ELEMENTS OF ENGINEERING DESIGN PROJECT ASSESSMENT RUBRIC TO ADDRESS WASHINGTON ACCORD'S COMPLEXITY ATTRIBUTES

Institution of Engineers, Bangladesh

International Symposium on
QUALITY ASSURANCE IN ENGINEERING EDUCATION THROUGH ACCREDITATION-II

26-27 August 2020 VENUE InterContinental Hotel Dhaka, Bangladesh

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INTRODUCTION

The studies of assessment rubrics have been undertaken in many non-engineering disciplines and for multiple purposes

- ✓ Instructional materials
- ✓ Student achievement

Literature revealed that the assessment rubrics designed to evaluate design projects were loosely aligned to Popham's (1997) guidelines on rubric development

In addition, these rubrics showed limited reference to the attributes of CPS and CEA as specified by WA

Sources: (Potter et al, 2006; Estell & Hurtig, 2006; Gnanapragasam, 2007; Pop-Iliev & Platanitis, 2008; Reddy & Andrade, 2010; William et al., 2013; Yousafzai et al., 2015; Lanziner & Strong, 2017)

INTRODUCTION

Some **complex attributes** are **underexplored** in the assessment rubrics

That can be incorporated to provide a wider variety of complex engineering problem-solving to the students

Absence of **complex engineering activities** discovered in most of assessment rubrics

That can be incorporated in the communication skills' assessment rubrics

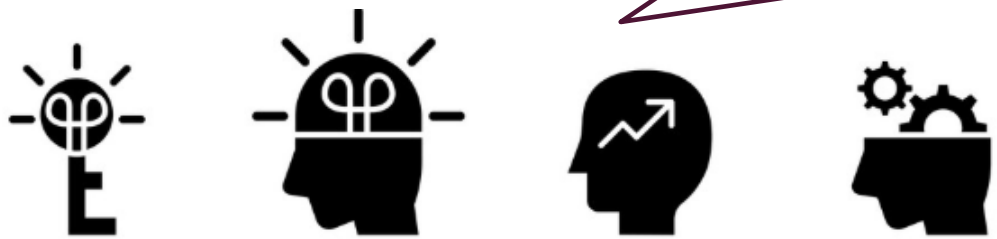
Students are normally required to communicate the final deliverables of their projects to the engineering community and society

LEARNING OUTCOMES

At the end of this session, participants are able to:

1) Classify the evaluative criteria of the given assessment rubric to complexity attributes defined by WA.

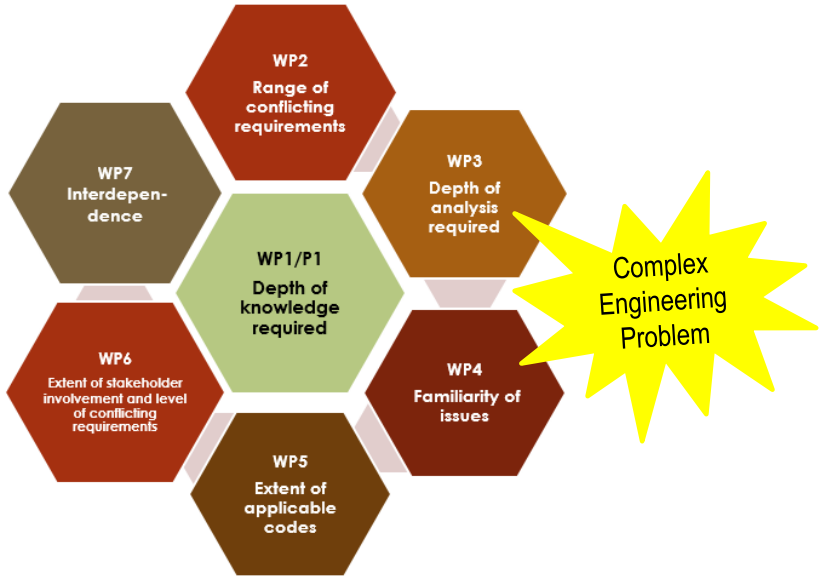
2) Incorporate additional criteria to address students' design attributes (WA3).

