Model for Developing Rubric Scoring Categories Based on Knowledge

Paul Mungai and Rabelani Dagada

***Abstract*—Rubrics are sometimes viewed to only focus on generating good grades rather than "on making sense of ideas" [1]. This proposition usually seeks to ban the use of rubrics. However, this study seems to identify a gap that could have led to this proposition. Learning aims at creation of knowledge and thus, each purpose and objective leads to the creation of certain types of knowledge. Therefore, the criteria developed should be sufficient in developing these types of knowledge. This study proposes a model that could be used in developing rubrics that lead to the amplification of specific types of knowledge.**

***Index Terms*—Knowledge, types of knowledge, rubric, assessment**

I. Introduction

Authentic assessments use rubrics to provide clear scoring criteria to learners enabling them to conduct self-assessment or peer-assessment before submitting [2; 3]. The effectiveness of a rubric is dependent on its validity and reliability. Validity entails having a clear definition based on the area of interest, a specific construct such as reasoning, problem solving or creativity and a criterion that ensures that learners can apply the acquired knowledge in the professional environment successfully. Reliability entails having consistency in the assessment scores [4].

In order to ensure that the rubric is valid and reliable, Hanny (2000) as cited by Moskal & Leydens (2000) suggests a four step process for evaluating the validity and reliability illustrated in *Fig. 1* above.

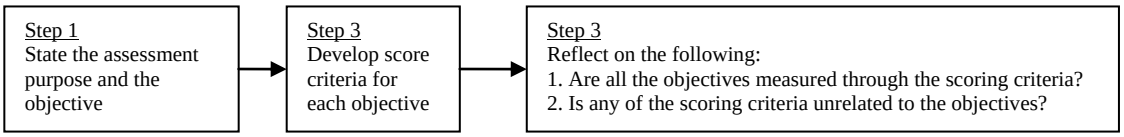

Fig. 1. Evaluating the appropriateness of scoring categories to a stated purpose

The purpose and objectives are useful in determining the content, construct and criterion. Depending on the area of interest, a criteria for evaluating the appropriateness of the content developed by learners is developed. Following the criteria, a check is developed to ensure that all the objectives are addressed in the criteria, and that the relevance of such criteria is conducted [4].

The purpose and objectives are achieved through various learning activities. These activities include; conversations, contradictions, learning actions (such as questioning and analysis) and debates between different positions based on the defined purpose and objectives. It is in these activities that learning and consequently knowledge creation takes place [5].

There are different types of knowledge, and each learning activity leads to the creation of a unique set of knowledge. Therefore, it is important to identify the types of knowledge that these activities generate. However, noting that these activities are determined by the purpose and the objectives of study, it would be important to determine all the possible types of knowledge that learners can demonstrate given such objectives. This knowledge would help inform the criteria used, by ensuring that the learners interpret the criteria as intended and thus demonstrate the expected types of knowledge.

A study was conducted at the University of the Western Cape aimed at understanding the types of knowledge that learners demonstrate as they developed ePortfolios. The main learning activity was development of ePortfolios using artefacts from fieldwork activities. This study was useful in helping determine the importance of identifying the types of knowledge that the rubric aims at creating before developing the criteria. The following sections describe the context, research criteria, findings and the proposed model for evaluating the appropriateness of scoring categories to a stated purpose - based on specific types of knowledge.

II. Context

The study was conducted at the Social Work department, University of the Western Cape, South Africa. This involved four second year learners and a course convener. The learners were expected to develop ePortfolios that would showcase evidence that they have acquired competency in each of the exit level outcomes outlined in the rubric. The learners used the rubric for self and peer review before submitting to the course convener for evaluation.

A. Criteria

Face to face interviews and content analysis were used to obtain data. Face to face interviews with the course

Manuscript received Apri 11, 2012; revised June 12, 2012.

The authors are with University of the Witwatersrand, South Africa (e-mail:wandopm@gmail.com).

convener revealed that the rubric did not specify the types of knowledge that would be manifested from its use. A total of 573 statements from the learners' ePortfolios were also analysed. In order to quantify the knowledge content, a statement received a score of one if some of the characteristics of a knowledge type in question were traceable, and zero, if none was traceable. *Table 1* below was developed to help in analysing the types of knowledge in the ePortfolio content.

