

## Measuring attainment of foundation skills in general education at a public university in the United Arab Emirates

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**ABSTRACT:** To increase the employability of graduates, tertiary education must emphasise what are known as foundational skills, such as critical thinking, teamwork and information literacy, to name a few. These skills, however, are recognised as difficult to both teach and assess. In this article, the authors describe a novel performance assessment - the General Education Foundational Skills Assessment (GEFSA) - that can be used to teach and measure attainment of foundational skills for non-native English speaking students in a General Education programme, and the results of a pilot study conducted at Zayed University in the United Arab Emirates. The GEFSA is comprised of a scenario of an unresolved contemporary issue, prompts to engage students in an on-line discussion, and a task-specific analytic rubric to assess the extent to which students attain the targeted skills. This article focuses on the GEFSA Rubric development and the supporting instruments. The pilot study results indicated that the method could be used to both teach and measure the foundation skills, as well as to be used for programme assessment reporting purposes.

### INTRODUCTION

To increase the success of United Arab Emirates (UAE) baccalaureate graduates as they enter the workplace, tertiary education must include ample development of foundation skills. These skills include, but are not limited to, the ability to think critically, evaluate information sources, and function successfully on teams to achieve a common goal, and to possibly do so in a non-native language. The research team defines foundation skills as the skills of language, literacy and numeracy considered essential by the Organization of Economic Cooperation and Development (OECD) across all countries for success in living and working, plus employability skills in the information age, such as teamwork, problem-solving and self-management [1]. Across the Gulf Region, the core mission of higher education is focused on educating students to be productive members of society with the requisite skills for gainful employment. In the UAE, the stakes are particularly high. With rapid cross-sector advancement and diversification in both the government and industry, the nation needs dedicated and qualified fresh native-UAE graduates to achieve the goals outlined in the Abu Dhabi Economic Vision 2030, the 2013 Abu Dhabi Competitiveness Report and the UAE National Vision 2021.

Yet numerous reports point to a notable misalignment between the knowledge, skills and attitudes demonstrated by university graduates and the competencies demanded by employers. UAE employers said they value foundational skills more than specific disciplinary skills [2]. Unfortunately, these are learning outcomes in which students in the region, and the UAE in particular, are especially weak [3]. The challenge surrounding student attainment of these learning outcomes is that employers prioritise them, students are weak in them, and they are often considered difficult to teach and assess [4]. Many measurement instruments evaluate each skill separately, as distinct from one another. In addition, the metrics available typically evaluate a skill indirectly through focus groups, interviews or surveys eliciting opinion [5]. Disparate measurement tools not designed to complement one another and that rely heavily on perceptions are inadequate for data-driven curriculum decision making. These constraints can be problematic for accurate and useful assessment of attainment of skills because they: a) do not provide direct measures of learning; and b) can make the assessment process resource intensive and cumbersome to implement.

The Zayed University (ZU) Learning Outcomes or ZULOs, were developed as institutional outcomes and were intended to be used by colleges to guide programme curriculum development and to assess student attainment of the outcomes for both continuous improvement and quality assurance reporting purposes. The six ZULOs are: 1) Information Literacy (IL); 2) Technological Literacy (TL); 3) Critical Thinking and Quantitative Reasoning (CTQR); 4) Global Awareness (GA); 5) Language (LA); and 6) Leadership (LS). See Appendix A for a definition of each ZULO.

ZU University College (UC) is responsible for teaching and assessing based upon the ZULOs over the course of the two-year General Education (GE) programme. Because the ZULOs are institutional learning outcomes, they are necessarily broad which, in turn, makes it challenging for instructors to design learning interventions and assessments

for meaningful use in courses. As a response to the challenges outlined above, the authors of this article developed the General Education Foundation Skills Assessment (GEFSA), a performance assessment that is directly aligned with the ZULOs. The GEFSA is comprised of a scenario of an unresolved contemporary issue and prompts to engage students in an on-line discussion, and a task-specific analytic rubric to assess the extent to which students attain the targeted foundation skills.

The GEFSA Rubric development and associated support instruments described in this article is an adaptation of work being done in the ZU College of Technological Innovation in which a Computing Professional Skills Assessment (CPSA) Rubric was developed based on the Accreditation Board for Engineering and Technology (ABET) computing student outcomes [6]. The CPSA Rubric is itself an evolution of the Engineering Professional Skills Assessment (EPSA) Rubric that was validated over a period of three years with funding from the US National Science Foundation and was to be used to measure student attainment of the ABET engineering student outcomes [5].

