VOL. 10, NO. 2, FEBRUARY 2015 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

# PRELIMINARY STUDY ON SEMANTIC KNOWLEDGE MANAGEMENT MODEL FOR COLLABORATIVE LEARNING

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**ABSTRACT**

Knowledge management (KM) is about collecting, organizing, and storing the knowledge assets of an organization to make it accessible for future knowledge reuse and application. Effective knowledge management system (KMS) should be able to deliver relevant knowledge to the right knowledge user at the right time. Yet, existing KMS is limited in several ways, and still largely relies on human efforts to access, extract and filter information pertinent to their knowledge need. Successful KMS requires the identification of proper technology designed with the right system features to support the KM activities, hence achieve the goals of KM. Due to this motivation, this paper aims to discuss the application of semantic technology to enhance the KMS and propose a semantic KM model to support collaborative learning environment. This preliminary model has been proposed based on the review of the literatures on KM, KMS, semantic technology and collaborative learning environment and the verification of the model components will be done using a questionnaire survey. A pilot survey was conducted to several academicians in Higher Learning Institutions (HLIs) in Malaysia to validate the survey instruments before the actual survey is carried out. Rasch Unified Measurement Method (RUMM) is used to analyze the pilot data. As a result, Person reliability is found to be quite high, but Item reliability suggested fair data. A few respondents and items were identified as misfits with distorted measurements. Some problematic questions are revised and the negative questions are considered to be reworded into positive questions.

**Keywords:** knowledge management, collaborative learning, knowledge management system, semantic.

## INTRODUCTION

Knowledge is one of the most crucial success factors for today’s organizations. It requires a successful dissemination of relevant knowledge to people who need it, whenever they requested for that knowledge. To ensure proper knowledge consumption, a suitable tools need to be developed and implemented to support the knowledge management activities. In modern years, Information Technology (IT) adoption in organizations to support knowledge processes has been recognized as one of the significant KM enablers, and knowledge management system (KMS) is acknowledged as one of the most successful tools to facilitate knowledge management projects (Maier and Hädrich, 2011). This recognition resulted in surge in the augmentation of sophisticated KMS for handling organizational knowledge assets. There are various definitions of knowledge management system found in the literature and one of them proposed by Davenport, De Long and Beers (1998) that describe KMS as a technology based system that supports KM processes including knowledge creation, capture, storage and knowledge dissemination and sharing. This means that if the knowledge users fail to locate the knowledge that they need, then the KMS is not successful in meeting its user’s expectation, hence is not effective to support knowledge needs of its users.

Today, as online information is growing at exponential rate and massive information collected which resulted from various business activities, the task of finding and using information becoming more difficult than ever. Especially to large and distributed organizations, it is harder for them to exploit their knowledge assets without the right KMS features designed to solve their knowledge related problems. Current KMS still requires much of human efforts to access information, extract and filter information relevant to their knowledge needs (Fensel *et al*. 2000; Davies, 2007). Several studies have been conducted to discuss the limitations with current KMS related to technical issues such as the KMS architecture design and infrastructural requirements for such system. For instance, the research conducted by Joo (2006) indicated two main limitation factors in current KMS; system quality and knowledge quality. Joo (2006) proposed the recent technology of Semantic Web to overcome the limitations with existing KMS, similar with several projects proposed in the literature (Davies 2007; Schaffert 2006; Vega-Gorgojo *et al*. 2010; Stojanovic and Handschuh, 2002).

### Semantic knowledge management

The recent technology of the Semantic Web has given a new drive to the old knowledge management research field. The goal is to build a unified information medium that is both understandable for people and computers thus allows the computers to do certain tasks on behalf of human users (Berners-Lee, Hendler, and Lassila, 2001). The development of Semantic Web has created many opinions and dialogue on the impact of associated technologies such as XML and RDF for developing effective and efficient KMS.

One of the major components of the Semantic Web is ontology. Ontology must be constructed for each domain of human knowledge to provide meaningful description about the knowledge of that particular domain. The use of ontologies in the escience community determines ultimate success for the Semantic Web (de Bruijn *et al*., 2006). On the Semantic Web, data is annotated using ontologies to describe background information that enriches the description of the data, hence providing contextual information about specific data. Because ontologies are shared specifications, they can be used for several data sources including Web documents and relational databases. This enables a certain degree of inter-operation between multiple data sources (de Bruijn *et al*., 2006) and provide meaning to content of Web documents through its structure, hence enabling software agents to perform sophisticated tasks for human users (Berners-Lee, Hendler, and Lassila, 2001).