TABLE I: KNOWLEDGE METRIC

Type of Knowledge	**Description**	**Characteristics**
Implicit or Tacit Knowledge	• It consists of beliefs, perceptions, ideals, values, emotions and mental models so ingrained in us that we take them for granted [6]. These are formed through concrete experiences [7]. They are highly personal, hard to formalize, difficult to communicate or share with others [8; 6]. • Tacit knowledge is mainly acquired through observation, imitation & practice [9].	• It informs the action • Guides on 'what to do' • Contains personal information • Comprised of individual experiences • Consists of ideas, values and emotions • Associations made are not explicit at the beginning • Difficult to verbalize • Relatively disorganized within memory • Informal • Does not require conscious control to apply it • Comprises of internalized rules
Explicit Knowledge	• This is knowledge about certain knowledge and how to use such knowledge [10]. • It is expressed using words, numbers, scientific formulae, product specifications, manuals and principles [6].	• It is expressed in written form and includes: Scientific formulas, Principles, Manuals and Specifications • It is specific • Contains explanations on "how to" use knowledge • It is applied consciously • It is controlled • It is declarative and stable • It is factual • It is learnable
Subjective Knowledge	• This is what one thinks they know [11]. • It is self-perceived knowledge which could be explained as the sum of knowledge and self confidence [12].	• Subjective knowledge = knowledge + self confidence • It is self-perceived • It is self-assessed • It is sourced from personal and impersonal sources • Personal sources – Internal memory, word of mouth • Impersonal sources – Written sources, mass media • Informs decision making • Relies on experience
Objective Knowledge	• This is actual knowledge and is measured by some tests [11].	• It is stored in memory • It is the content or substance of knowledge • It is actual knowledge • It is measurable • It comprises of: standards, conventions, accepted procedures, pragmatic results and models
Declarative Knowledge	• It entails the memory of facts and events [8]. • It is knowledge about facts [13], figures, rules, relations and concepts in a task domain [14]. • Address "what" type of questions [8].	• It is factual • Its application requires the memory of facts • Comprised of a combination of: figures, rules, relations and concepts • Addresses "what" type of questions • It is content-based – information in need of meaningful interpretation • It is experiential
Procedural Knowledge	• It is knowledge about how things are done [13]. It is comprised of steps, procedures and sequences [14]. Pertains accomplishment of some task and comprises of a sequence of steps [15]. • Some of these procedures are formed from declarative knowledge, others from tacit knowledge comprising of heuristics [8].	• It explains "how things are done" • It is stored in either short or long term memory • It comprises of ; steps, procedures, rules, sequences, strategies and skills • It is domain specific • It lacks flexibility • It depends more on explicit knowledge • It relies on intuition
Rationale Knowledge	• It is knowledge about why things are done [13].	• It consists of explanations • It tells "Why things are done"
Synthetic Knowledge	• It is knowledge that is obtained out of the use of existing knowledge using methods such as observation [16].	• It is context specific • It uses tacit knowledge • It is formed during the application phase of knowledge • It is mainly used in industrial settings such as engineering
Analytic Knowledge	• Involves conclusions reached by applying declarative and procedural knowledge to a particular domain [13]. • It's the sum of concepts and evidence supporting	• It consists of conclusions reached through the application of declarative and procedural knowledge • It requires understanding of the world in question • It requires the ability to memorize, induce and deduce facts

Type of Knowledge	Description	Characteristics
	such concepts [16].	• It explains why an object of study is the way it is • It requires deductive reasoning • It generates concepts and provides the required evidence to explain the validity of such concepts
Factual Knowledge	• It entails factual information such as the existence of something in a specific domain, validity of a belief [15].	• It contains assertive statements • It comprises of facts
Inferential Knowledge	• Created from existing factual knowledge and is captured during knowledge acquisition phase [15].	• It uses factual knowledge • It consists of solutions developed from the application of factual knowledge • It tells "how and why"
Descriptive Knowledge	• It entails description of situations, conditions and events and is presented in the form of text, video, audio and graphics such as pictures and tables [15].	• It consists of descriptive statements and evidences • It comprises of text and other media types • It explains situations, conditions and events • It depends on factual knowledge
Objective Knowledge	• This is actual knowledge and is measured by some tests [11]	• It is actual knowledge • It is measurable • It forms the content or substance of knowledge • It is stored in memory • It consists of : Standards, Conventions, Accepted procedures, Pragmatic results and Models

A. Findings

Table II below summarizes the outcome of the content analysis:

TABLE II: RESULTS PER KNOWLEDGE TYPE

Code	Knowledge Type	Overall %	Learner %			
			A	B	C	D
A	Implicit	4	10	1	2	2
B	Explicit	10	7	11	15	10
C	Subjective	28	37	20	11	34
D	Objective	0	0	0	2	1
E	Declarative	10	7	12	14	10
F	Procedural	3	1	4	2	4
G	Rationale	7	3	9	12	6
H	Synthetic	0	0	0	0	0
I	Analytic	11	14	9	10	9
J	Factual	0	0	1	0	0
K	Inferential	0	0	0	0	0
L	Descriptive	27	21	33	32	24
	Total (%)	**100**	**100**	**100**	**100**	**100**

B. Discussion

Despite the fact that each of the four learners used the same rubric, each produced different sets of types of knowledge. These findings are illustrated in *Table 2* above. The fact that each learner demonstrated a unique set of knowledge types is attributed to the failure to explicitly identify the types of knowledge that the purpose and objectives of the rubric aims toward. This implies that some of the knowledge that these learners demonstrated was not awarded by the rubric since the criteria lacked in assessing such types of knowledge.

