

Minimizing Cognitive Load of Students in Practical Engineering Laboratories Through Augmented Reality

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1. Abstract:

Physical laboratories in electronic engineering curriculum play a crucial role in enabling students to gain “hands-on” learning experience to get a feel of problem solving. However, students often feel frustrated in these laboratories as disconnects exists between theory, practice and their learning experiences. To overcome these issues, an Augmented Reality (AR) based mobile application prototype was developed and tested amongst undergraduate students of Basic Electronic Engineering laboratory course. The intention is to create applications that can act as an assistive medium for students by providing instructions – similar to those of a human tutor. Data was qualitatively collected from user studies using semi-structured interviews, observational studies, making video recordings of live laboratory and think aloud session. It is hypothesized that this application will reduce the cognitive load of students in labs thereby improving their learning experience

Keywords: Education • Augmented Reality • Cognitive Load

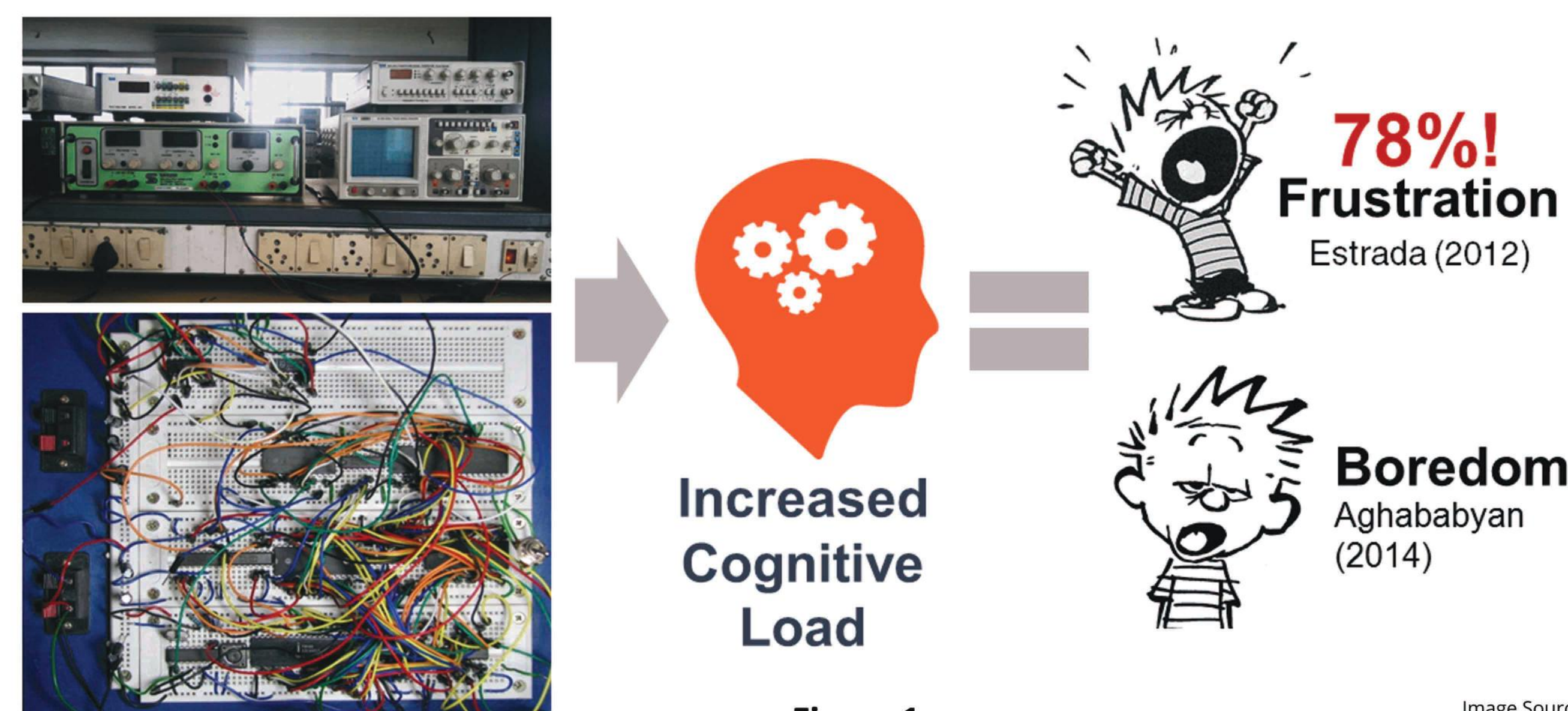
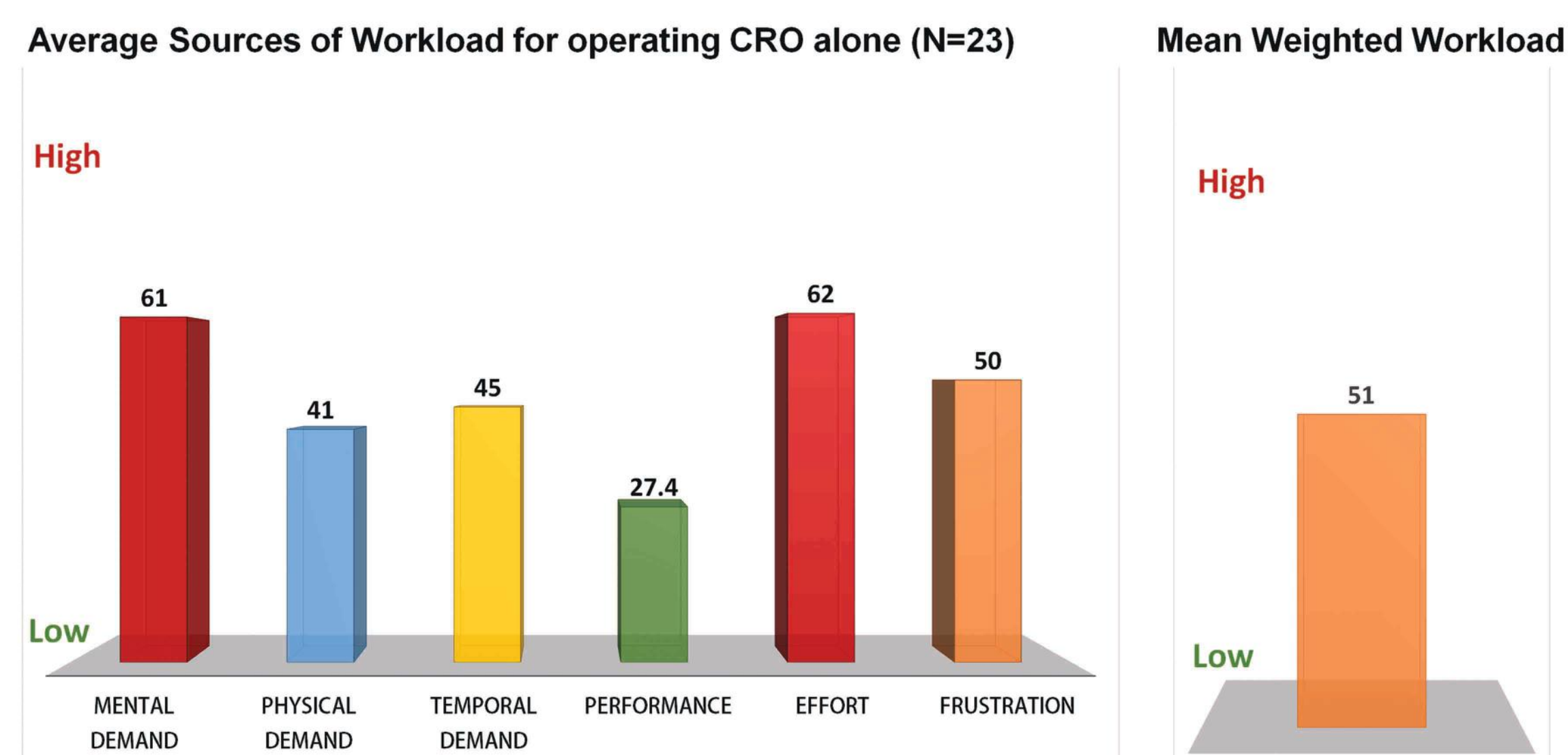


Figure 1

Image Source: Internet



Students subjective workload accessed using NASA TLX questionnaire administered immediately after lab session.