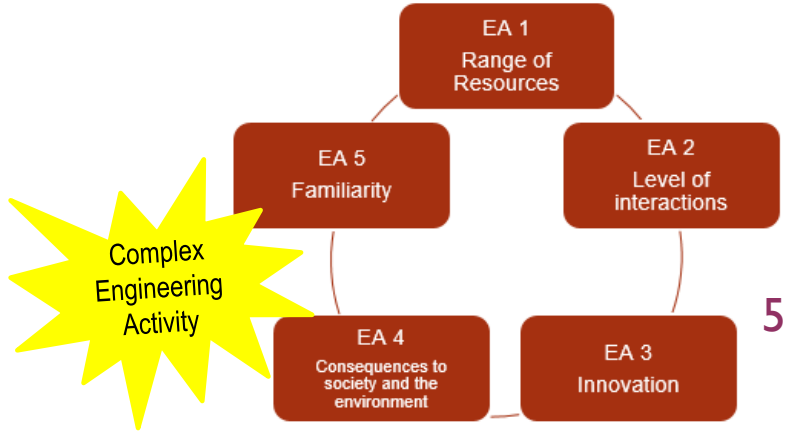


PRE-WORKSHOP

Classify the evaluative criteria of the given assessment rubric to the complexity attributes defined by IEA.

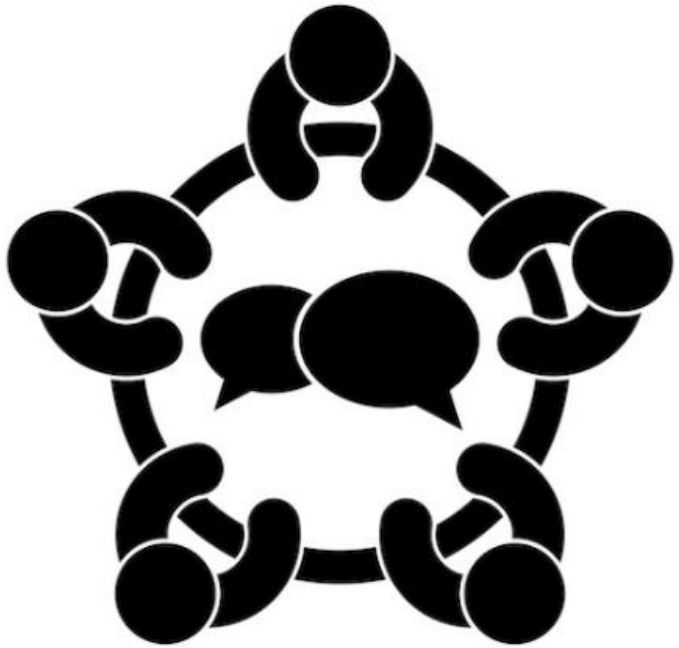
Suggest additional criteria that could be used to address students' design attributes in the assessment rubric.





DISCUSSION

[On the Assessment Rubrics]



EXERCISE: IDENTIFY THE ATTRIBUTES OF WP AND EA ADDRESSED BY THE ASSESSMENT RUBRICS (WHERE APPLICABLE) ACCORDING TO THEIR EVALUATIVE CRITERIA

Assessment rubric by Zytner et al. (2015) mapped to Popham (2006) and IEA (2013)

Programme Outcome 3: Design or development	Zytner et al. (2015) Design: An ability to design solutions for complex, open-ended engineering problems and to design systems, components, or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural, and societal considerations.	IEA (2013) Design or development: Design solutions for complex engineering problems and design systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (WK5)

Evaluative criteria:		Quality distinctions: performance-level descriptors				Complex problem solving or engineering activities
		Exceeds expectations	Adequately meets expectations	Minimally meets expectations	Fails to meet expectations	
1. Construct design-specific problem statements	Problem identification	Constructs complete problem identification with a thorough discussion on the expected design components that is consistent with the readily available information.	Constructs complete problem identification with a light discussion on the expected design components that is consistent with readily available information.	Constructs problem identification with no discussion and does not consider all available information.	Problem identification is not consistent with available information.	
	Literature review	Prepares an excellent literature review of the problem	Prepares a good literature review of the problem	Prepares a fair literature review of the problem	No literature review provided	
	Constraints, criteria, and assumptions	Identifies and discusses all constraints, criteria, and assumptions	Identifies and discusses the major constraints, criteria, and assumptions	Identifies the constraints, criteria, and assumptions	Fails to identify the constraints, criteria, and assumptions	
	Social, environmental and economic, health and safety perspective	Anticipates and explains needs and impacts in social, environmental, and economic, health, and safety terms beyond the immediate client and users.	Anticipates needs and impacts on social, environmental, and economic, health, and safety terms for clients and users.	Explains the problem in social, environmental, economic, health and safety terms	Fails to consider the problem in social, environmental, economic, health and safety terms	

