OBE Method of Assessments for Capstone Civil Engineering Project Design

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Abstract

Civil Engineering capstone design course has been introduced in UNITEN since Semester 2 2006/2007. In the earlier of the introduction, this subject is considered as an elective subject but during Semester 2 2008/2009, the subject has become compulsory due to the requirement by Engineering Accreditations Council (EAC). This subject is a team design project applying engineering and project management principles for multidisciplinary design which would involve an integration of Civil Engineering including environmental, geotechnical, structural, water supply and drainage system, sewerage system, project management and road design. This course has divided the design stage into two stages which are preliminary design and final design. This paper is a review paper on the method of assessment for capstone design course and the example on the implementations of OBE method assessment in UNITEN. Method of assessment in this subject should be based on the student's participations, formal presentation, written reports, conceptual and detailed design and finally tender document and construction cost estimates. The assessments also including the bloom taxonomy to produce a well balanced student with ability to have critical thinking, soft skill and also technical skills. The rubric system makes the assessment easier by implementing range of marks to the quality of the works done by the undergraduate for the capstone design course. The future predictions of this course would be giving the real engineering projects to the students to help in the construction of a houses or buildings for poor community. This would expose the students to the importance of helping the community as the primary role of civil engineering is to help the community.

Keywords: bloom taxonomy, capstone engineering design, outcome based education, rubric assessment, method of assessment

1.0 Introduction

Civil Engineering Capstone design course are introduced to incorporate all the discipline in civil engineering branch into one subject. This course is to give an exposure to the undergraduates to real working design experience. The world faces challenges of global proportions that are complicated by significant human dimensions. As an engineering educator, we are challenged to prepare a generation of engineering professionals that are more versatile, socially conscious and able to collaborate and communicate effectively across cultural boundaries. This subject would provide a platform to produce graduates that are satisfying the widely-varied stakeholders: users, business and technical personnel and society at large.

Table 1: Course Outcome and Programme Outcomes of Capstone Design Civil Engineering Projects

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1. Apply civil engineering principles to solve structural, water supply, drainage road and environmental engineering project(C)		x									
2. Conceptualize plan and design (apply critical thinking) to solve structural, water supply, drainage road and environmental engineering project(C)				x							
3. Analyse structural, water supply, drainage, road and environmental engineering related problems (C).			x								
4. Discuss sustainable issues related to the projects. (C)					x						
5. Able to comprehend professional and ethical responsibilities (C).						x					
6. Function as a team member and as well as a leader in the project group.(A)									x		
7. Ability to use engineering software to conduct **civil** engineering design as well as to analyse data (P).							X				
8. Able to communicate effectively between client and team members (P)								x			
C – Cognitive domain; **A** – Affective domain; **P** – Psychomotor domain											

A number of assessment approaches have been proposed for measuring achievement of engineering design outcomes. The assessment for the class is done based on the Outcome Based Education (OBE) method. In OBE method, the Course Outcome (CO) of the subject and the Programme Outcomes (PO) are link together in order to achieve the OBE target. In UNITEN, we have developed 11 POs. The PO1, PO2, PO3, PO4, PO5 and PO6 are to educate the student on the fundamental and engineering knowledge of the students. These PO1 until PO6 are in assessing the cognitive domain. The PO7 is to assess the student ability to apply engineering tools and techniques to conduct civil engineering task as well as to analyze data. PO8 is to assess the student's ability to communicate effectively. These 2 POs are assessing the psychomotor domain. PO9 is to assess the student's ability function effectively as a team members as well as a leader. PO10 is to assess the student's appreciation towards social, cultural, global and environmental responsibilities of a professional engineer with the awareness

of contemporary issues. PO11 is to assess the student's ability on being able to engage in life-long learning in their civil engineering fields and their respective works. The PO9 to PO11 are addressing the affective issues in this course. The relationships of CO-PO are shown in Table 1.

