirements for assessing students' participation in Internet forums. The survey respondents comprised Information Systems (IS) educators in institutions of higher education in Malaysia. IS discipline was selected as the context in this study for the following reasons which leads to its uniqueness for requirements and research in how ICT is used in instructions: (a) it has a good blend of Information Technology and non Information Technology courses, and (b) the programme is either administratively positioned in business or computing schools. The survey results showed that timeliness of message, message category, number of messages posted and message length were opted 67.1%, 58.9%, 56.2% and 24.7% respectively by the respondents (n=73). The survey findings showed that a criterion in a performance indicator is and will remain as a subjective option of the respondents. However, consistent with Winkler and Clemen's [27] study, the combination of assessment criteria from multiple aspects has been proven useful for increasing the forecast accuracy.

The authors assume that the quality of learning in online forums is revealed by the category or description of the messages. The category of a message is analyzed along SCAFFOLD to reflect the depth of student's knowledge; therefore the message category is taken as an indicator for the learning quality. Messages that are categorized as 'analysis', 'synthesis', and 'evaluation' reflect students interaction with one another at higher levels of learning. These types of messages could be considered as indicators for high learning quality. SCAFFOLD was adopted since it is comprehensive and contains elements of higher order thinking skills (i.e. 'analysis', 'synthesis', and 'evaluation') and was build upon the theoretical foundation established in the literature.

Knowlton opined that "for the benefits of online discussion to be realized, students must have formal opportunities for self evaluation" [14]. As such students must practise evaluating their own contributions to an online discussion against a clearly articulated set of criteria. An approach to resolve the challenges of collecting and coding large data sets might be to directly involve students in a process of categorizing their own discussion in such context. As such, students are required to categorize their messages using SCAFFOLD when posting (as shown in Figure 1). Educators are able to change students' message categories from Control Panel if necessary.

Due dates are best for stimulating the discussion online. It is important that messages are posted or replied on time [1, 14, 28]. Some students will not participate until other students have posted their work or they will wait until just before the discussion ends [1]. The timeframe for discussion is important to be considered. If the timeframe is too long the discussion may be slow to

take off and early contributors may have no responses to further their discussion. On the other hand, a short timeframe may not provide the flexibility in time to allow participants to undertake the associated coursework requirements and reflection. The best interaction comes when postings are made in a quick sequence. Therefore, educators have to observe and decide based on their experience about timeliness of posting. For instance, the timeliness of posting could be three (3) days if the discussion topic is relatively new to the students. As such students' contributions in the virtual dialogue could be measured by setting a date where only messages posted before the stated date are included for assessment.

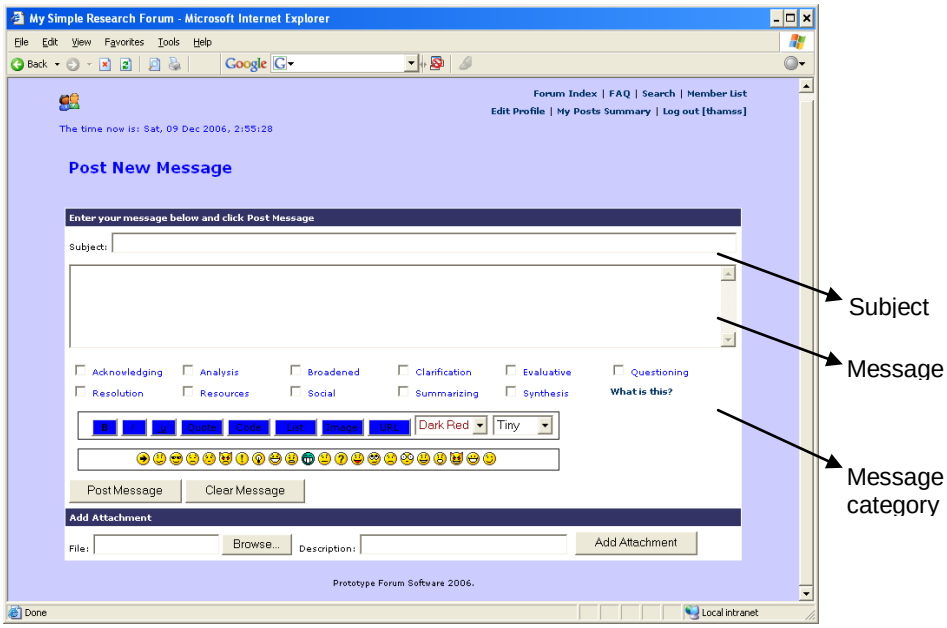

Fig. 1. Screen capture of "post new message" interface

The authors apply the idea of weighting to assign weights to the assessment criteria. The four measures are combined to compute the following Performance Indicator (PI) score:

PI score = a * Tot_Mess + b * Tot_Length + c * Count_ Acknowledging + d * Count_ Analysis + e * Count_Broadened + f * Count_Evaluative + g * Count_Clarification + h * Count_Questioning + j * Count_Resolution + k * Count_Resources + m * Count_Social + n * Count_Summarzing + p * Count_Synthesis .

Where
a, b, c, d, e, f, g, h, j, k, m, n, p are coefficients.

Tot_Mess – total messages posted by a member.
Tot_Length – total message lengths posted by a member.
Count_ Acknowledging – total count of 'acknowledging' messages posted by a member.
Count_ Analysis - total count of 'analysis' messages posted by a member.
Count_Broadened - total count of 'broadened' messages posted by a member.
Count_Evaluative - total count of 'evaluative' messages posted by a member.
Count_Clarification - total count of 'clarification' messages posted by a member.
Count_Questioning - total count of 'questioning' messages posted by a member.
Count_Resolution - total count of 'resolution' messages posted by a member.
Count_Resources - total count of 'resources' messages posted by a member.
Count_Social - total count of 'social' messages posted by a member.
Count_Summarzing - total count of 'summarizing' messages posted by a member.
Count_Synthesis - total count of 'synthesis' messages posted by a member.

For timeliness of posting, a date is set so that the system includes only messages that fall before the input date for assessment purpose. All posts after the specified input date will not be updated to the posts statistics.

5. Evaluation of the Assessment Formula

The main objective of the evaluation is to determine the accuracy of the assessment formula in predicting students' score for their contributions to online discussion forum. The evaluation of the forum software was conducted in the second semester of an academic year at the Faculty of Computer Science and Information Technology at a research-intensive university in Malaysia, on two different IS courses (referred to in this study as W1 and W2). Two (2) IS educators and a total of sixty four (64) students enrolled in W1 and W2 participated in the evaluation of the forum software. The educators (referred to as Educator A and Educator B) were the lecturers teaching the two (2) courses respectively. The students were required to complete a group project in the two courses, of which they were instructed to discuss learning issues in the online discussion forum. At the end of the project, all messages in the forum were tabulated into 39 tables. A total of 26 tables were stored in a file (named courseW1) for course W1; the other 13 tables were stored in another file (named courseW2) for course W2. Each table contained posts detail of a student such as posts' subjects, time and date of posts, posts category(s), and aggregate contributions of a student in the online forum (Figure 2). A total of 61% (39) students contributed to the discussion. Almost 39% (25) of the students were either silent or invisible in the online forum and these students would very likely to get zero mark for the

online discussion. The authors decided not to include these invisible students in the comparison of the PI scores with the students' actual grades assigned by the IS educators for the two courses involved. This is simply because it may increase the correlation between the PI scores and the actual grades, and subsequently may not reflect the accuracy of the assessment formula. The compiled data files were sent to the IS educators involved for assessment purpose. This is a common approach for manual grading. Three (3) other IS educators (referred to as independent educator X, Y, and Z) were contacted independently to assess the same set of compiled data files (students' messages). These three IS educators admitted that they did not know who the students were. All five (5) educators involved have had more than six (6) years of teaching experience. The educators were given the freedom to decide on their assessment criteria. They admitted feeling comfortable reviewing the discussions. The online forum software was made available to all five of them for viewing the learning context even though the discussion was over. The project titles and their description were sent to the educators as well. The project for course W1 required the students to discuss the use of intelligent agents in information retrieval whereas in course W2, students were required to describe the decision rules approaches and explore the application of data mining technology in practical approaches within Malaysia or international context.