The aim of the GEFSA Rubric is to deliver a valid method to demonstrate student attainment of foundation skills aligned with the ZULOs. ZU degree granting colleges can use this data to inform curricula and facilitate student transition from UC to individual majors. Within UC this method can facilitate ZU students and faculty working as partners in developing and enhancing General Education foundation skills. This article will commence with the steps of the design of the GEFSA Rubric via adaption of the CPSA Rubric with occasional reference to the EPSA Rubric. Next, the article outlines the supporting instruments needed to complete the GEFSA framework. Finally, the article will discuss some results obtained from a pilot deployment of GEFSA framework in spring 2016.

## THE GEFSA METHOD

The GEFSA is a performance assessment. Performance assessments are designed to elicit and measure complex thought processes necessary for deep learning by asking participants to solve realistic or authentic problems. Participants in a performance assessment demonstrate their knowledge and skills by engaging in a process and/or constructing a product.

Performance assessment typically has three components: 1) a task that elicits the performance; 2) the performance itself (which is the event or artefact to be assessed); and 3) a criterion-referenced instrument, such as a rubric, to measure the quality of the performance [7]. The GEFSA comprises: 1) a portfolio of scenarios and prompts as the on-line discussion performance task; 2) the student team discussion transcript as a response; and 3) the GEFSA Rubric as the criterion-referenced instrument to measure the quality of the student team performance of foundation skills. To ensure the reliability and validity of the performance assessment, four support instruments were developed: scenario development guidelines, scenario prompts, a student survey tool and a faculty survey tool.

## DESIGNING THE GEFSA RUBRIC

In designing the GEFSA Rubric, essentially there were three steps:

1. A review of the ABET student outcome skills used in the CPSA and EPSA Rubrics was undertaken to determine the appropriateness of the skills examined in these rubrics to the needs of a GEFSA Rubric. The motivation was to reuse as many of the skills in the tried and tested (validated) CPSA and EPSA Rubrics, or at least, with minimal changes;
2. Ensure that the skills selected from step 1 could align to the ZULOs;
3. Write definitions for each skill using terminology similar to that of the ZULOs.

The resultant GEFSA Rubric skills and definitions (with ZULO alignment) are provided in Appendix B. Skill Performance Indicators and associated Criteria for each of three student achievement levels (Emerging, Developing, Practicing) are omitted for article brevity. One dimension of the rubric is provided in Appendix C.

## DESIGNING THE GEFSA SUPPORT INSTRUMENTS

### Scenario Creation Guidelines

To elicit students' knowledge, understanding and their ability to apply foundation programme skills to real-world issues, it is imperative that scenarios are carefully constructed. Scenario guidelines from the CPSA were adopted and adjustments made to suit the GE level students. There were a number of considerations when altering the guidelines, such as:

- To what extent should the scenarios provide local/regional context? Typically the issues at the core of the scenarios are global issues, so it was agreed that the international content would be around 70% and local content around 30%.
- What is an appropriate word length? It was decided that 600-700 words was sufficient (excluding references).
- What should the readability level be? The authors decided that to suit the average reading abilities of the students the writing should have a Flesch-Kincaid value of 12-13.

## Scenario Prompts

When a scenario is given to students it is necessary to provide prompts to guide the students in their work. The GEFSA prompts were created by adapting the CPSA prompts. The prompts are designed so that they follow typical steps in problem-solving and, particularly, that they elicit responses that are indicative of performance on all six skills. They are presented in the box below:

Discussion Board Instructions	
Imagine that you are part of an interdisciplinary team working together for a government organisation on the issues raised in the scenario. Consider the following guiding questions as your team reaches a consensus to identify possible solutions:	
<ol style="list-style-type: none"> <li>1. <i>Identify the primary and secondary problem(s).</i></li> <li>2. <i>Who are the major stakeholders and what are their perspectives?</i></li> <li>3. <i>What are some of the ethical, social and security issues involved?</i></li> <li>4. <i>What are possible approaches to address the problems? Do these approaches have their own disadvantages?</i></li> <li>5. <i>What are the local implications/impacts of both the problem/s and possible solutions (on individuals, organisations and society)?</i></li> <li>6. <i>What, if any additional information would you need to effectively address the problem(s)?</i></li> </ol>	