2.0 Methodology

2.1 Method of Assessment

A study by McKenzie et al. (2004) provides findings on the assessment method which were divided into two phases. Phase one findings are based on the survey on the faculty members of the institutions. They were asked a variety of questions about the nature of the capstone experience, type of assessments employed and the extent to which current practices align with ABET criteria. It was reported that some ABET criteria are currently not well assessed in capstone design courses and expressed interest in collaborating with colleagues across the country on capstone design assessment, development and use. Phase 2 reports the findings from interviews and surveys of 98 faculty members identified from Phase 1. Findings suggest uncertainty on the part of many faculty members concerning sound assessment practices including writing objectives, using appropriate assessment strategies, and sampling material appropriately and controlling for mis-measurement of student achievement. The study shows that the method of assessment were not very comprehensive to cover all the criteria in ABET as to achieve the programs outcomes. Thus, this paper has made some suggestions on using OBE assessment based on the level in Bloom's taxonomy and rubric template for assessment method of capstone design.

The summary of the assessment of capstone design course in UNITEN is as shown in Table 2. In Table 2, there will be two stages of design namely preliminary design and final design. In the preliminary design, the preliminary report, conceptual design and preliminary presentations will be assessed. While in final design, the final report, detailed design, tender document with construction cost estimates, final presentations and detailed drawings will be assessed. Other than that, the project participations and team work will also be assessed based on weekly client consultant meetings. The assessment of participations and teamwork will be divided into three domains of Bloom Taxonomy.

Table 2: Assessment of Capstone Civil Engineering Design Projects

Project Participation & Team Work			20%
Written Reports	Preliminary Report (due in week 5)	5%	20%
	Final Report (due in week 14)	15%	
Conceptual & Detailed Designs	Conceptual Design (due in week 5)	10%	25%
	Detailed Design (due in week 14)	15%	
Formal Presentations	Preliminary Report & Conceptual Design Stage (due in week 5)	10%	25%
	Final Report & Detailed Design Stage (due in week 16/17)	15%	
Tender Document With The Construction Cost Estimates			10%
TOTAL			100%

2.2 Preliminary Report and Conceptual Design

The Preliminary Report & Conceptual Design is due in week 5 and to be submitted to the Course Coordinator. The Preliminary Report & Conceptual Design will have to be prepared on a collective basis with input from each and every member of the design teams while the presentation will be done individually on a particular aspect of the design undertaken by the particular student.

Assessment of the Preliminary Report & Conceptual Design will be based on the following:

a) A brief scene setting introduction to the context of the design project
b) A clear statement of the project objectives and design parameters
c) Collection of information about the constraints and the requirements to be embodied in the design solution
d) Proposing design solution by determining the general arrangements, material types, shapes, sizes etc of all design components
e) A project schedule in Gantt Chart form to provide an estimated timeline of the project deliverables and important milestones

2.3 Final Report and Detailed Design

The Final Report & the Detailed Design will have to be submitted in week 14 on a collective basis with a distinct contribution from every member of the design teams. The design teams will present the Final Report & Detailed Design to a committee, which may comprise of members from the Department and Industry. The Final Report & Detailed Design should document and discuss the project development, civil and structural design with an emphasis on the technical aspects of the project, including preparation of a brief cost plan. The final report is a complete report pertaining to the project carried out. It contains improved contents of the Preliminary Report. It should consist of discussions, design solutions and conclusions. It is to be evaluated by a panel of assessors. The Detailed Design is the document where all the details of the final design are specified and construction drawings and documentation are produced.

2.4 Bloom's Taxonomy

The threes Bloom Taxonomy's of learning domains are namely cognitive domain, psychomotor, and affective. Each domain has different level of assessment. The cognitive domain (Bloom, 1956) involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns and concepts that serve in the development of intellectual abilities. There are six major categories of cognitive domain. The affective domain (Krathwohl, Bloom, Masia, 1973) includes the manner in which we deal with things emotionally such as feelings, values, appreciation enthusiasms, and attitudes. The five major categories show the simplest behavior to the most complex. The psychomotor domain (Simpson, 1972) includes physical movement coordination, and use of the motor skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. The seven major categories are listed in Table 3 from the simplest behavior to the most complex.