This paper aims to propose a Semantic Knowledge Management Model to support knowledge users in collaborative environment. This preliminary model is proposed based on the review of the literature. A pilot study has been conducted to collect data about the current KMS used for education targeted to several IPTA's in Malaysia that have been using KMS for more than 1 years. The pilot survey result will be analyzed using RASCH. The pilot study is conducted to validate the questionnaires for data collection to verify the proposed semantic components for the KMS.

## RELATED WORKS

Studies of knowledge management implementation has been conducted and discussed in many different domains such as in oil and gas companies (Robert M. Grant, 2013), in software maintenance organizations (Mohd Nor, Abdullah, Selamat and Azmi Murad, 2009), in healthcare institutions (Ali, Tretiakov, Whiddett and Hunter, 2010) and in education domain (Ali, Sulaiman and Che Cob, 2014; Butnariu and Milosan, 2012; Abdullah *et al*., 2008). These authors also discussed the role of KMS to support KM processes in their selected research domains. These works has proven that the KMS indeed plays an important role for successful KM implementation in organizations. Hence, important attention needs to be given related to the requirements of developing effective and efficient KMS.

There are many definitions proposed by KM researchers to describe KMS from various perspectives. For instance, Meso and Smith (2000) defined KMS from two perspectives; technical and social-technical (Meso and Smith, 2000). The Technical Perspective comprises of Technologies, Functions and Knowledge components whereby the KMS functions related to specific technologies should be able to support knowledge works of employees in organizations. The Socio-Technical Perspective views KMS as combinations of technology infrastructure, organizational infrastructure, corporate culture, knowledge and people. Abdullah, Shamsul, Alias and Selamat (2005) proposed more specific KMS framework to support collaborative works in learning organisations and suggested several important components for a KMS framework. Similarly, these authors also highlighted KMS functionality as one of the crucial component to build a successful KMS.

Another definition of KMS proposed by (Abdullah *et al*., 2008), which defined KMS as a tool for managing and storing knowledge to provide easier knowledge access and retrieval to support learning organizations. (Abdullah *et al*., 2008). In addition, KMS also can be categorized into two types according to their business functions; horizontal and vertical KMS (Benjamins, Fensel and Perez, 1998). Vertical KMS is a more specific KMS solution that suits a particular business needs while horizontal KMS is a general type KMS that can be applied to several business situations.

However, our work is mainly related to the technical definition of KMS concerning the three main components suggested by Meso and Smith (2000), Abdullah, Shamsul, Alias and Selamat (2005) and Abdullah *et al*. (2008). The main goal of this paper is to illustrate the capabilities of semantic technologies to enhance the knowledge processes during collaboration works, not just supporting the tasks of the knowledge users. Enhancing in this context means easy and effective knowledge acquisition and retrieval, hence making the process of finding and using knowledge much faster with minimal user efforts.

As KM field has gained much attentions over the years, many KM and KMS frameworks and models and have been proposed. However, the existing KMS models did not adequately realized the roles of KMS to support KM initiave (Abdullah *et al*., 2008). A model that addresses important concepts or components and relationship between these components is very important to idealize the idea of semantic knowledge management, which guides the direction for implementing KMS in organizations.

### Knowledge management systems limitation

The findings from the analysis of the literature outline several limitations of current KMS. Davies (2007) claims that rapid growth of today's information resources result in difficulty to find, organize, access and maintain required information. Another important findings from survey conducted on online educators' current practices and requirements in 2006 where all survey participants reported a lack of feedback about the learning process (Jovanovic *et al*., 2007).

Meanwhile, Joo and Lee (2009) conducted an empirical study to analyze the technological limitations of existing KMS. They highlighted three limitations; 1) search limitation, 2) integration limitation and 3) inconvenience with regards to poor knowledge quality of the KMS. The authors proposed the semantic technology as a solution to these limitations and concluded that semantic KMS will be able to reduce the time and increase efficiency in completing tasks, hence improved quality of the solution.

Existing KM Systems offers only limited ways of describing knowledge content itself, hence hinder many possibilities that KM Systems can provide to Community of Practice (CoP). Knowledge workers are increasingly flooded by information from various sources which resulted in more difficult task and extra efforts needed to filter needed information to solve a particular problem in hand. Offering and finding relevant information and knowledge is a huge challenge as the ability to learn quickly is one of the determinant for competitive advantages that a company should have. Semantic Web technologies are a tool that can be used to better manage information and to increase the level of automation in knowledge and information acquisition tasks.

