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A NOVEL TEXT ANNOTATION TOOL FOR FORMATIVE ASSESSMENT

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ABSTRACT

Formative assessment is the idea of enabling continual feedback on the efficacy of learning alongside the teaching activities throughout the course of instruction. By contrast, summative assessment is the act of judging the efficacy of learning after the course of instruction. Formative assessment gives diagnostic feedback during and throughout the instruction period so that the teacher can address weaknesses in learning in a personalized manner. This is all the more important in today's world for the following reasons:

1. With the ever-more competitive job market, the human cost of falling behind education is very high. Since the number of job-seekers outnumber the number of jobs,[16] it is not enough to have a qualification, one needs to be thoroughly competent.
2. With the ever-dwindling attention span due to smartphone driven distractions (as studied in[12] and[13]), it is crucial to see that short periods of inattention or distraction doesn't get to jeopardize the learning efficacy.
3. For best results in quality, schools, colleges and Universities need to compete like private-sector service providers, and therefore teachers need to find every possible avenue to ensure learning excellence.

This paper outlines some challenges and possible strategies using a text annotation tool *'the Spectral editor'* [5] for formative assessment in the context of computing science pedagogy.

INTRODUCTION

Summative assessment can be used to inform learning by working in groups, peer assessment of work, individual tests, quiz etc.[21] It plays the following important roles:

1. Motivating students to put an effort so as not to do poorly in the assessment.
2. Quantifying the learning and performance characteristics of the student, which may be used in subsequent selection criteria.

Summative assessment however has the limitation that it does not play a role in addressing the specific needs of individual students over the duration of instruction. Despite best efforts towards standardization, every student is different. The diversity is not just in innate traits but also in the spectrum of life experiences, concept-repertoire, vocabulary, and perceptions about objects and issues[20] (discusses the effect of socio-economic differences in college students). This diversity inevitably manifests in variations in learning efficacy. Let alone the diversity, a brief span of inattention or distraction or absence can make a student miss out on a crucial concept that is critical to understanding the subsequent material.

When feedback is only marks or grades, students do not benefit from the feedback. Feedback improve learning when it gives each pupil specific guidance on strengths and weaknesses.[22] This is where formative assessment helps by continually providing the crucial diagnostic feedback that helps the teacher identify an individual student's weaknesses without relying on the low-likelihood event that the student seeks help proactively. The effectiveness of formative assessment is a proven fact, and has been widely documented in the literature (e.g. in[1,14,15]), and has been in widespread use in school-level pedagogy. The key change in the current times is that distraction is more prevalent, thanks to ever-present smartphones (as studied in[12] and[13]). On the positive side, there are new media and technologies available for formative assessment (e.g. online quizzes where automated gradual hints can be provided without demanding teacher's personal involvement). E-learning courses are particularly amenable to formative assessment on a large scale, as is evidenced by the quizzes on online learning websites like khanacademy.org,[7] courser,[9] udemy[8] etc. A good study of effectiveness of formative assessment in the context of E-learning is presented in.[4]

In particular, the teaching of computing science can benefit immensely from internet technologies by way of formative assessment. For example, for logic and programming assignments, the output can be automatically checked against output corresponding to inputs that are not revealed to the student. Such online program checking systems are called "online

judges",[6] and admittedly give a very limited feedback - whether the program works or not for the test cases. A teacher curated, and personalized feedback is also necessary because not all aspects can be automatically assessed. Multiple-choice questions can be checked by an online checker (as reported in[10,11]), but automated free-text checking is not yet fully feasible in current technology. Thus, while fully automated feedback is not really feasible for assessment tasks with free-form answers (e.g. tasks like essays and stylistic and design aspects of programming), considerable improvement is possible in ergonomics of the feedback delivery process.

The following section describes a multi-media enriched innovative text annotation environment that can ergonomically enhance formative assessment.

A text editing/annotation environment for formative assessment

In computing science assessments, the tasks frequently involve writing programs or parts thereof. Programs are traditionally written in plain text format. It can ease the job of giving quick feedback if the text environment allows a way of annotating the text with comments, audio, video, pictures, etc. For example, using such a multi-media feedback tool, the teacher or lecturer is able to highlight a part of the code/text and press a button to start recording audio of her verbal feedback on that part of the code. The audio would be saved with a tiny button widget next the selected text, which the student can play back on a laptop, phone or tablet. The efficacy of audio-visual feedback was studied in[19] and it was found to be more effective and appealing to students than the traditional written feedback. Such a multimedia annotation environment called "*the spectral editor*" was developed by the author and reported in.[5] Although its primary purpose was code-comprehension and inspection in a software industry setting (on the lines of similar work reported in[2] and[3]), it can equally serve as a feedback tool for formative assessment in computing science classes.