3.0 Discussions

Engineering design subject is also recognized as a vehicle for cultivating many of the practical skills needed for engineering practice (Dym et al., 2005). In order to facilitate this requirement, students are taught to learn in exploring and formulating problems by using interactive assignment structure (Stuart, 1997). The implementation of combination of cognitive domain, psychomotor domain and affective domain has become challenges to the lecturers and also the students to carry out the assessment. The framework of assessment has been proposed to provide a structure for aligning learning outcomes, methods for examining performance related to these outcomes and providing feedback that improves student learning in these outcome areas (Meyer, 2005).

Based on Sobek and Jain (2004), the assessment for his capstone course was done based on cost, time and quality of the design process. In the capstone design projects, time can measured in terms of number of weeks of total design time, e.g., one 15-week semester. The cost can be measured by the number of person hours devoted to the project. Additionally, he also focuses on quality measurement, specifically the development of two distinct instruments designed to measure the quality of a design outcome, the Client Satisfaction Questionnaire (CSQ) and the Design Quality Rubric (DQR). They found that they obtained significantly different scores using the two instruments. Thus, the CSQ and DQR scores should not be combined: customer satisfaction and design quality should keep as separate measures of capstone project outcomes where such measures are applicable.

Kim (2009) has implemented a formative assessment to the capstone design course. Formative assessment is a self-reflective process that intends to promote a learner to obtain an adequate level of skill of some subject. Formative assessment works as a means of adapting learners' needs and their attainment, and stands opposed to summative assessment which provides an indicator of progress at the end of particular learning course. Fundamentally, he have designed a formative feedback structure where students recognize course outcomes explicitly and prepare for improving their skill in terms of course outcomes by self-motivated problem-solving and peer learning. But the studies are still in the early of implementations. There are some problems that need to be solved before full implementations.

A conceptual model for engineering design has been introduced by Davis et al. (2006) that offer a valuable resource for improving design education, especially in capstone design courses. The model addresses design performance considered important to both learner development and solution development. Four performance areas which are personal capacity, team processes, solution requirements and solution assets are focusing students' and educators' attentions on four aspects of design performance that together can represent achievements of design experts. Iterative and interactive aspects of the model describe the repeated use of an elementary design process to advance development and reveal ways in which area of performance contributes to development of each area. Therefore, this conceptual model presents a "scientifically credible understanding of ways learners represent knowledge and develop expertise in domain of design, which is required for developing assessments.

Furthermore, as suggested by Dinehart and Gross (2010), the capstone course could be expand to the higher level by incorporating the real international service project to the students. Their studies have showed that the students which participate on the service project achieved higher non-technical outcomes compared to those who do not

participate. In UNITEN these service project has not been implemented but it will be further improved in the future.

As the current practice in UNITEN, there were two stages of the assessment which is preliminary and final stage. In the preliminary stage the report is about the conceptual designs. The students are to present their concept of the building which consists of structure system of the building, water reticulations system, water sewerage system, foundations system and environmental plan. The complete conceptual design need to be presented by the students before it can be commenced to the final design stage. The approved conceptual design will be further progress with the detail design. The detail design consists of the detailed design calculations of the structure system such as beam design, column design, staircase, slab design, pile cap design and roof system design. Foundation detailed design consist of borehole interpretation, piling design, retaining wall and also slope design. Water reticulations system consists of water supply system from the tapping point to the water tank and piping system. Water drainage system consists of drainage flow system from the parameter drainage until it is being discharge to the main drainage. Environmental detailed design consists of the environmental management plan report for the area. Sewerage system detailed designs consist of the reticulation design from manhole system and discharged to the nearest STP. Apart from the preliminary report and detail report, we have the teamwork and participation marks. The teamwork and participation marks are given based on the rubric system developed for the capstone design course.