2. Implement engineering design solutions - identifies possible solutions from a proposal perspective.	Discusses the possible design approach, identifying some possible solutions, and recognizing available resources.	Discusses the possible design approach, identifying some possible solutions but does not recognize available resources.	Presents a possible design approach and does not recognize available resources.	No design approach or possible design solution provided.	
Programme Outcome 5: Modern tool usage	Zytner et al. (2015) An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.		IEA (2013) Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems, with an understanding of the limitations. (WK6)		
Evaluative criteria:	Quality distinctions: performance-level descriptors				Complex problem solving or engineering activities
	Exceeds expectations	Adequately meets expectations	Minimally meets expectations	Fails to meet expectations	
3. Select appropriate engineering tools from various alternatives - a proposal perspective	Identify the hardware tools (physical, hand, and prototyping) and software tools that may be used in the development of the design, with a critical discussion on how these tools will benefit the design.	Identify the hardware tools (physical, hand, and prototyping) and software tools that may be used in the development of the design. Some basic discussion provided to support the tool selection.	Identify the hardware tools (physical, hand, and prototyping) and software tools that may be used in the development of the design, with some supporting documentation.	Only rudimentary tools were identified for possible use in the design, with no supporting documentation.	

Programme Outcome 10: Communication	Zytner et al. (2015) An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.	IEA (2013) Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Evaluative criteria:		Quality distinctions: performance-level descriptors				Complex problem solving or engineering activities
		Exceeds expectations	Adequately meets expectations	Minimally meets expectations	Fails to meet expectations	
Develop and deliver clear, key concepts using methods appropriate for the intended audience	4. Supporting material, including a letter of transmittal and executive summary	Clearly and concisely indicates purposes of the report using professional language appropriate for the target audience. Provides context of deliverables. Properly addressed and signed.	Clearly and concisely indicates the purpose of the report. It provides the context of the overall project. Properly addressed and signed.	The purpose of the report is vague. Context of deliverables as part of the project stated. Properly addressed and signed.	Purpose of the report not clear or obvious. A letter is bound within the report, and improperly addressed or signed.	
	5. Organization of Report	The objectives and scope of the project are completely provided and in thoughtful order. Key report elements are integrated and mutually reinforcing.	The objectives and scope of the project are clear. Complete order with evidence of logical thinking.	Aspects of problem objectives or scope unclear. Reasonable presentation in all sections, with some thought and effort.	Random order to structure the report. Little effort or thought.	
	6. Figures and Formatting	Clear, informative figures with excellent formatting. Enhance presentation consistently and are of professional quality.	Clear figures with good formatting. Most aid the report presentation and are of professional quality.	Clear figures with good formatting. Some aid in the report presentation; professional quality could be improved.	Unclear figures. Formatting detracts from the presentation.	
	7. Literacy	Flawless English with no punctuation errors.	A few flaws in English grammar or spelling. Punctuation errors are infrequent.	Some flaws in English grammar, spelling, and punctuation, but do not severely inhibit reading of the report.	Very seriously flawed English spelling, grammar, and punctuation. The report is difficult to read.	

CONCLUDING REMARKS

Amendments in the existing assessment rubrics are expected to:

- Improve the instructional materials for implementing complex engineering design projects; and
- Subsequently, improving students' ability to solve complex engineering problems.

A well-constructed rubric can help engineering educators to better understand the nature of high-level skills that ought to be acquired by students and to provide diagnostic data for improvement as well.

Source: (Liew, Puteh & Hamzah, 2020)

THE END

THANK YOU

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