Exploiting semantic technology for Knowledge Management System will bring many potential benefits to enhance knowledge management activities and provide richer experiences to KMS users. Current systems to support knowledge processes are limited in terms of understanding and interpreting the stored documents hence limit the potential of KMS's role in supporting KM initiative. The most recent semantic KM development proposed by Felic, König-Ries, and Klein (2014) illustrate a system called Product Lifecycle Management (PLM) as a tool to manage product development knowledge. The authors highlighted major issues addressed by PLM are data integrity and completeness, interoperability and facilitation of collaboration between different expertise areas (Felic *et al*., 2014). In addition, semantically enhanced knowledge resources that hold machine interpretable and meaningful documents are very much needed to manipulate the full potential of web technologies to support knowledge users (Kohlhase and Kohlhase, 2008).

Semantic web-based KMS will be able to solve the limitations faced by current KMS as two of the main motivators for semantic web are data integration and providing intelligent support for users (Hendler, Berners-Lee, and Miller, 2002; Davies, 2007). One of the key enabling technologies of semantic web, ontology is suitable to represent consensus knowledge. This will solve the information overload problem for users of KMS which involves lots of information exchanged across CoP and enable automated processing of information items which will result in minimum human intervention required to operate KMS.

**Semantic knowledge management systems for collaborative environment**

Education domain is one of the knowledge intensive industry, and lots of collaborative works occur in this setting. In education domain, several researches have been conducted to study the benefits of semantic to manage learning resources (Biletskiy *et al*. 2009; Jiang *et al*. 2008; Kohlhase and Kohlhase, 2008; Li *et al*. 2011; Memon and Khoja, 2009; Sánchez-Vera *et al*. 2012; Sampson *et al*. 2004). Jovanovic *et al*. (2007) demonstrates the use of semantic web technologies to improve the learning environments and connect the students and learning content teachers.

The application of semantic technology in education setting can be used to describe the relationship between learning resources thus help users understand relationships and dependencies between facts to make them more effective to support teaching and learning processes (Kohlhase and Kohlhase, 2008). The massive growth of learning resources on the web with thousands of documents easily available makes the task to find required and relevant learning resources becomes time consuming. The Semantic Web can reduce this time by automatically acquiring links to relevant resources on the Web providing information about needed products that matches learners' interest. The semantic web based KMS will be able to do a reasonable job of collating, cross-referencing and synthesizing the results by employing software agents that can find, distill and exchange information with other agents to build meaningful information collages (Ohler, 2008).

Some recent works use semantic web to improve the capabilities and user experiences in education domain by mean of artificial intelligence and knowledge management techniques. Semantic web technology is able to provide the ability to integrate different e-learning systems, and to give semantics to entities and relations in the database by mean of ontologies. The focus of semantic web based KMS for learning is on the learner's context, to be able to provide richer learning experience to the users.

Recently, some initiatives to start the semantic web-based educational systems (SWBES) have emerged in the field of artificial intelligence in education (AIED) (Bittencourt, Costa,Silva and Soares, 2009). The main idea is to incorporate semantic web resources to the design of AIED systems aiming to update their architectures to provide more adaptability, robustness and richer learning environments. However, the construction of such systems is highly complex and faces several challenges in terms of software engineering and artificial intelligence aspects.

The semantic web (Web 3.0) have significant impacts for learners including the ability to access relevant up to date information more quickly, enable personalised tailored content to fit current learning requirements, and facilitate close contact with those who provide the information, while sharing information with those with similar interests (De Waard *et al*. 2011).

Jovanovic *et al.* (2007) demonstrates how to use Semantic Web technologies to improve the existing online learning environments by providing the linking between teacher and student. The ontological framework proposed to formalize learning objects and their relationship between different learning resources within a context of learning environment.

More recent work by Peredo, Canales, Menchaca and Peredo (2011) described a set of integrated tools to build an intelligent Web-based education system. The aim is to create a Web learning environment that can be tailored to the Learners' needs, hence providing personalized environment to the knowledge users.