The duration for completing the capstone design project in UNITEN is one semester. Based on the experienced of 8 semesters, the students are able to complete the project within the semesters with limited scope. As compared to Ricketts (2006), the course has been introduced since 2001 until today, shows that there is significant improvement in students performance. The faculty carefully formulated projects to be smaller in scope than the ones previously attempted by students. This scaling back has enabled the students to successfully complete the projects within the allotted time constraints of one semester. Additionally, students demonstrate that they can apply in practice; both the theoretical and the practical knowledge gained from an applied technical curriculum. They consistently show an ability to integrate multiple curriculum topics (*i.e.,* synthesize) in such a way that a minimum acceptable level of competency is demonstrated. Therefore, the durations given to the students are sufficient to complete the project.

3.1 Rubric Assessment

Rubrics are tools that can help capstone instructors come to legitimate conclusions about the construction of higher level conceptual knowledge, performance skills, and attitudes. Attributes of a quality rubric include: (a) clear criteria, (b) rich, descriptive language, (c) positive attainment, (d) differentiation of performance, product and effort, and (e) universal validity and reliability (Beyerlein et. al, 2006).

For the easier assessment of the project participation and teamwork, a rubric system has been introduced. Rubric system is an authentic assessment tool used to measure student's work. It is a scoring guide that seeks to evaluate a student's performance based on the sum of a full range of criteria rather than a single numerical score. Table 3 shows the criteria and the quality level of students for teamwork and participations in capstone design project course. The importances of rubric system are to focus on measuring a stated performance, to use a range to rate performance and it contains specific performance characteristics arranged in levels indicating the degree to which standard has been made.

The levels of the criteria are divided into 4 components which are from the highest quality level to the lowest quality level i.e. distinguished until unacceptable.

Table 3 Criteria and Quality Level of Teamwork and Participation in Capstone Design Project

Criteria	Distinguished *(20-17 marks)*	Proficient (16-14 marks)	Basic (13-9 marks)	Unacceptable (8-3 marks)
Workload	Did a full share of the work--or more; knows what needs to be done and does it; volunteers to help others.	Did an equal share of the work; does work when asked; works hard most of the time.	Did almost as much work as others; seldom asks for help.	Did less work than others; Doesn't get caught up after absence; doesn't ask for help.
Getting Organized	Took the initiative in proposing meeting times and getting group organized.	Worked agreeably with partner(s) concerning times and places to meet.	Could be coaxed into meeting with other partner(s).	Did not meet partner(s) at agreed times and places.
Participation in Presentations	Provided many good ideas for the unit development; inspired others; clearly communicated desires, ideas, personal needs and feelings.	Participated in discussions; shared feelings and thoughts.	Listened mainly; on some occasions, made suggestions.	Seemed bored with conversations about the unit; rarely spoke up and ideas were off the mark.
Client Consultant Meeting Deadline	Progress in the design project ahead of time.	Progress in the design project on time.	Needed some reminding; progress work was late but it didn't impact grade.	Needed much reminding; project progress was late and did impact quality or grade.
Showing up for Meetings	Showed up for meetings punctually, sometimes ahead of time.	Showed up for meetings on time.	Showed up late but it wasn't a big problem for completing work.	No show or extremely late. Feeble or no excuse offered.

Score				
Providing Feedback on the comment from meeting score	Habitually provides dignified, clear, and respectful feedback.	Gave feedback that did not offend.	Provided some feedback Sometimes hurt feelings of others with feedback or made irrelevant comments	Was openly rude when giving feedback.
Receiving Feedback Score	Graciously accepted feedback.	Accepted feedback.	Reluctantly accepted feedback.	Refused to listen to feedback.

3.2 Bloom's Taxonomy Assessment

The total of 100% marks is divided into three parts for the bloom taxonomy assessment marks namely 80% cognitive domain, 10% psychomotor domain and 10% affective domain. The Programme Outcomes are aligned with the bloom taxonomy and are shown in Table 5. The level of the bloom taxonomy from level 1 until level 5 (i.e. lowest level to the highest level) is shown in Table 4. Psychomotor domain is only assessed for level 1 until level 3. We do not assess to the highest psychomotor level because we are producing engineers not technician. The same applies for affective domain. The levels of affective domain only up to level 3 are assessed.