Figure 2

2. Methodology

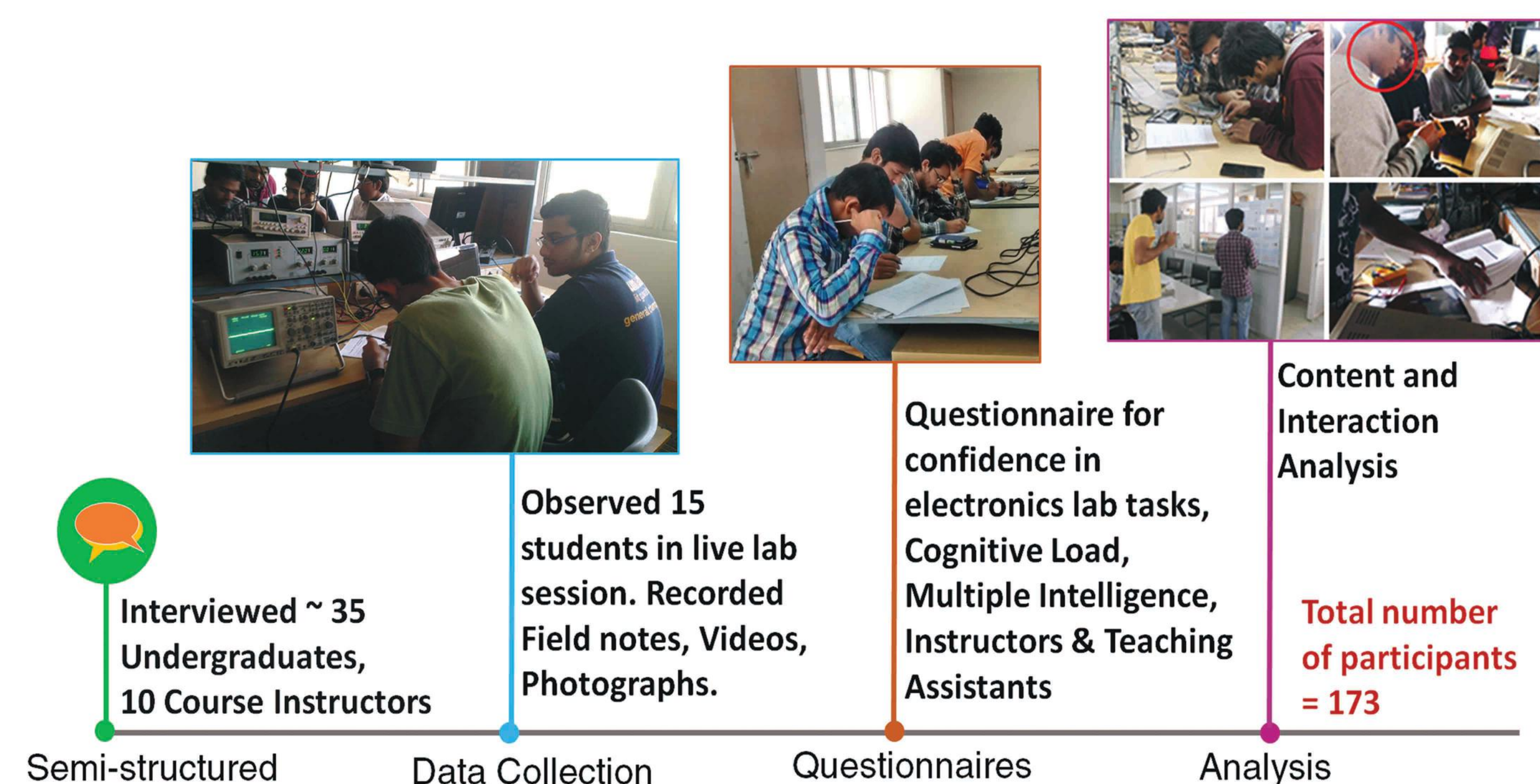


Figure 3

Quantified Responses of Students Obtained from Transcribed Interviews and Open-ended Questionnaires

