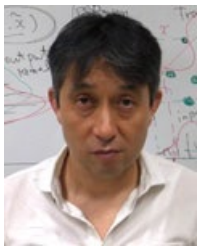
【Grant-in-Aid for Scientific Research (S)】

Broad Section J



Title of Project： Development of e-Testing platform ensuring sustainable reliability

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Research Project Number：19H05663　Researcher Number：50262316
Keyword：e-Testing, equivalent tests, adaptive test, performance test, automated essay scoring

【Purpose and Background of the Research】

e-Testing, a computer based testing that enables to measure abilities of examinees who take different test forms on the same scale, has been used in various testing organizations, such as the information-technology promotion agency (IPA) and the common achievement tests organization (CATE). e-Testing requires uniform test forms for which each form comprises a different set of items but which still have equivalent accuracy. Our group has developed a uniform test assembly method that maximizes the number of generated test forms with the best measurement accuracy. The proposed method has been used in various testing organizations such as IPA and CATE. However, we found a critical problem that the measurement accuracy deteriorates over time because IRT item parameters with high exposure frequency tend to be changed dynamically. To resolve this problem, this study develops a platform that ensures sustainable high reliability for e-testing which includes performance test such as essay test, practical skill test, and so on. This study also operates the platform on some actual large scale tests to show the effectiveness.

【Research Methods】

Our platform consists of the following four subsystems.

1. Uniform test assembly system that increases the number of assembled equivalent test forms drastically.
2. Item bank management system that predicts the number of deteriorated items and generates uniform test forms efficiently from the item bank after new items are appended.
3. Uniform adaptive testing system with item exposure control using the uniform test assembly system
4. Performance testing system that ensures equivalent and reliable measurement using the item response theory and automated essay scoring methods.

Furthermore, we will operate the developed platform on several actual tests, such as the common achievement tests for medical and dental students, writing tests in the National Center for University Entrance Examinations, and OSCE in the Tokyo Medical and Dental University, to evaluate the effectiveness and to develop the guidelines.

【Expected Research Achievements and Scientific Significance】

Ensuring sustainable reliability is a new important problem that we found through our long experience. Therefore, our research will contribute to technical innovation and widespread use of e-Testing in actual society. Furthermore, our proposed methods are new technologies that integrate various research fields, such as artificial intelligence, computer science, mathematics, and statistics.

ISO standard obliges to evaluate test forms equivalence and the measurement accuracies although the details of the evaluation results have not been reported from the test organizations in the world. However, in Japan, several testing organizations, such as CATE, has reported these indices. Furthermore, almost all test organizations in Japan consider to introduce this CATE e-testing operation.

In the future, we expect that such the Japanese style e-testing will be a world standard. In this study, we will develop a high quality e-Testing system for making a good chance to create a new testing market from Japan.

【Publications Relevant to the Project】

Maomi Ueno, Yoshimitsu Miyazawa (2018) IRT-Based Adaptive Hints to Scaffold Learning in Programming, IEEE Transactions on Learning Technologies, IEEE computer Society, Vol.11, Issue 4, 415-428

Masaki Uto, Duc-Thien Nguyen, Maomi Ueno (in press) Group optimization to maximize peer assessment accuracy using item response theory and integer programming, IEEE Transactions on Learning Technologies, IEEE Computer Society.

【Term of Project】

FY2019-2023

【Budget Allocation】

123,900 Thousand Yen

【Homepage Address and Other Contact Information】

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