The literature studies performed suggested the potential of adopting semantic technology to improve

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KMS to successfully support the KM processes. Semantically enabled knowledge resources provide intelligent content, which allows computer to understand and interpret knowledge documents. Hence, this semantic capability of KMS will leads to semantic features such as the ability to link knowledge resources and provide more accurate search results. In addition, as the machine can understand knowledge resources, it allows knowledge to be filtered to tailor to specific user's context with minimal user's efforts, which leads to personalization of information and knowledge. The ability to deliver the right knowledge to the right user can be served through this semantic based KMS features and consequently facilitate KM activities to achieve the main goals of KM.

## A PROPOSED SEMANTIC KNOWLEDGE MANAGEMENT MODEL FOR COLLABORATIVE ENVIRONMENT

The proposed semantic KM model consisted of five important components to support collaborative works. These five components are identified as critical elements for implementing KMS. The importance of these five components (refer **Error! Reference source not found.**) is described below:

A. **KM processes:** KM implementation should address the four basic processes of KM. These four basic knowledge processes are derived from literature (Abdullah *et al*. 2008; Alavi and Leidner, 2011; Davenport and Prusak, 1998). The features of KMS developed should be able to support each of the KM processes:

i. Knowledge Acquisition - in collaborative environment, regular knowledge creation takes place especially in today's learning organizations. Activities related to knowledge creation and acquisition needs to be supported by KMS features and functions.

ii. Knowledge Storage - the knowledge created and acquired resulted from the collaboration activities need to be captured and represented in explicit knowledge form. This captured knowledge must be organized in a proper form and stored for future knowledge retrieval and dissemination.

iii. Knowledge Dissemination - The important knowledge captured and stored in the repositories will be disseminated to relevant knowledge whenever requested. In this proposed model, pro-active knowledge dissemination is expected through alert and notification whenever new knowledge is created and deposited into the KMS.

iv. Knowledge Application - the main aim of KM is to retain knowledge for easier access by knowledge users, thus resulted in knowledge utilization. Knowledge dissemination leads to knowledge sharing. This knowledge is then used and applied by the knowledge users to accomplish their work tasks and goals.

B. **Ontology-based knowledge repositories:** The semantic capability of this system is realized through the use of ontology for knowledge storage (Antunes, Seco, and Gomes, 2007; Apostolski *et al*., 2010; Felic, König-Ries, and Klein, 2014; Jovanovic *et al*., 2007). Ontology based knowledge models (teacher's model, student's model, and course model) define the structure of the acquired knowledge to be stored in the knowledge repositories. The ontology describes the knowledge objects which provides meaning to the computer that enables computer to understand the objects, hence results in semi/ automation of certain knowledge management system (KMS) functions.

C. **Semantic knowledge management features:** Semantic KMS features include ontology-based knowledge model, which provides shared description, common understanding of the knowledge objects. These shared descriptions will allow integration of knowledge across platforms (Knowledge integration). Knowledge search allows the KMS user to search the metadata i.e. semantic search rather than using traditional keyword-based search, hence enable the system to provide more accurate search results which will reduce the user efforts to filter the relevant knowledge that they need (Tablan, Bontcheva, Roberts, and Cunningham, 2014). In addition, the ontology based knowledge model enable the computer to understand the meaning of the information being stored, hence it will be able to automatically filter the knowledge to relevant KMS users (who might be interested with specific knowledge (know-who; know-what) whenever they need it (know-when). It allows personalization of knowledge that tailor to KM user's preferences and needs (based on ontology based user's model in knowledge repository).

