

Rasch Measurement Analysis for Validation Instrument to Evaluate Students Technical Readiness for Embedded Systems

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Abstract—Embedded systems have become a significant manufacturing sector and essential in our life due to their large applications. As a result, higher education institutions acknowledge the significance for offering embedded system design course to electrical, electronics, and computer engineering students. Unfortunately, embedded systems design course continues to be challenging and complex despite current attempts in introducing new embedded system teaching methods. This paper deals with this issue by developing and validating an instrument to measure students' readiness to learn embedded systems using Rasch model. An expert panel was used to verify the content validity and a pilot study (N = 40 respondents) was performed to measure the instrument reliability. A total of 365 respondents from different universities completed the 10-item scale and provided demographic data. The scale dimensionality was evaluated using WINSTEPS 3.92.1, with results showed that all the items fit the Rasch measurement model with acceptable fit index (0.6-1.4) and expressed revealed good consistency, with reliability alpha of 1.00 and 0.72 for items and persons respectively. The instrument was found to have appropriate psychometric properties, and the overall results are well aligned with theoretical expectations. This work has shown that the students were not technically ready for embedded system study.

Keywords—*embedded system; Rasch analysis; instrument; reliability; validity, Readiness*

I. INTRODUCTION

In recent years, embedded systems have emerged as leading manufacturing sector and becoming essential in our life due to their wide range of applications. Embedded systems are usually an integration of electrical, mechanical that are custom design to perform a predefined specific tasks with the real-time requirement. That makes them an excellent field of education that offers strength, full span, and discipline for meeting the emerging labor force as well as science, technology, and engineering education need. As a result, higher education institutions acknowledge the significance for offering real-time embedded system design course to computer science and

software engineering students. As it occurs amid any technology shift period, skills shortage can be a problem as the current curriculum may not address the whole set of issues involved.

The rapid and increased growing of interest in mobile devices and the Internet of Things (IoT) changed the type of the devices that were connected, their data, and interaction with them into an object-oriented paradigm. As a result, companies are acknowledging the importance of embedded systems data collection and machinery control. Their applications span widely from software automobile manufacturers to medical equipment and home appliances; since their applications are flooding the world. Their development projects must manage before they hit the market. Engineers with experience in traditional enterprise application development are likely to find themselves in a new world. [1, 2]

Technology is one of the several disruptive influences that significantly affects many areas of society including education today. We live in an era where evolution in the development of new knowledge to challenge institutions to rethink teaching and learning in the global market. There is also need to prepare students to improve competition in the workplace. With technology as a catalyst, moving from education to the cooperation model of knowledge transfer, active, self-respect, and an attractive model that helps students improve their knowledge and develop the skills needed to succeed in the Learning Society [2].

This growth in embedded systems technology will require a steady supply of skilled workers, regarding numbers and skill sets appropriate to meet current and future of the sector. This work aims to develop and validate using Rasch model a scale to Measure Student Readiness for Embedded System Design. The scale will be introduced to gauge the students' prior readiness through holistic assessment by taking into account all the domains: technical understanding. It will produce the measures that can be used as the foundation to identify the gaps in universities curriculum prerequisite and incorporate these