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Assessing learning outcomes through students' reflective thinking

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Abstract

Assessing students' reflective thinking could reveal learning outcomes which summative assessment could not. Therefore, the researcher as course instructor decided to look into students' reflective writing for a more insightful feedback on their learning outcomes. One cohort of students in an environmental management course were requested to write reflection notes at the completion of each assignment, and towards the end of the course a piece of reflective essay. The students' reflective writings were then analysed for snippets of evidence that purportedly meets the course learning outcomes. These evidences of students' learning outcomes were gathered and examined for emerging patterns and trends in the students' reflective thinking that relates to the course objectives. The document analysis method was applied to identify and match the students' reflective writings with the learning objectives. Findings reveal students' achievement of learning outcomes and higher order thinking skills, as outlined in the course objectives. It is hoped that findings from this research will further support the significance of reflective thinking on learning. Reflective notes provide meaningful feedback on learning to instructors that could be acted upon towards improvement of a course. Educators and educationists could look at students' reflective writings as an effective form of assessment that would provide a more insightful assessment of students' learning and thoughts.

1. Introduction

This paper presents the preliminary analysis of reflective writings by students in a practical based environmental management course.These reflection notes were written after each practical module and a reflective essay at the end

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of the course. These reflection notes were analyzed to detect learning outcomes in the cognitive, affective and psychomotor domains. These learning outcomes were predefined at various levels for each domain of learning. The standard modes of assessment are based on coursework and a sit in paper and pencil final examination. These classic forms of assessment are not able to capture the thought processes that occur during the learning experience. In attempting to get a more insightful feedback on student learning outcomes, the course instructor as researcher, decided to explore students' reflective writings.According to Marzano (1993), information may be gathered from a variety of situations to obtain feedback on student learning which may be used to assess students' 'multiple dimensions of learning'. Evaluating students' reflective writing is one form of alternative assessment. Alternative assessments evaluate not only the product and performance outcome but also the process. Unlike standardized achievement tests, alternative assessments strive to uncover the learning process students engage in.

In this research, reflective writing is conceptualized as a process tool to assess learning outcomes and critical thinking. The objective of this research is to analyse students' reflective writings and identify learning outcomes in the cognitive, affective and psychomotor domains, critical thinking and problem solving skills, and life-long learning.

1.1. Theoretical framework

This classroom-based research draws on the essence of reflective thinking and the encapsulation (and/or decapsulation) of learning experience and metacognition in reflective writing, with the ultimate aim of informing professional practice.Student reflection is deemed central to a student's learning experience. Reflection captures the conceptualization of knowledge, thoughts and feelings that are undetected in normal class routine. Assessing students' reflective thinking could reveal learning outcomes which summative assessment could not. Students who are asked to elaborate on topics and explain it are more likely to remember it and use that knowledge later. It is important for students to be able to structure or restructure an experience, a problem, or existing knowledge or insights in the midst of practice. In this regard, two great proponents of reflective thinking, Dewey (1910) and Schon (1983, 1996), concur in their believes that the process of developing reflective practitioners requires student to continually reflect on the self and experiences past or future. According to Boud and Walker (1985), reflection is an important human activity in which people recapture their experience, think about it, mull it over and evaluate it. The ability to reflect characterizes effective learning from experience.

The value of reflection in teaching and learning is that it encourages one to view problems from different perspectives. Dewey (1910) pointed out that it is not sufficient to just 'know', it is also necessary to 'apply' concepts learned. Dewey postulated two components of reflective thinking: the first involves a state of perplexity, hesitation, doubt, and the second involves an act of search or investigation directed toward bringing to light further facts which serve to corroborate or to nullify the suggested belief. Subsequently Dewey draws the conclusion that "thinking proceeds from a higher faculty (of reason), and is occupied with spiritual or at least literary things" (Dewey, 1944, p.153).