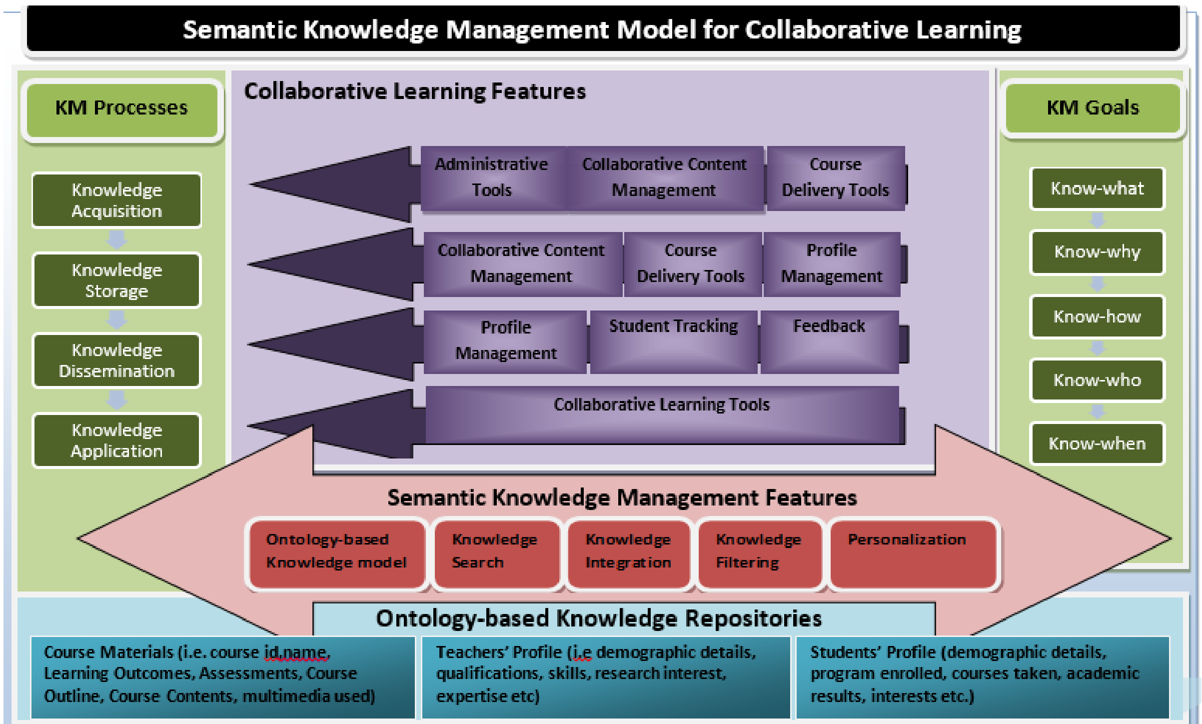


**Figure-1:** A proposed semantic knowledge management model for collaborative learning.

D. **Knowledge management goals:** Adding the semantic to KMS will be able to answer important knowledge management questions such as know-what, know-why, know-how, know-who and know-when, thus realize the ultimate goals of KM implementation.

E. **Collaborative learning features:** This component identifies the important KMS functions to support specific KM processes (Abdullah, Sahibudin, Alias, and Selamat, 2005; Lipponen, 2002; Mohd Nor *et al.*, 2009). The administrative tool is important to support the management of the knowledge in the system and the functions of the KMS. The KMS user's profile management function allows the personalization to happen; hence the right knowledge can be disseminated or delivered to the right users at the right time. Collaborative content management tools support the knowledge provider (i.e. teacher) to create knowledge about a particular subject/ course. As specific course knowledge might be created by more than one knowledge providers/ experts, this function enable collaboration work between a group of knowledge experts to create and acquire knowledge which will be later stored inside the knowledge repositories. Student tracking will function to monitor student's learning experience. For example, student's competency level can be monitored through the assessment scores and appropriate level of course assessment questions (i.e. quiz) can be suggested for that particular student according to their competency level. Collaborative learning tools such as electronic forum, discussion board are important to facilitate the process of knowledge usage and application, hence lead to knowledge utilization (Mohd Nor, Abdullah, Azmi Murad, and Selamat, 2010).

## RESEARCH METHODOLOGY

This research is conducted based on literature analysis and data collection from selected Higher Learning Institutions (HLI) in Malaysia. The aim of these activities is to study the limitations of current KMS implemented to support teaching and learning processes at the HLIs and to identify important KM components to manage knowledge to support collaborative works in this setting. In depth review of literature covered on related topics such as KM, KMS and Semantic technology. A comparison study has been performed on several KMS models to critically analyze and identify the important components of KMS. A questionnaire was then developed based on the identified contructs from the literature analysis. Before the actual data collection is performed, a pilot study was conducted to validate the survey questionnaire items.

A pilot survey was conducted via surveymonkey (www.surveymonkey.com) and the link was emailed to academicians from several HLIs in Malaysia. In this pilot study, Rasch measurement model (RUMM) is used to analyze the data. RUMM is used to measure observable events and analyzing performance of respondents and questionnaire items. The Rasch analysis is mainly performed to determine reliability of respondents and items and also to determine the outliers for both respondents and items. This should give us the final

VOL. 10, NO. 2, FEBRUARY 2015 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

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questionnaire items to be used in the actual data collection to verify the proposed components of the model.

This paper shall discuss use of Rasch measurement to analyze and validate questionnaires used to verify components in Semantic KM model for collaborative learning environment.