## Student Survey

A student survey aligned to the GEFSA skills is used to obtain meaningful feedback as to how the students themselves perceived that the activity improved their foundation skills. This feedback can assist with refinement of the GEFSA framework. The survey was developed by adapting the CPSA student survey and its student outcome alignments to meet the needs of the GEFSA Rubric. The resultant GEFSA foundation skill aligned survey is presented below in Table 1. The survey consists of eight closed-ended items and three open-ended items. The close-ended items are scored on a Likert scale from 1 - strongly disagree, to 5 - strongly agree. The open-ended items were: *What I liked about this activity?*; *What I did not like about this activity?*; *What changes I would like to see?*

Table 1: Survey.

Item	GEFSA foundation skill	St*	Fac**
1. <i>The activity helped me develop my ability to work as a team member.</i>	Skill B. Interact within a group to accomplish shared goals.	4	5
2. <i>The activity helped to develop my problem-solving skills.</i>	Skill A. Demonstrate competence in understanding and evaluating information (qualitative and/or quantitative) to solve problems and propose solutions.	4	4
3. <i>The activity helped to improve my skills in written communication.</i>	Skill D. Comprehend and communicate using academic and professional language conventions.	4	3
4. <i>As a result of the activity, I feel more confident about tackling unfamiliar problems.</i>	Skill A. Demonstrate competence in understanding and evaluating information (qualitative and/or quantitative) to solve problems and propose solutions.	3	4
5. <i>The activity helped me to develop my understanding of ethical and social issues.</i>	Skill C. Understand and evaluate technologies and their use ethically, socially, and where appropriate, securely.	4	5
6. <i>The activity helped me to develop the ability to analyse the impact of new technology developments.</i>	Skill E. Examine a global issue, propose solutions, and assess impact locally on individuals, organisations and society.	4	4
7. <i>The activity helped me to recognise when I needed to look for additional information.</i>	Skill F. Locate, evaluate and use relevant information to respond to a variety of situational needs.	5	4
8. <i>The activity helped me to recognise the limits of my knowledge and the need to continue to learn more.</i>	Skill F. Locate, evaluate and use relevant information to respond to a variety of situational needs.	5	3

\* Student responses - averaged Likert scale score

\*\* Faculty responses to similar items on faculty survey - averaged Likert scale score

## Faculty Survey

Similar to the development of the student survey, the faculty survey was created by adapting the CPSA faculty survey to reflect the needs of the GEFSA research project. As with the student survey, the faculty survey can also assist with refinement of the GEFSA framework. The faculty survey is presented in the box below:

*Did the GEFSA activity help students:*

1. *Develop their abilities to work as team members?*
2. *Develop their problem solving skills?*
3. *Improve their skills in written communication?*
4. *Increase their confidence about tackling unfamiliar problems?*
5. *Develop their abilities to understand the ethical and social issues?*
6. *Develop their abilities to analyse the impact of new technology developments?*
7. *Recognise when they needed to look for additional information?*
8. *Develop their abilities to manage their time and plan their own work?*

*What else did you notice about your students as they participated in this GEFSA activity?*

Eight questions are very similar to the eight closed-ended items of the student survey. Faculty complete this survey by answering each question in their own words, and also assigning a Likert scale rating of 1 to 5 to each question. Their opinions are based upon their observations and their interactions with the students during the 14 days of the activity.

### GEFSA FRAMEWORK PILOT FINDINGS

During spring 2016, the activity was conducted twice for 14-day periods in two classes totalling 47 second year students (an English Composition class and a Living Science class) using scenarios on Clean Energy and Obesity. To ensure participation, the activity was a mandatory course requirement. Students were placed randomly in groups of 5 to 6. The first run of the activity was for the purpose of familiarising the students with the process. The students have not previously experienced discussion boards or problem-solving in teams in a manner like this. This type of scaffolding is considered essential and is an excellent learning activity as the students get to practice the foundation skills. Like the students, the faculty were new to this type of performance task, so the faculty were supported by the research team during the activities.