1.2. From reflective thinking to reflective writing

Reflective writing is one practice that reinforces and concretize the process of reflection, as exerted by Olson (2009, p.51), "through writing, expressions become permanent objects fixed in time and space." Journal writing skill is a tool in becoming reflective practitioners. Reflective writing, as in journal writing, is a habit that needs to be developed (Eddy, 2011). Levin and Wagner (2005) believe that writing is one of the most powerful tools for discovering, organizing, and communicating knowledge. The authors stress the importance of writing and the value of combining articulate writing with discipline-based learning, including scientific inquiry

Writing is not just a way to express or display our knowledge. Writing in itself is a fundamental mode of learning, allowing students to reflect on what they have learned, clarify their thoughts, stimulate and foster the ability to organize knowledge and reflect upon beliefs. Writing also encourages analytical criticism and the development of ideas, and provides an important discursive tool for organizing and consolidating basic ideas into more coherent and structured knowledge. When writers use their writing as a tool for reflection, they can clarify

their thoughts more precisely. In concurrence with Levin and Wagner (2005), Greene (2011) believes the use of reflective writing can transform learning when students begin to incorporate meta-cognition, or thinking about their thinking, into their writing processes as they simultaneously learn the curriculum. Allan and Driscoll (2014) found that integration of reflection into writing assignments could enhance assessment of learning outcomes, foster student learning, and encourage faculty engagement in professional development.

Students need to be guided in reflection writing to focus on learning. An important question, then, is to explore whether and if scaffolds and other support structures can help to develop the needed intellectual level to be able to reflect at higher levels.Levin and Wagner (2005) maintains that writing-to-learn tasks should encourage students to conceptualize writing in a way that emphasizes exploration, expressive inquiry, discovery,problem-solving, decision making and knowledge construction. In order to achieve these learning outcomes, students should be assigned writing tasks that require them to consolidate their understanding and reflect on what they have learned through writing. Writing-to-learn techniques in the science classroom is considered a tool for improving thinking and communication skills and facilitating enculturation into the community of science practitioners. It follows that reflective writing, while improving thinking and communication skills, enables students to discover knowledge and develop comprehension in science, thereby engendering scientific literacy (McDonald & Dominguez, 2009).

2. Methodology

The population under study consists of first year Bachelor of Environmental Management students taking the Science and Geography Practicals for Environmental Management in the Faculty of Environmental Studies. This course consists of three credits of practical classes delivered in fourteen weeks. This course explicitly outlined the learning outcomes in the cognitive (C), psychomotor (P), and affective (A) domains, critical thinking and problem solving (CTPS), and life-long learning (LL). During each practical class, students carry out modular practical activities in the laboratoryor outdoors. Students write reflective notes as they worked oneach modular activity, and upon completion of the course, students were asked to write a reflective paper on the course.

One intact class of thirty-nine students was selected for the study. Twenty-four students submitted their reflective writings. The participants' background is shown in Table 1.

Table 1. Background

Sample:	N=24
Course Major:	Bachelor Environmental Management
Mean Age:	20
Gender	
Female:	17 (70.8%)
Male:	7 (29.2%)

The students' reflective writings were analyzed for the learning outcomes outlined in the course objectives.

The document analysis method is applied in the analysis of students' reflection whereby each defined text segments corresponding to a coherent idea in the reflective writing were identified (Kember, 1999). These text segments or snippets of texts were then coded according to the category of learning outcomes in the cognitive, affective and psychomotor domains (UPM, 2013).The codes used and the corresponding learning outcomes are given in Table 2. The text segments were also coded for life long learning (LL) and critical thinking and problem solving skills (CTPS). Although team spirit (TS) is not a stated learning outcome for this course, it is also coded because this learning outcome repeatedly appeared in the students' reflection papers. Each defined text segment was evaluated according to the highest level of reflection for each learning outcome.

This analysis acknowledges fourlevelsofreflective writings as identified by Hatton andSmith(1994).Thesefourlevels are(1)descriptivewriting(reportsofeventsorliterature,whichisnotreflectionatall), (2)descriptivereflection(providingreasonsbasedonpersonaljudgment),(3)dialogic reflection(aformofdiscoursewithoneselfandexplorationofpossiblereasons),and(4) criticalreflection(involvingreasonsfordecisionoreventswhichtakeaccountofthe broaderhistorical,social,politicalcontexts). The first form, descriptive writing, does not involve reflection, therefore only writings at levels 2, 3, and 4 were regarded as reflective forms of writing. Taking this into

consideration throughout the analysis, plain descriptive writings were ruled out, only writings that conform to levels 2, 3 and 4 were accepted as reflective writings.