The spectral editor[5] was developed as a desktop application, so that it would involve an additional upload process to make the annotated text available online to the student. Such a tool would be more convenient as a web application (perhaps as a plugin to the moodle system as presented in[17,18]) so that the teacher can provide feedback from a phone or tablet (e.g. while travelling on a train).

Fig. 1 shows a screenshot from a text annotation tool with features/palettes similar to the tool presented in.[5] However, the pre-existing tools prior to[5] work only for document formats

like MS Word doc, PDF, and webpages. Since[5] makes such features available for plain text, it makes the feedback process of formative assessment both richer (i.e. multimedia enriched) and convenient for computing science pedagogy.

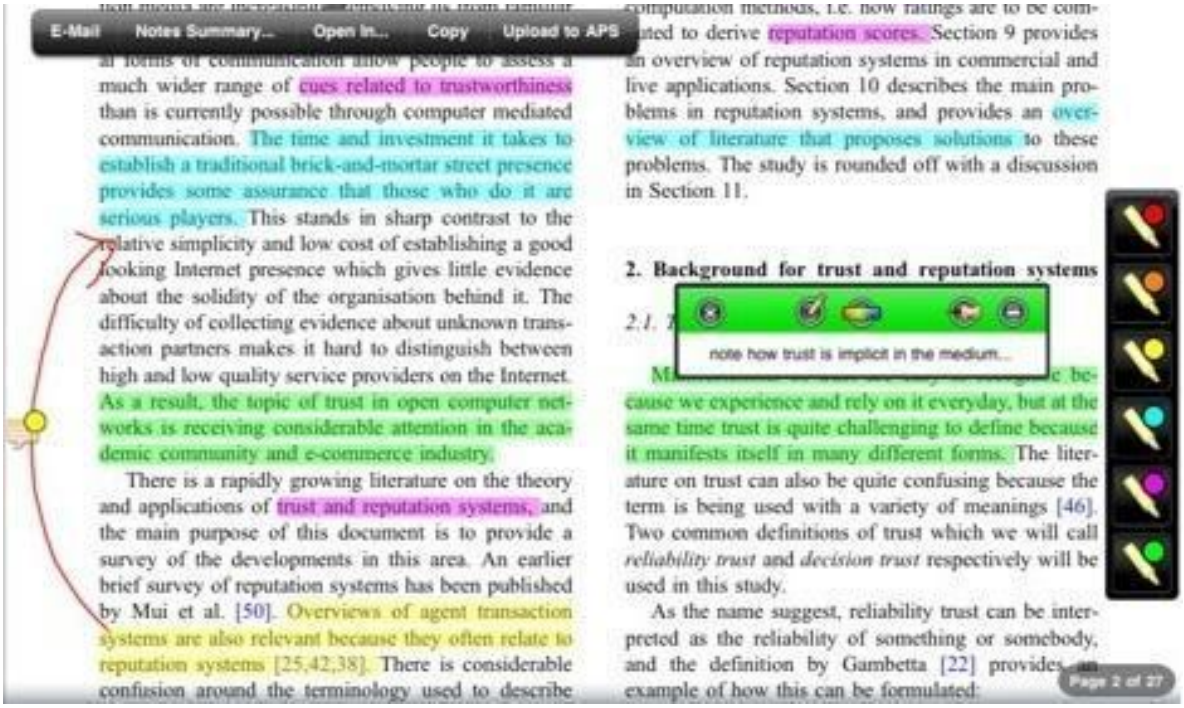

Fig. 1: A document annotation tool.

Following are a few examples of annotations done on formative assessment tasks using the tool presented in[5]:

https://jm21.s3.amazonaws.com/Shikha/SamMaj2019/dimers_annotated.html.

https://jm21.s3.amazonaws.com/Shikha/KFergu205/finalCoursework.html.

https://jm21.s3.amazonaws.com/Shikha/Gho200/calculator_coursework.html.

https://jm21.s3.amazonaws.com/Shikha/KWard200/calc_interface.html.

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