Engineering Education Qualifying Exam
August 2015

Assessment

Evaluate the assessment plan described in the conference paper by Guarch et al., 2013 titled "Assessment of Problem Solving in Computing Studies" from the Proceedings of the 2013 FIE Conference, October 23-26, 2013 (attached). In your response, clearly define your evaluation criteria and describe the basis by which you will determine compliance and quality for each criterion. As you evaluate the assessment plan, provide concrete, detailed examples of the degree to which the plan satisfies each criterion. For each weakness you identify, offer a constructive suggestion. List citations as appropriate. Your response must not exceed 15 pages (using the template provided) excluding references. All figures and tables must fit within the page limit. No appendices are permitted.

Guarch, C.V., Espinosa, P.M., Cobos, R., Perez, J. E., Caro, E. T., and Viejo, G. B. (2013). Assessment of problem solving in computing studies, Proceedings of the 2013 FIE Conference, Oct. 23-26, 2013, Oklahoma City, Oklahoma, USA.

Research Methods Question

The article by Hames and Baker, "A study of the relationship between learning styles and cognitive abilities in engineering students", describes a quantitative study exploring the relationship between engineering students' learning styles and their cognitive abilities.

First, evaluate the strengths and weaknesses of the research method, including the decision to adopt a quantitative approach, the specific survey instruments employed, the statistical tests employed as well as the authors' conclusions; use appropriate sources to support your evaluation. Please focus on the research methods and do not offer a critique of learning styles from a theoretical perspective.

Second, design a follow-up study that employs qualitative methods to further explore one focused research question of your own choosing based on the findings of this quantitative study. Your study design should include:

a) a justification of the research question based on the findings of the quantitative study;

b) a description of the data collection and analysis procedures, including preliminary research protocols (e.g., potential interview questions, observation protocols, or documents collected);

c) an explanation of why these data collection and analysis procedures are appropriate to the research question; and

d) a discussion of the limitations of your study design.

Again, use sources where appropriate to support your ideas and arguments. Note that there is not a page limit for this question but you should be able to answer the question in about 20 pages.

E. Hames & M. Baker (2014): A study of the relationship between learning styles and cognitive abilities in engineering students, European Journal of Engineering Education, DOI: 10.1080/03043797.2014.941338 Retrieved from: Virginia Tech Interlibrary Loan

Foundations

The Department of Engineering Education at Virginia Tech is collaborating with other disciplines, including industrial design, business, and science and technology studies, to design a new undergraduate minor in Innovation. You have been hired by the collaborating departments as a consultant to think through some of the potential features of this new program and subsequently develop a report. It is essential for the program to be theoretically grounded based on what we know about how people learn, different mechanisms of supporting student success, and undergraduate engineering education in general.

The Innovation minor is part of a new initiative for students to satisfy General Education requirements through cohesive "pathways." One option for satisfying these requirements is earning a "Pathways Minor" and the minor in Innovation is to be designed towards this purpose. As President Timothy D. Sands states: "The Pathways General Education curriculum empowers students to choose a pathway that aligns with their goals and interests while meeting the needs of employers that are looking for graduates who can think critically, communicate clearly, and solve complex problems. Integration of ethical reasoning and intercultural and global awareness across the curriculum is in alignment with the university's InclusiveVT efforts." http://www.vtnews.vt.edu/articles/2015/07/072215-uged-pathways.html

At this stage in the process of developing the minor, your stakeholders are not concerned about funding models, resource availability, logistical details, or assessment/evaluation plans. Rather, the stakeholders are hoping for a creative set of programmatic ideas that are well-supported by the literature. You are encouraged to think outside the box in your report, but be sure each idea is well-argued with support from resources that are readily available from any Virginia Tech Foundations in Engineering Education course.

Specifically, your stakeholders would like you to address the following points in your report:

1. Articulate the need for such a minor degree program. How—and why—might this minor degree program help students develop certain learning outcomes for engineering in the 21st century?

2. Describe two ideas for curricular features or pedagogical approaches that you believe should be key components of the new degree program—you should explain why these ideas *specifically* fit an interdisciplinary Innovation minor as opposed to talking about ideas that can be transplanted to any programmatic setting. (For example, describing problem-based learning or a spiral curriculum in general terms would not meet the stakeholder's request since these approaches can fit into any context.) Using theory, why do you believe that each of the two ideas that you described will work? Additionally, for each of the two ideas, what mechanisms can you put into place to encourage a broad range of students to be successful? Why do you believe these mechanisms will work? How can an *integrative* approach be used to help students relate various ways of thinking with the curriculum specific to their own major?

The target audience for the report will include faculty members and administrators in engineering, industrial design, business, and the humanities, as well as administrators in the Provost's office. Thus, you should not assume that your readers have a working knowledge of the theories or foundational works from which you draw. Note that there is not a page limit for this question but you should be able to answer the question in about 20 pages.