Table 4: Bloom's Taxonomy Assessment and Programme Outcomes for Capstone Design Course

PO No.	Descriptions	Bloom Taxonomy Domain	Level of Bloom Taxonomy
PO2	Apply engineering principles in solving problems relevant to **civil** Engineering	Cognitive domain	1,2,3,4,5
PO3	Analyse **civil** engineering related problems	Cognitive domain	1,2,3,4,5
PO4	Apply critical thinking in designing and evaluating components, processes and systems related to **civil** engineering.	Cognitive domain	1,2,3,4,5
PO5	Comprehend the principles of sustainable development.	Cognitive domain	1,2,3,4,5
PO6	Comprehend professional and ethical responsibilities.	Cognitive domain	1,2,3,4,5
PO7	Apply engineering tools and techniques to conduct **civil** engineering design/experiments as well as to analyse data (P).	Psychomotor domain	1,2,3

PO8	Communicate effectively	Psychomotor domain	1,2,3
PO9	Function effectively as a team member as well as a leader.	Affective domain	1,2,3
PO11	Acknowledge the need for, and be able to engage in life-long learning in their civil engineering fields and related works.	Affective domain	1,2,3

3.3 Professional Practitioner Input

The assessments of formal presentations for preliminary and final stage as shown in Table 2 were evaluated by professional practitioner and other faculty member from civil engineering department. These assessments are important to expose the student to the real world where professional practitioner would comment their design work. This was also being practiced by Beyerlein et. al (2006). They have experience that their assessment framework served as a quality assurance tool to ensure the execution of each step in the methodology of capstone design course. Their assessment method also includes the feedback by professional practitioner, students and educational researcher. The feedbacks are important for continuous quality improvement.

3.4 Integration of Ethics

The ethical issues need to be address as recommended by EAC. The integrations of ethics have only been highlighted in terms of preparation of report and submission of design to local authority. However, the assessment has not been measured directly. As been implemented by Catalano (2004) in State University of New York at Binghamton, USA, the ethics is integrated into the design course using both individual and design team assignment. Throughout the fall semester, several lectures focus on the following relevant topics: (a) moral reasoning theories including utilitarianism, Kantianism and right based theories, (b) engineering ethics and ethical case studies, (c) global and societal issues related to growth of modern technology and (d) the impact of technology upon nature. His students were typically assigned two case studies which challenging them to formulate their recommended plans of action using one of the moral reasoning theories. A survey has been done by Catalano (2004), and the result of this attempt to integrate ethics into engineering curriculum is certainly preliminary at best and inconclusive, yet they seem to hold promise. It can be concluded that the ethical issues are important to be addressed but the issues here is the additional work that need to be done apart from designing the real structure of building. Thus, at the moment, students are challenged to discuss in their report not only the reliability and economics of the structure but also sustainability, safety, societal impact and impact upon environment.

4.0 Conclusions

In conclusion, the capstone design course is the final year subject for undergraduate that prepares the student for the practical life of engineers. The Programme Outcomes (PO) and Course Outcomes (CO) are link together and the level of assessment is based on the Bloom Taxonomy and Rubric assessment. The bloom taxonomy has 3 domains which are cognitive, psychomotor and affective domain. The three domains are assessed based on the following percentages i.e. 80% for cognitive, 10% psychomotor and 10% affective. The assessment of the

students are based on the student team work and participation, preliminary report which consist of conceptual design and preliminary presentations, final report which consist of detailed design and final presentations, and finally tender document and construction cost estimates. These methods of assessment are hoped to help produce a well balanced undergraduates with ability to have critical thinking and soft skills and prepare the students to the real engineering practice. The future predictions for this course are to have a real challenging project to be given to students to help the community for example design and construction of house for poor people. This is important for the engineering students as the primary role of a civil engineer is to serve the community. Thus it is essential that students understand the impact of engineering projects on, and the context of engineering projects within society.

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Appendix 1: Assessment Rubric on Professionalism and Ethics (Affective Domain).