## RESULT

15 academicians from Higher Learning Institutions (HLIs) in Malaysia participated in this pilot study. The pilot data were tabulated and analyzed using WinSteps, a RUMM tool. Rasch identified an extreme score which will later be excluded from further analysis. Person and Item summary statistics results and measures are shown in Table-1 and Table-2.

In Rasch, person separation is used to classify people. Low person separation (< 2, person reliability < 0.8 ) with a relevant person sample implies that the instrument may not be not sensitive enough to distinguish between high and low performers (Mohd Nor, Abdullah, Azmi Murad, Selamat, and Aziz, 2010). However, this study shall not be used to separate respondens into groups. As can been from Table-1, person reliability score of 0.91 is quite high. Hence, it means that the responses are reliable for analysis.

Meanwhile, item reliability score of 0.67 shown in Table-2 indicates fair data. This might be due to small sample size being used for analysis. The spread of person responses is 3.29 logit is fair. This is due to extreme responses by a person. However, person Reliability = 0.91 and Cronbach Alpha=0.99 indicates high reliable data and hence the data could be used for further analyses.

Rasch provides the Wright Map that allows both person and items to be mapped side-by side on the same logit scale to give us a better perspective on the relationship of person responses to the items. Wright Map (shown in

Figure-2) indicates a higher Person Mean (0.30) compared to the constrained Item Mean. This indicates tendency to endorse higher importance for the questionnaire items. Person 2427534 from University Malaysia Pahang being the highest in PIDM, have the tendency to give high importance ratings to most of the questionnaire items, whilst 2426005 (UPM) and 2427569 (UTeM) tends to rate lower.

On the Item side, the distribution is quite closely bunched together, except for q5. This might be due to respondents do not understand the term 'structured format' used in the item. Therefore, this question will be revised for easier understanding. Among these items q6, q10, q11, q13, q17, q20, q21, q22, q23 and q47 are below the minimum measure of Persons. This indicates overall agreeableness on the high importance of these components.

Eigenvalue of 1st contrast has the strength of 12 items (refer Table-3). This is quite high (>3) and may suggest a secondary dimension. Items ABCDE items are quite distinctly located from other items (refer

Figure-3).

Items q40, 42, 43, 44, 45 are the main items contributing to the secondary latent trait (refer Table-4).

Upon investigation, these item are negatively worded. These shall be reworded in the final questionnaire into positive questions.

**Table-1.** Summary of 15 measured person.

| | RAW SCORE | COUNT | MEASURE | MODEL ERROR | INFIT MNSQ | INFIT ZSTD | OUTFIT MNSQ | OUTFIT ZSTD |
|---|---|---|---|---|---|---|---|---|
| MEAN | 122.9 | 43.0 | .82 | .29 | 1.02 | -.3 | .98 | -.4 |
| S.D. | 29.5 | 9.5 | 1.11 | .04 | .56 | 2.8 | .52 | 2.6 |
| MAX. | 166.0 | 51.0 | 2.98 | .40 | 2.09 | 4.5 | 1.88 | 3.7 |
| MIN. | 62.0 | 25.0 | -1.23 | .25 | .24 | -5.2 | .24 | -5.1 |

REAL RMSE .33 ADJ.SD 1.06 SEPARATION 3.19 Person RELIABILITY .91
MODEL RMSE .29 ADJ.SD 1.07 SEPARATION 3.65 Person RELIABILITY .93
S.E. OF Person MEAN = .30

VALID RESPONSES: 82.7%
Person RAW SCORE-TO-MEASURE CORRELATION = .59 (approximate due to missing data)
CRONBACH ALPHA (KR-20) Person RAW SCORE RELIABILITY = .99 (approximate due to missing data)

**Table-2.** Summary of 52 measured items.

| | RAW SCORE | COUNT | MEASURE | MODEL ERROR | INFIT MNSQ | INFIT ZSTD | OUTFIT MNSQ | OUTFIT ZSTD |
|---|---|---|---|---|---|---|---|---|
| MEAN | 35.4 | 12.4 | .00 | .55 | 1.17 | -.1 | 1.18 | -.1 |
| S.D. | 11.1 | 3.0 | 1.35 | .13 | 1.14 | 1.5 | 1.13 | 1.5 |
| MAX. | 50.0 | 15.0 | 3.92 | 1.15 | 7.45 | 3.1 | 7.40 | 3.1 |
| MIN. | 8.0 | 3.0 | -2.09 | .46 | .17 | -2.6 | .15 | -2.6 |