Data were analyzed using statistical analysis software for the frequencies in which each type of learning outcome occurs.

Table 2. Codes for learning outcomes in the cognitive, affective and psychomotor domains

Code-Cognitive Domain	Code-Affective Domain	Code-Psychomotor Domain
C1 Knowledge	**A1** Receiving phenomena	**P1** Perception
C2 Comprehension	**A2** Responding to Phenomena	**P2** Set
C3 Application*	**A3** Valuing*	**P3** Guided Response
C4 Analysis	**A4** Organising Values	**P4** Mechanism*
C5 Synthesis	**A5** Internalising Values	**P5** Complex Overt Response
C6 Evaluation		**P6** Adaptation
		P7 Origination

*Expected learning outcome level for the course

4. Results and discussion

Results showed that 54.2% of the student reflections were at the lowest cognitive level of knowledge acquisition (Table 3). Only 29.2% met the set course learning outcome at the application level (C3).Approximately 80% of students showed learning outcomes in the affective domain.Remarkably, one student showed affective learning outcome at level 5 (internalizing values) which surpassed the set course learning outcome of A3 (Valuing).Only two-third of the students reflected on their psychomotor skills; 62.5% perceived they have acquired psychomotor skills at the first level, but none had achieved the set course learning outcome of P4 (Mechanism).

Only 12.5% of students indicated basic critical thinking and problem solving skills (CTPS) in their reflections. Most of the writings (87.5%) did not indicate any critical thinking (Table 4).About two-third (66.6%) expressed life-long learning (LL) in their reflective writings. Life-long learning is a stated learning outcome.A number of students (6%) had reflected upon the importance of team spirit (TS) in their writings (Table 4) although it is not a stated learning outcome for this course. This serendipitous finding is not surprising since practically all activities require students to work in groups.

Table 3. Learning outcomes in the cognitive, affective and psychomotor domains

ConitiveDomain	Frequency (%)	Affective Domain	Frequency(%)	Psychomotor Domain	Frequency(%)
NA	1(4.2%)	NA	2(8.3%)	NA	8(33.3%)
C1 Knowledge	13(54.2%)	A1 Receiving Phenomena	19(79.2%)	P1 Perception	15(62.5%)
C2Comprehension	3(12.5%)	A2 Respond to Phenomena	2(8.3%)	P2 Set	1(4.2%)
C3 Application	7(29.2)	A5 Internalize Values	1(4.2%)		
Total (N)	24(100%)	Total(N)	24(100%)	Total (N)	24(100%)

NA - Not Applicable

Table 4. Learning outcomes in critical thinking and problem solving, life-long learning and team spirit

Learning Outcomes	Frequency
Critical Thinking & Problem Solving (CTPS) CTPS1 identify, analyse problem	3(12.5%)
Life-Long Learning (LL) LL1 seek and manage information from a variety of sources	14(58.3%)
LL3 inquisitive and thirst for knowledge	2(8.3%)
Team Spirit (TS) TS1 build good relationship & interact with others	6(25%)
TS3 respect others	1(4.2%)

5. Conclusion

In summary, students' reflective writings revealed low achievement of the stated course learning outcome in the cognitive domain and critical thinking. Students are more inclined to express personal feelings and emotions

(affective domain) in their reflective writings. Many students were receptive to the course content and life-long learning in view of their future career. Some students showed awareness of the importance of cooperation and team spirit while working in groups.Reflective writings can be a valuable alternative assessment tool to evaluate student learning outcomes where summative assessment could not. Results from this study reveal the thought processes that occur in students' reflective thinking. Classroom instructors may apply findings obtained from this study to improve reflective writing and encourage reflection in higher order thinking skills (HOTS) among students, and all learning communities in general. Reflective writing is a life-long learning skill that can be developed. Educators need to engage in reflective practice to improve student learning and partake in the scholarship of teaching and learning.

Acknowledgement

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