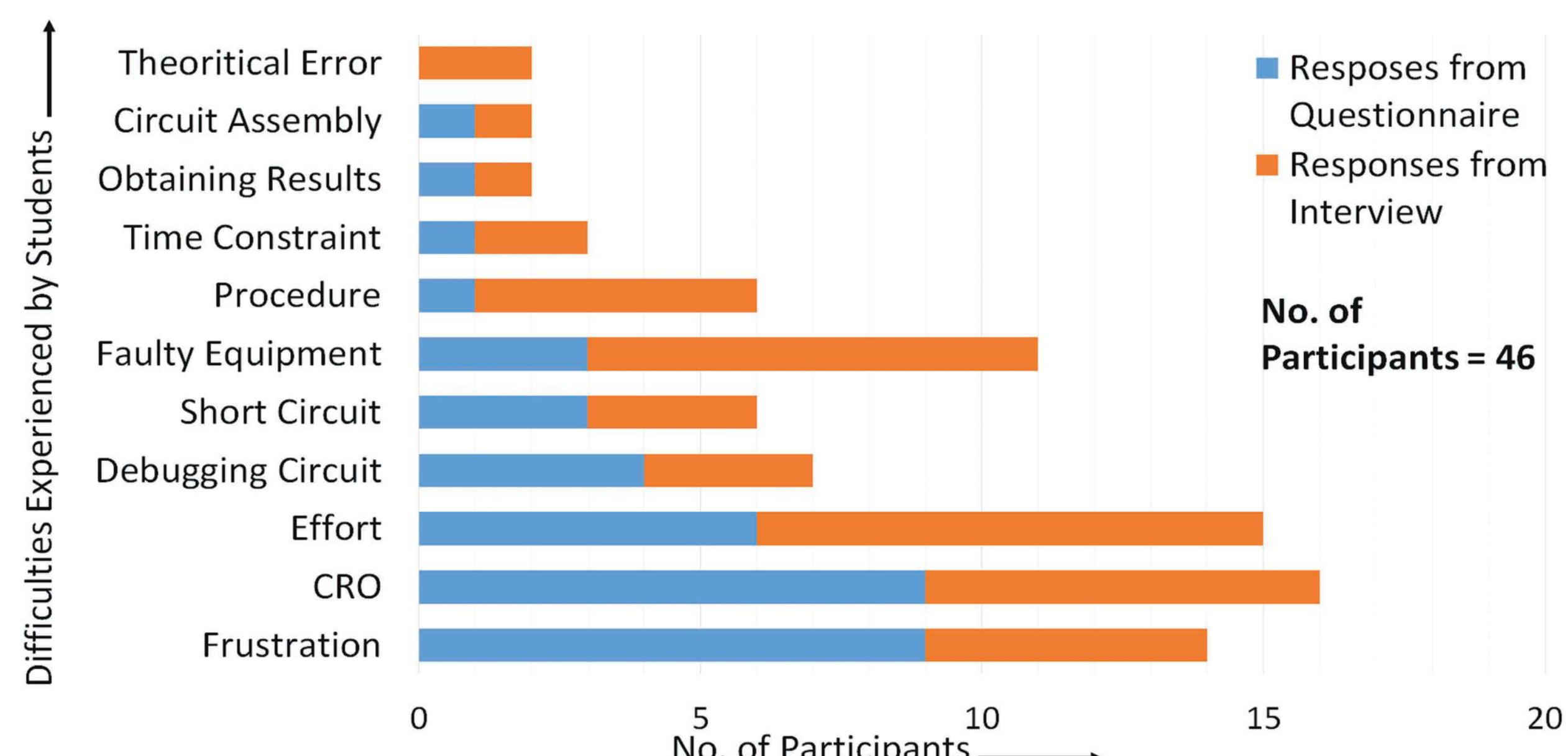
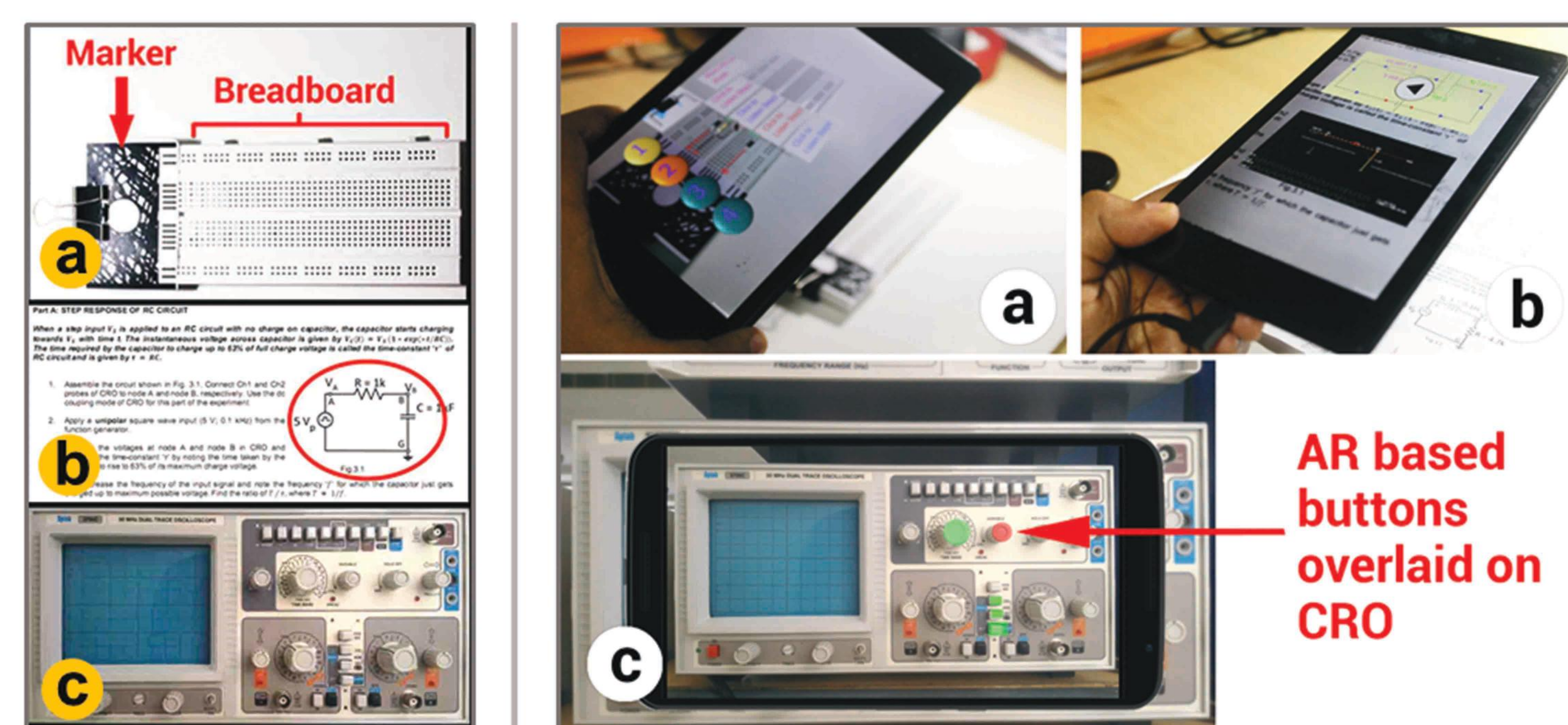


Figure 4

3. Augmented Reality Prototype Functionalities



a) Marker and Marker-less feature

b) Digital information augmentation over real space.

Figure 5

Our prototype consists of a mobile AR based lab manual and circuit building application capable of providing on the spot- just-in-time, information to students such that errors made during learning become prompts for self-evaluation and self-tutoring. The progress so far has been validated in part with encouraging positive results.



Excerpts of students' response obtained during user-testing of AR prototype.

Figure 6

Following hypotheses are being tested:

H1: AR app is expected to reduce the cognitive load of students in electronics lab practical by a range of 10-12%.

H2: AR app is expected to increase students' performance in electronics lab practical by a range of 5-10% than their current level.