REAL RMSE .78 ADJ.SD 1.10 SEPARATION 1.42 Item RELIABILITY .67
MODEL RMSE .56 ADJ.SD 1.23 SEPARATION 2.18 Item RELIABILITY .83
S.E. OF Item MEAN = .19

UMEAN=.000 USCALE=1.000
Item RAW SCORE-TO-MEASURE CORRELATION = -.66 (approximate due to missing data)
645 DATA POINTS. APPROXIMATE LOG-LIKELIHOOD CHI-SQUARE: 1019.44

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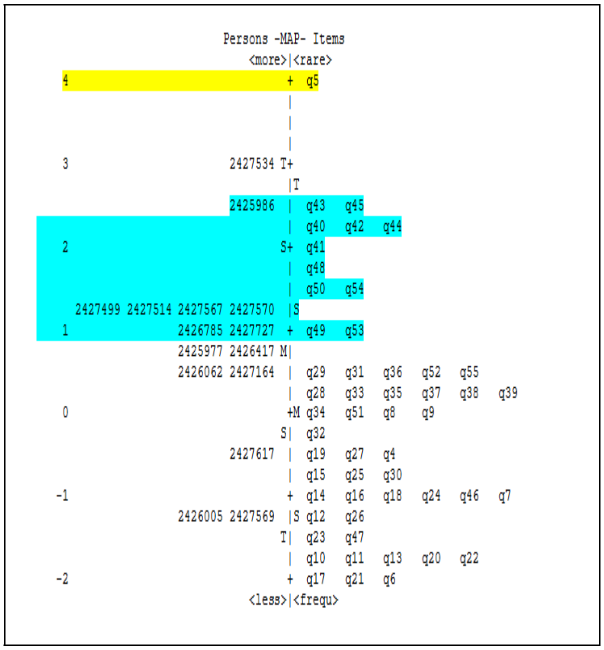


**Figure-2.** Wright map.

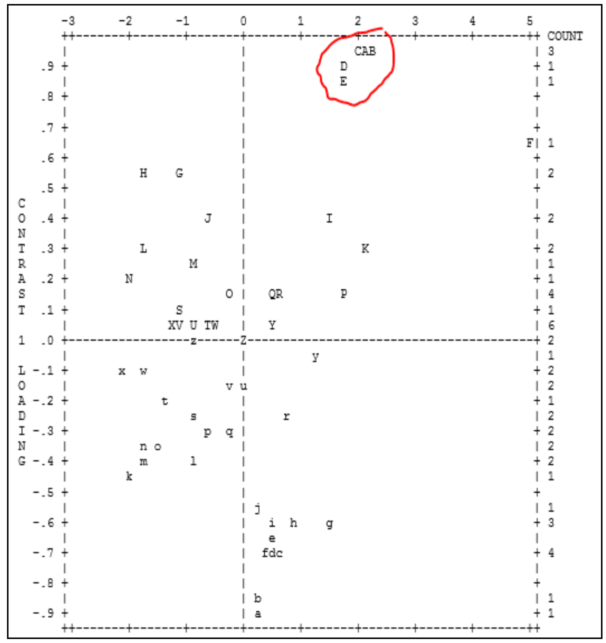


**Figure-3.** Standardized residual variance (in eigenvalue units).

**Table-3.** Unidimensionality test.

Unidimensionality test

TABLE 23.0 Student Marks ZOU321WS.TXT Oct 31 21:31 2014
INPUT: 14 Persons 52 Items MEASURED: 14 Persons 52 Items 4 CATS 1.0.0

STANDARDIZED RESIDUAL VARIANCE SCREE PLOT
Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

| | | Empirical | | Modeled |
|---|---|---|---|---|
| Total variance in observations = | 87.9 | 100.0% | | 100.0% |
| Variance explained by measures = | 35.9 | 40.8% | | 40.3% |
| Unexplained variance (total) = | 52.0 | 59.2% | 100.0% | 59.7% |
| Unexplned variance in 1st contrast = | 12.0 | 13.7% | 23.2% | |
| Unexplned variance in 2nd contrast = | 8.7 | 9.9% | 16.8% | |
| Unexplned variance in 3rd contrast = | 7.5 | 8.5% | 14.4% | |
| Unexplned variance in 4th contrast = | 6.5 | 7.4% | 12.5% | |
| Unexplned variance in 5th contrast = | 3.7 | 4.2% | 7.1% | |