C. Proposed model

This model aims at addressing gap in rubrics where the purpose and objectives are not mapped to types of knowledge. The criteria developed for each objective is therefore made more specific as it is informed by the types of knowledge possible for that objective. This would help in ensuring that learners create content that is relevant to the rubric.

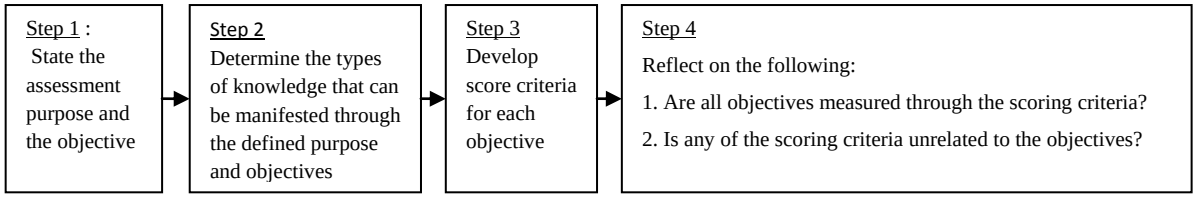

Fig. 1. Evaluating the appropriateness of scoring categories based on knowledge

ACKNOWLEDGEMENTS

Much appreciation to the University of the Western Cape, in particular, the Social Work department lecturers and learners who participated in this research.

III. REFERENCES

[1] K. Alfie, "The trouble with rubrics," *English Journal*, vol. 95, no. 4. pp. 12-15, 2006.
[2] M. Kathleen, "Classroom Rubrics: Systematizing What Teachers Do Naturally," *The Clearing House*, vol. 73, no. 6, pp. 324-328, 2000.

[3] H. G. Andare, *Understanding Rubrics*, Educational Leadership 54, pp. 4-8, 1997.
[4] M. M. Barbara and A. L. Jon, "Practical Assessment, Research and Evaluation," *Scoring rubric development: validity and reliability*. vol. 7, no. 10, 2000.
[5] *Expansive Learning at Work: toward an activity theoretical reconceptualization.* Journal of Education and Work, vol. 14, no. 1, pp. 133-156, 2001.
[6] S. Hari (2010). "Types of Knowledge," *The Global Development Research Center*. gdrc [Online] Available: http://www.gdrc.org/kmgmt/km-7.html.
[7] *Knowledge types and Organizational Forms in Knowledge Management.* Jorna, Rene, International Symposium on the Management of Industrial and Corporate Knowledge (ISMICK), 2001.
[8] M. Gorman, "Types of Knowledge and Their Roles in Technology Transfer," *Journal of Technology Transfer*, pp. 219-231,2002.
[9] N. Ikujiro, *The Knowledge-Creating Company.* New York : Oxford University Press, 1995.
[10] *The Definition and Measurement of L2 Explicit Knowledge.* Ellis, Rod. 2004, Language Learning, pp. 227-275, 2004.
[11] L. L. Reinecke and E. G. Ronald, *A Short Reliable Measure of Subjective Knowledge*, *Journal of Business Research 46*, pp. 57-66, 1999.
[12] P. S. Raju, L. Subhash, and W. G. Mangold, *Differential Effects of Subjective Knowledge, Objective Knowledge, and Usage Experience on Decision Making: An Exploratory Investigation.* 1995, Journal of Consumer Psychology, pp. 153-180, 1995.
[13] M. Christine and M. A. S. Miner, "Organizational Improvisation and Organizational Memory," *The Academy of Management Review*. October 1998, pp. 698-723, 1998.
[14] C. J. Nancy, et al, Human Factors *Measuring Team Knowledge.*, 42, pp. 151-173, 2000.
[15] B. Jasen, and G. Bray, and S. N. France, "13th International Conference Avignon," *Context and Knowledge Types vs Serendipity*, pp. 85-95. 1993.
[16] M. Jerker, C. Lars, and A. Bjorn, "Environment and Planning A" *Explaining spatial patterns of innovation: analytical and synthetic modes of knowledge creation in the Medicon Valley life-science cluster*, vol. 40, no. 5, pp. 1040-1056, 2008.