Username: Fahimy Kamaruddin, total post: 1

Under subject: Assignment 1	marks
Posted on: Thu, 11 Jan 2007, 3:28:33 Post subject: What's your approach to solve this assignment? Post category: Synthesis Lets see... 2 questions Whats an IA & How IA is used to support the IR. Some people browse through the internet to find some uncertain answer... But, should we retrieve the answer instead of browse? Well, you can google for Intelligent Agent or IA + IR for browsing, but how about searching for the exact answer such as googling for "intelligent agent properties" or "IA's implementation". I mean look for and answer not anything related to IA and IR. What do you think? Act speaks louder than words...	

Username: jwee_ching, total post: 3

Under subject: Assignment 1	marks
Posted on: Mon, 15 Jan 2007, 3:58:09 Post subject: Just focuses on only one type of IA? Post category: Questioning Hi,Pooi Yee. After reading your message, I got another question. Can we do our research for this project by focuses on one type of intelligent agent such	

as intelligent multimedia agent that is developed for efficient retrieval and processing of information stored in multimedia databases , or in general? Posted on: Mon, 15 Jan 2007, 7:39:55 Post subject: Just an example... Post category: Questioning Hi,Pooi YeeThe Intelligent Multimedia Agent that i mentioned is just one of the example of IA. It is almost same with the Information Agent that mentioned by Soon Ee, the only different thing is that IMA more for retrieving documents that contains very large data objects such as images and video. Now, my problem is that i not sure whether we need to do our research in general or just focuses on only one type of IA. Can anyone give me some opinions.Thnx Posted on: Thu, 18 Jan 2007, 1:34:28 Post subject: Methods used by IA to retrieve information Post category: Analysis, Resolution Dear mwai, In my opinion, i don't think that we need to focus on the importance of searching process because the question states "How IA support IR" and not "How importance IA to IR". From the articles that i found, i think if we focus on the method used by IA in searching for a relevant information will be better. Like a IA may use keyword searching method, agent-based complex query method and so on. Hope to get some opinions from all of you if i get any misunderstanding about mwai ideas. Thnx... Have a nice day:	

Fig. 2. Two tables in a compiled data file (courseW1 file)

The authors set the coefficients (c, d, e, f, g, h, j, k, m, n, p) of SCAFFOLD to 1, a = 1 and b = 0.01. All coefficients, except b, are set to 1, which means all criteria used in the formula are equally important. The coefficient for message length (b) is set to 0.01. The authors assumed that the message length takes about 100 words to construct perspectives that can become the basis of knowledge. The same coefficients were set for the two IS courses throughout the evaluation. This is because the IS educators' grading criteria were not known. However, when the grading criteria are known, it is easy to adjust the coefficients to reflect the actual grading. Table 5 and Table 6 present a summary of actual marks given by the educators and PI score generated using the assessment formula for course W1 and W2. The assessment criteria used by the educators is unknown. Twenty six (26) and thirteen (13) students from course W1 and W2 respectively were assessed for their online participation. To measure the accuracy of the assessment model, Pearson product-moment correlations between the PI scores and the actual grades were calculated. The correlations between individual measures and the actual grades were also calculated as shown in

Table 7 for course W1 and Table 8 for course W2. The results in the second row of Table 7 and Table 8 demonstrate that there is a high correlation between the PI and the actual grades (0.827 – 0.996). The results in the third, fourth, fifth and sixth column of Table 7 and Table 8 demonstrate the correlation between individual assessment variables and the actual grades given by the independent IS educators. According to a report by Williams [29] on essay grading, the agreement between computer graders and human judges varies from 0.4 to 0.9 approximately, and that is comparable to or even better than the agreement between two human graders. The results of this study also show that, in most cases, PI performs slightly better than any of the three measures i.e. total message count, total message length and SCAFFOLD (highlighted in Table 7 and Table 8).

Table 5. A Summary of Actual Grades given by educators and PI scores for course W1(N=26)