SCORING	1	2	3	4	5
AFFECTIVE RESPONSE CRITERIA	POOR		ACCEPTABLE		EXCELLENT
A. ATTITUDES & BELIEF ABOUT PROFESSIONALISM AND ETHICS	No awareness of professionalism and ethics development in the capstone design project. *None or erroneous evaluation of* professionalism and ethics *issues related to engineering projects/products.*		Valuing (acceptance) professionalism and ethics values in the capstone design project. *Mostly effective evaluation of* professionalism and ethics *development in engineering projects/product and its impact leads to improve results.*		Internalizing (embodiment) professionalism and ethics values in the capstone design project. *Totally effective assessment of* professionalism and ethics *development in engineering projects/product with explain results.*
B.MOTIVATION TO IMPLEMENT	No motivation to implement professionalism and		Motivate by belief to implement professionalism and		High level of engagement in implementing

PROFESSIONALISM AND ETHICS	ethics development *Student not motivated on* professionalism and ethics *development in their written assignment and teamwork report.*		ethics development *Students are motivated on* professionalism and ethics *development in their written assignment and teamwork observation.*		professionalism and ethics development *Student advocate professionalism and* ethics *development intrinsically in their written assignment and teamwork observation.*
C.CONFIDENCE LEVEL	Low *Receptive to participate in discussion/teamwork*		Medium *Ability to contribute in discussion/teamwork*		High *Advocacy for* professionalism and ethics *in discussion/teamwork*

Appendix 2: ORAL /PRESENTATION SKILLS BASED ON RUBRICS SYSTEM (Psychomotor Domain)

PO8 – Communicate Effectively (Psychomotor Domain)

Scale	1 Poor	2	3 Satisfactory	4	5 Excellent
Criteria					
1) **Content**	Insufficient in the components of a presentation. No / lacking references.		Presentation must consist of the following: 1. Title 2. Objective 3. Methodology 4. Results & analysis 5. Discussion & conclusion 6. References		Apart from 'Satisfactory', extra elements are included such as concise abstract appendix, proper &

						sufficient references TOC, etc.
2)	**Presentation tools**	Blurry pictures, too many texts, small font size. No effort is seen in the usage of effective presentation tools.		The use of proper audio visual aids, e.g. OHP, power point video, LCD etc		Extra effort in the manipulation of aids and effectively attract and capture attention of audience. E.g. flash macromedia applications include the use of multi-application tools.
3)	**Fluency**	Poor command of language, improper usage of grammar. Taught process is vague. Self-interrupted presentation.		Good command of the use of the language. Able to organize the thought process according the content. Flow of presentation is continuous.		Highly competent in the usage of language. Excellent intonation /voice control. Spontaneous without referring to flashcards/notes.
4)	**Style / delivery**	Very rigid, monotone voice. Not good time keeping.		Gestures (body language) / psychomotor is in accordance to the content. Confident. Appropriate use of space. Good time keeping.		Excellent usage of body gestures to capture the attention of the audience. Highly confident. Presentation is appropriately distributed in time according to the content.
5)	**Question & answer**	Unable to answer most of the questions. No effort		Most of the questions can be answered and supported with evidence.		All questions can be answered confidently

	in justifying the answer.			and calmly, with justification.

Appendix 3: REPORT ASSESSMENT RUBRIC (Cognitive Domain)

Criteria	Distinguished	Proficient	Basic	Unacceptable
Statement of Purpose	Readily apparent to the reader; concisely stated in a single sentence, this is engaging and thought provoking.	Clear but may sometimes digresses in the paper; stated in a single sentence.	Not consistently clear stated in a single sentence.	Generally unclear Incomplete, unfocused, or absent.
Introduction	Relevance of topic to class or audience is apparent. The groundwork for paper easy to predict because important topics that will be discussed are specifically mentioned.	A good attempt is made as to why the topic is pertinent but may be slightly unclear, or lacking in insight or originality Organization for rest of the paper stated.	May be unclear (contain many vague terms), appear unoriginal, or offer relatively little that is new; provides little around which to structure the paper.	No reference to the topic audience or relevance.
Content	Clear examples to support specific topic sentences and to support the overall purpose; reader gains important insight analysis poses novel ways to think of the	Examples support most topic sentences and support general purpose; reader gains some insight occasional evidence of novel ways to think about the	Examples support some topic sentences reader gains little insight; The essay shows little of the writer's own relying instead on quotes and paraphrasing that are	The essay relies on stringing together quotes or close paraphrasing; Failure to support statements with major content omitted Quotes not integrated improperly.