The discussion board transcripts were analysed to measure student attainment of the foundation skills on the first draft GEFSA Rubric. The rating process is also part of the refinement of the rubric. As development of the rubric is iterative each rating session highlights areas for improvement. The rating process was conducted as follows. Each team member scored the discussions of the groups on the skills making notes on the transcript and the rubric page. Then, the team compared scores and discussed all differences at length in order to try and reach consensus. Initially, the rating work proceeds in small steps - one skill at a time is taken and scored and discussed. As the team members become more aligned bigger steps are taken - all the skills for a group are scored before the discussion begins. During the discussion, notes are also made on areas for improvement of the rubric.

The levels on the rubric are referred to as Emerging (1), Developing (2) and Practicing (3). The authors would expect students in their second year of studies to be in range of 2 to 3. The results from the rubric are given below in Table 2 and reveal low levels of skill achievement. Although the GEFSA Rubric is in its first draft, nonetheless it has pointed out areas of weakness in the students that need to be addressed. For example, in information literacy, the students scored particularly low, so the reasons should be investigated and remedial action taken.

Table 2. Results from pilot run of GEFSA Rubric.

Skill	A	B	C	D	E	F
ZULO	CTQR	LS	TL	LANG	GA	IL
GEFSA Score	1.7	1.5	1.1	2.0	1.5	1.0

The research team members were particularly interested in this iteration to learn about the usefulness of this method from the perspective of the students and the faculty. As mentioned above, surveys were developed and administered to students and faculty at the completion of the second activity.

The average scores for the students to each question are shown in Table 1. It may be seen that the students felt that they:

- Performed best in skills related to planning what they need to learn and locating information;
- Performed well in skills related to ethics, impact of technology and global awareness;
- Performed least well in skills related to problem solving.

Results from the faculty survey showed that the faculty felt that:

- Students performed best in the skills relating to teamwork and ethics;

- Students performed well in the skills relating to problem-solving, tackling unfamiliar problems, technology impact and global awareness;
- Students performed least well in the skills relating to written communication and planning what they need to learn.

The research team compared the faculty ratings to the students' responses to determine if there was a meaningful correlation. The faculty scores for the related questions are shown in Table 1. It may be seen that there is a reasonable alignment between both sets of scores with a couple of questions getting the same score. Students underestimated their performance compared to faculty in three areas - teamwork, tackling unfamiliar problems and ethics. Students overestimated compared with faculty on only one question - seeking additional information.

The student responses showed that they felt least comfortable with tackling unfamiliar problems. This is not surprising as ZU students typically have difficulty in applying existing knowledge to new situations or solving similar, but different problems. Their cognitive skills (critical thinking, problem-solving) are underdeveloped when they enter the GE programme. Students felt more comfortable with seeking additional information and awareness of the limitations of their own knowledge.

From the instructor results, the research team feel confident that the activity benefited students in developing their foundation skills. Likewise from the student responses, it is clear that, with combined agree and strongly agree rates  $\geq 80\%$  for all questions except for tackling unfamiliar problems, students definitely felt that the activity improved their foundation skills.

As noted previously, the student survey contained three open ended questions. Presented below are some student responses for Question 1 - *What I liked about the activity?* (Spelling and grammar have been edited for readability).

<i>I like the strategy of group discussion with my colleagues and I really enjoyed doing it.</i>	<i>What I liked about the activity that it gave me the chance to read more about a topic that was not that familiar with.</i>	<i>I liked the topic, because it is important that we know more it. I now have new ideas and knowledge after reading about this topic.</i>
<i>I liked this activity, because it has improved my ability in writing and vocabulary.</i>	<i>I think it help us in improving our writing and problem-solving skills.</i>	<i>Learning new information by searching and reading.</i>

In response to the question: *What I did not like about the activity?* no student complained about the academic value. A few complained about practical aspects, for example suggesting that it would be better to have it earlier in the semester or that the team members did not participate or that a team member said what they wanted to say. In response to the question: *What changes I would like to see?* the suggestions were again about practical issues, such as holding it earlier in the semester, picking own team members and having more time. The student comments clearly show that they were very positive about the activity and that they believed it improved their foundation skills.

## CONCLUSIONS

This article outlined the design, development and an initial pilot of the GEFSFA framework. This framework is intended to provide a direct assessment method to measure attainment of foundation skills in General Education students. Further, the method is also an excellent means to help develop these skills in students.