Students	Educator A	Independent educator X	Independent educator Y	Independent educator Z	PI scores
Student 1	2.0	3.0	1.0	1.0	2.08
Student 2	8.0	17.0	3.0	4.0	16.82
Student 3	5.0	8.0	2.0	2.0	7.24
Student 4	4.0	9.0	2.0	3.0	10.19
Student 5	3.0	7.0	2.0	3.0	7.10
Student 6	3.0	5.0	1.0	2.0	5.13
Student 7	9.0	18.0	3.0	4.0	16.88
Student 8	4.0	6.0	1.0	2.0	5.18
Student 9	3.0	5.0	1.0	2.0	4.12
Student 10	5.0	9.0	1.0	3.0	7.24
Student 11	4.0	6.0	1.0	2.0	5.27
Student 12	3.0	3.0	1.0	1.0	3.11
Student 13	6.0	9.0	1.0	3.0	8.29
Student 14	6.0	6.0	1.0	2.0	6.24
Student 15	1.0	2.0	1.0	1.0	2.03
Student 16	1.0	3.0	1.0	1.0	2.03
Student 17	3.0	3.0	1.0	1.0	2.15
Student 18	6.0	9.0	2.0	3.0	7.47
Student 19	4.0	3.0	1.0	1.0	2.21
Student 20	1.0	4.0	1.0	1.0	4.10
Student 21	3.0	3.0	1.0	1.0	2.17
Student 22	4.0	3.0	1.0	1.0	2.38
Student 23	2.0	3.0	1.0	1.0	2.02
Student 24	1.0	3.0	1.0	1.0	2.01
Student 25	1.0	3.0	1.0	1.0	2.02
Student 26	1.0	3.0	1.0	1.0	2.02

Table 6. A Summary of Actual Grades given by educators and PI scores for course W2(N=13)

Students	Educator B	Independent educator X	Independent educator Y	Independent educator Z	PI scores
Student 27	5.0	5.0	4.5	2.0	5.5
Student 28	8.0	17.0	4.5	4.0	17.2
Student 29	2.0	2.0	4.0	1.0	2.0
Student 30	5.0	6.0	4.0	1.0	6.1
Student 31	2.0	2.0	4.0	1.0	2.0
Student 32	5.0	5.0	4.0	2.0	4.1
Student 33	8.0	14.0	4.5	3.0	14.2
Student 34	3.0	2.0	4.0	1.0	2.0
Student 35	3.0	3.0	4.0	1.0	2.0
Student 36	2.0	3.0	4.0	1.0	3.1
Student 37	2.0	2.0	4.0	1.0	2.0
Student 38	2.0	2.0	4.0	1.0	2.0
Student 39	2.0	3.0	4.0	1.0	2.0

Table 7 Correlations for IS course W1 (N=26)

		Educator A	Independent educator X	Independent educator Y	Independent educator Z
PI generated	Pearson Correlation	0.885**	0.852**	0.988**	0.936**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
Total message count	Pearson Correlation	0.900**	0.806**	0.979**	0.928**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
Total message length	Pearson Correlation	0.797**	0.905**	0.887**	0.758**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
SCAFFOLD	Pearson Correlation	0.863**	0.857**	0.980**	0.935**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000

** . Correlation is significant at the 0.01 level (2-tailed).

Table 8 Correlations for IS course W2 (N=13)

		Educator B	Independent educator X	Independent educator Y	Independent educator Z
PI generated	Pearson Correlation	0.827**	0.930**	0.996**	0.942**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
Total message count	Pearson Correlation	0.789**	0.923**	0.993**	0.937**
	Sig. (2-tailed)	0.001	0.000	0.000	0.000
Total message length	Pearson Correlation	0.901**	0.905**	0.853**	0.835**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
SCAFFOLD	Pearson Correlation	0.848**	0.926**	0.991**	0.901**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000

** . Correlation is significant at the 0.01 level (2-tailed).

6. Conclusion

The authors have come up with a solution to automate the assessment of student online participation using an assessment model. The model consists of four (4) different participation indicators namely, total number of messages posted, total message lengths, total counts for each SCAFFOLD category, and timeliness of messages. The evaluation results showed that the PI score generated by the assessment model was highly correlated with the actual grades assigned by the educators. It is reasonable to assume that such correlation is comparable to what has been reported in the automatic essay grading literature [29]. Thus, the evaluation results suggest that the assessment model is reliable to be used. The assessment model can be implemented in online discussion forum to help educators obtain a reference to students' online performance without reading through the huge amount of class messages. The strength of using this assessment model is that the PI score for individual student is updated instantly and it reflects the students' ongoing performance in online forums; as such students have the opportunities to improve their online performance before the discussion is over. However, the delimitation of the evaluation was that it was conducted on two (2) different IS courses for a final year degree programme. As such it

would not be prudent to generalize the evaluation results. Future research includes broadening the investigation of the research context and scope of the users to other academic disciplines.

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