	material; quoted material well integrated; depth of coverage without being redundant.	material. Quotes well integrated into sentences. Topics adequately addressed but not in the detail or depth expected.	poorly connected Examples support some topic sentences no evidence of novel thinking and intermittent support of thesis through with evidence.	
Organization	The ideas are arranged logically to support the purpose Transitions link paragraphs. It's easy to follow the line reasoning. Subheadings are used throughout the paper allowing the reader to reader moves easily through the text. Paragraphs have solid topic sentences.	The ideas are arranged logically to support the central purpose Transitions usually link paragraphs. For the most part, the reader can follow the line of reasoning. Subheadings are used throughout the paper to guide the reader without undue confusion; a few paragraphs without strong topic sentences.	In general, ideas are arranged logically, but sometimes ideas fail to make sense together. The reader is fairly clear about what writer intends. While subheadings are used the content beneath them does not follow many paragraphs without topic sentences.	Ideas are not logically organized. Frequently ideas fail to make sense together. The reader cannot identify a line of reasoning Subheadings not used Few or no topic sentences.
Tone for an academic research paper.	Consistently professional and appropriate.	Generally professional and appropriate.	Not consistently professional or appropriate.	Not professional or appropriate.

Sentence Structure	Sentences are well-phrased and varied in length and type. They flow smoothly from one to another with no run on sentences or comma splices.	Sentences are correct with minor variety in length and structure. The flow from sentence to sentence is generally smooth although some run on sentences are present.	Some sentences are awkwardly constructed so that the reader is occasionally distracted. Run on sentences are present or Short, simple and compound sentences prevail.	Errors in sentence structure are frequent enough to be a major distraction to the reader. Run's on and fragments common.
Word Choice	Word choice is consistently precise and accurate. The writer uses the active voice.	Word choice is generally good. The writer often finds words that are more precise and effective. Unnecessary words are occasionally used.	Word choice is merely adequate, and the range of words is limited. Some words are used inappropriately. unnecessary words are fairly common.	Many words are used inappropriately, confusing the reader. It is difficult for the reader to understand what the writer is trying to express.
Grammar, Spelling Writing, Mechanics (punctuation, italics capitalization, etc.	Essentially free of grammatical errors. The writing is free of almost free of errors.	A few grammatical errors; There are occasional errors, but they don't represent a major distraction or obscure meaning.	Several grammatical errors; The writing has many errors, and the reader is distracted by them.	Pattern of ungrammatical writing; There are so many errors that meaning is obscured. The reader is confused and stops reading.
Conclusion	The writer makes succinct and precise conclusions based on the review of literature. Suggestions for	Some of the conclusions, however, are not supported. Suggestions for	Some of the conclusions, however are not supported; weak or trite suggestions for future research.	There is little or no indication that the writer tried to synthesize the information or draw conclusions based on the

	future research offered.	future research offered.		literature; no suggestions for future research.
Reference Quality	References are primarily peer reviewed professional journals or other approved sources; Numerous relevant scholarly sources (and primary sources, where available and appropriate) demonstrating extensive, in-depth research; little reliance on tertiary sources.	Although most of the references are professionally legitimate, a few are questionable (e.g. trade books, internet sources, popular magazines) Several relevant secondary sources, revealing adequate research.	Most of the references are from sources that are not peer reviewed and have uncertain reliability. Several relevant secondary sources, more than one tertiary source; some facts not referenced displays minimal effort in selecting quality sources.	There are virtually no sources that are professionally reliable. Over-reliance on tertiary sources; spotty documentation of facts in text.
Length	Number of pages specified in the assignment	Number of pages specified in the assignment.	Without approval paper has more or fewer pages than specified.	Without approval paper has more or fewer pages than specified.