The results from the first trial have shown that the method can measure all the skills. Additionally, both students and faculty alike are convinced that the method contributes to the improvement in foundation skills. The method will be further developed and refined in an iterative manner over the coming eighteen months. Findings from the application of the GEFSFA framework will provide input to data-driven curricula decision making both within the GE programme and the majors.

## ACKNOWLEDGEMENT

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#### Appendix A - ZULO Learning Outcomes

Information Literacy (IL): ZU graduates will be able to find, evaluate and use appropriate information from multiple sources to respond to a variety of needs.
Technological Literacy (TL): ZU graduates will be able to effectively understand, use, and evaluate technology both ethically and securely in an evolving global society.
Critical Thinking and Quantitative Reasoning (CTQR): ZU graduates will be able to demonstrate competence in understanding, evaluating, and using both qualitative and quantitative information to explore issues, solve problems, and develop informed opinions.
Global Awareness (GA): ZU graduates will be able to understand and value their own and other cultures, perceiving and reacting to differences from an informed and socially responsible point of view.
Language (LA): ZU graduates will be able to communicate effectively in English and Modern Standard Arabic, using the academic and professional conventions of these languages appropriately.
Leadership (LS): ZU graduates will be able to undertake leadership roles and responsibilities, interacting effectively with others to accomplish shared goals.

#### Appendix B - GEFSA Rubric Skills and Definitions

GE Foundation Skill A [ZULO CTQR]. Demonstrate competence in understanding and evaluating information (qualitative and/or quantitative) to solve problems and propose solutions.

Definition: Students clearly frame the problem(s) raised in the scenario with reasonable accuracy and identify approaches that could address the problem(s). Students recognise relevant stakeholders and their perspectives.

GE Foundation Skill B [ZULO LS]. Interact within a group to accomplish shared goals.

Definition: Students (guided by supplied prompts) work to understand the task and develop a solution. Students work together to address the problems raised in the task by acknowledging, building on, critiquing and clarifying each other's ideas to come to consensus to attain a group solution. Students encourage participation and respect of all team members.

GE Foundation Skill C [ZULO TL]. Understand and evaluate technologies and their use ethically, and where appropriate, securely in an evolving modern society.

Definition: Students can understand the use, describe the responsibilities and have an awareness of the ethical issues of technology use in modern society, which may include, but are not limited to, the social and security considerations.

GE Foundation Skill D [ZULO LA]. Comprehend and communicate using academic and professional language conventions.

Definition: Students adopt appropriate reading and writing strategies to communicate effectively. Students communicate clearly, coherently and concisely, with appropriate level of professional diction and tone. Students are able to develop main ideas with sufficient detail and explanation, drawing upon accurate comprehension of information. Students demonstrate accuracy of grammar and mechanics.

GE Foundation Skill E [ZULO GA]. Examine a global issue, propose solutions and assess impact locally on individuals, organisations and society.

Definition: Students analyse the local implications of both the problem and possible solutions on individuals, organisations and society within the UAE.

GE Foundation Skill F [IL]. Locate, evaluate and use relevant information to respond to a variety of situational needs.

Definition: Students refer to and examine the information and reliability of sources. Students identify what they know and do not know and show an ability to provide additional sources (primary and secondary) to support the discussion and extend their knowledge.

Appendix C - One Dimension of GEFSA Rubric

GE foundation skill A. Demonstrate competence in understanding, evaluating and using both qualitative and quantitative information to solve problems and propose solutions. [ZULO CTQR].

Rater Score for Skill \_\_\_\_\_

Definition: Students clearly frame the problem(s) raised in the scenario with reasonable accuracy and identify approaches that could address the problem(s). Students recognise relevant stakeholders and their perspectives.

	0 - Missing	1 - Emerging	2 - Developing	3 - Practicing
Problem analysis and solution ID	Students do not identify essential information to the problem(s) in the scenario.	Students begin to define the problem(s) using information provided. Potential solutions may be general and/or naive.		Students are generally successful using provided information in defining primary and secondary problems with reasonable accuracy and with justification. There is evidence that they have begun to formulate potential solutions.
Stakeholder perspective	Students do not identify stakeholders.	Students identify few and/or most obvious stakeholders, perhaps stating their positions in a limited way and/or misrepresenting their positions, therefore, not identifying key information.		Students explain the perspectives and key information of major relevant stakeholders and convey these with reasonable accuracy.