**Table-4.** Item measure.

| CON-TRAST | LOADING | MEASURE | INFIT MNSQ | OUTFIT MNSQ | ENTRY NUMBER | Item | LOADING | MEASURE | INFIT MNSQ | OUTFIT MNSQ | ENTRY NUMBER | Item |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .94 | 2.09 | 1.23 | 1.22 | A 39 | q42 | -.89 | .22 | .99 | 1.06 | a 32 | q35 |
| 1 | .94 | 2.09 | 1.23 | 1.22 | B 40 | q43 | -.84 | .22 | 1.55 | 1.68 | b 31 | q34 |
| 1 | .94 | 2.09 | 1.23 | 1.22 | C 42 | q45 | -.72 | .55 | .49 | .51 | d 35 | q38 |
| 1 | .88 | 1.81 | 1.31 | 1.31 | D 41 | q44 | -.72 | .55 | .49 | .51 | c 36 | q39 |
| 1 | .87 | 1.81 | 1.30 | 1.31 | E 37 | q40 | -.72 | .56 | .56 | .55 | f 49 | q52 |
| 1 | .65 | 4.98 | .85 | .70 | F 2 | q5 | -.72 | .56 | .56 | .55 | e 52 | q55 |
| 1 | .55 | -1.15 | .51 | .50 | G 9 | q12 | -.62 | 1.52 | .54 | .55 | g 51 | q54 |

The items shown in Table-5 are with infit and outfit z-std >2, which indicate erratic responses. These shall also be revised.

**Table-5.** Items misfit.

| ENTRY NUMBER | RAW SCORE | COUNT | MEASURE | MODEL S.E. | INFIT MNSQ | INFIT ZSTD | OUTFIT MNSQ | OUTFIT ZSTD | PTMEA CORR. | EXACT MATCH OBS% | EXACT MATCH EXP% | Item |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9 | 3 | -.62 | 1.22 | 8.36 | 3.2 | 8.31 | 3.2 | A .75 | .0 | 77.6 | q4 |
| 3 | 10 | 3 | -2.09 | 1.13 | 3.23 | 2.5 | 3.25 | 2.5 | B .37 | .0 | 62.3 | q6 |
| 6 | 24 | 9 | -.04 | .63 | 3.25 | 3.0 | 3.23 | 2.8 | C .78 | 33.3 | 68.6 | q9 |
| 4 | 18 | 6 | -1.19 | .81 | 3.15 | 2.4 | 2.84 | 2.2 | D .52 | 50.0 | 70.7 | q7 |
| 5 | 27 | 9 | -.61 | .68 | 2.85 | 2.5 | 2.74 | 2.3 | E .50 | 44.4 | 71.8 | q8 |
| 46 | 25 | 10 | 1.22 | .56 | 2.60 | 2.9 | 2.50 | 2.8 | F -.51 | 50.0 | 56.4 | q49 |
| 47 | 24 | 10 | 1.52 | .54 | 2.52 | 2.9 | 2.48 | 2.9 | G -.59 | 60.0 | 53.8 | q50 |

## CONCLUSIONS

KMS is critical to ensure that KM activities to support knowledge processes can be done in an effective and efficient manners. However, the KMS should be designed to exhibit features that enable faster and easier knowledge acquisition, provide knowledge storage that can link many different knowledge resources for easier integration and allow knowledge dissemination to relevant knowledge users. The ability to provide effective and efficient support for these KM processes will lead to better knowledge application and hence increase knowledge utilization. The advent semantic technology is proposed to solve the limitations of current KMS by providing semantic capabilities that enhance KMS functions to support collaborative works of users. To formulate the semantic KMS model for collaborative environment, the components on KM, KMS, semantic technology, and collaborative learning are composed from diverse literatures.

A preliminary model of semantic KMS components for collaborative learning is presented. A questionnaire is developed based on this model and the questionnaires items are tested in a pilot study. RUMM was used in analyzing pilot questionnaire. Person reliability found to be quite high, but Item reliability suggested fair data. A few respondents and items were identified as misfits with distorted measurements. Some problematic questions are revised and the negative questions are considered to be reworded into positive questions. The following step involves distribution the revised questionnaires to several selected HLIs targeted to academicians, students and system administrator to verify the proposed components for semantic KMS model for collaborative environment. The model shall be used to develop a semantic KMS protototype to provide more effective and efficient support for collaborative activities.

## ACKNOWLEDGEMENTS

This research is funded by the Malaysia Ministry of Science and Technology (MOSTI) e-ScienceFund Project No.01-01-04-SF1686.

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