Distractor Quality Analyze In Multiple Choice Questions Based On Information Retrieval Model

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Overview

In spite of the appealing characteristics of multiple-choice questions (MCQ) - assessment of knowledge using traditional MCQ is not objective and effective, Multiple choice questions are frequently used but there are no easy ways to investigate non-functioning distractors in developed tests. This presentation mentions advantages and disadvantages of traditional multiple choice questions and introduces a new way to investigate non-functioning distractors in developed tests based on information retrieval model. Unlike traditional statistical based analyses above-mentioned approach allows test developers to analyze test quality before knowledge assessment process.

Introduction

Multiple-choice questions are now a strongly preferred testing instrument across many higher education disciplines and business students in particular. Ultimately, there is no one ideal assessment process and so too, MCQ testing has its advantages and disadvantages.

Multiple Choice Question

A traditional multiple choice question (or MCQ) is one in which a student chooses one answer from a number of choices supplied. A multiple choice question consists of:

• Stem - the text of the question
• Options - the choices provided after the stem
• Key - the correct answer in the list of options
• Distractors - the incorrect answers in the list of options.

Advantages of MCQ

• Compared with traditional assessment questions, MCQs offer faster marking, less necessity for cross-marking.
• MCQs are useful to educational institutions under pressure to reduce unit costs.
• Multiple choice tests often require less time to implement.
• MCQs are now a strongly preferred testing instrument across many higher education disciplines and business students in particular. Ultimately, there is no one ideal assessment process and so too, MCQ testing has its advantages and disadvantages.

Disadvantages of MCQ

• There are no tools or approaches how to investigate non-functioning distractors in developed tests beside statistical analyzes.
• With MCQs there is a possibility of guessing the correct answer.
• They assess only trivial recognition of facts, rather than high-level thinking, such as exercising judgment and synthesis.
• They offer choices for answers, rather than ask the candidate to construct an answer.

Test Quality Analysis

Distractors play a vital role for the process of multiple-choice testing, in that good quality distractors ensure that the outcome of the tests provides more credible and objective picture of the knowledge of the testees involved. On the other hand, poor distractors would not contribute much to the accuracy of the assessment because obvious or too easy distractors will pose no challenge to the students and as a result, we will not be able to distinguish high performing learners from low performing.

Information Retrieval Model

Issues related to analysis and evaluation of non-functional distractors can be solved by the theory of artificial intelligence. However, this theory has incredible complexity and enormous number of objects to research.

The main reason for limiting the power of computer based solution in the knowledge assessment sphere is ambiguity (multi-variant) in the representation of test items (distractors). The reasons of ambiguity are synonyms, homonyms and polysemous vocabulary which are characteristics of any natural language.

A similar problem exists in the development of information retrieval systems, which have to solve essentially the same issues as in the case of investigating and analyzing distractors in test items. However, information retrieval systems have a longer road of development compared with the e-learning systems. So it makes sense to investigate systems of information retrieval in order to explore the possibility of reusing concepts of information retrieval model and use it as a basis for analyzing test items’ distractors.

Document Image and Descriptor dictionaries

In the descriptor based Information Retrieval Systems (IRS) there is a concept of Document Information (DI) which is a list of keywords or descriptors, and other information: numbers, names, product names, and others, reflecting the basic semantic content of the document where the document refers to any unit of information: article, a technical description of a device, a monograph, patent, scientific report, etc.

The process of generating document image (DI) from document is called Indexing. We used well known algorithms and solutions for keyword extractions such as KEA (Keyphrase extraction algorithm), Maui (Multi-purpose automatic topic indexing) and etc.

Keyword - a term which refers to the words of the document, many of which reflect its core semantic content.

Descriptor - does the same role as the keyword. For all keywords taken from the indexed text, with the help of Descriptor Dictionary corresponding descriptor codes are included to DI

With the help of descriptors all keywords of document are assigned to an artificial semantic uniqueness. Using Descriptor Dictionaries we are reducing the size of Document Image.

Match Criterion in Information Retrieval System

By analogy with the Document Image in this case we speak about Search Query Image (SQI). Having keywords and descriptors is not enough to perform search. We need to specify matching criterion based on which the computer decides to provide the document as responding or not.

The natural way is to define Boolean model. In construction of Boolean model, we introduce the following interpretation of the logical variables of Boolean functions. Let’s denote attributes/keywords as A1, A2, A3, … /An

Boolean function, which will be called as a search/retrieval function, assigning to the retrieval of the document. We assume that the document responds to the request if

\[ f(A1, A2, A3, \ldots, An) = 1 \]

Match Criterion in Knowledge Assessment Systems

Fig. 1 and 2 show the scheme of automatic search of documentation, and automatic matching of functioning distractors, respectively.

Consider Fig. 1. It shows the basic operations as a result of which the subscriber receives the information he/she needs.

Scheme of automated matching of distractors with documents presented in Fig. 2, is a complete analog of the automated search of documents. Finding non-functioning distractors in test items will improve whole assessment process. In our case we will find non-functioning distractors by finding functioning distractors, all remaining distractors will be considered as non-functioning.

Conclusion

As mentioned earlier, Information Retrieval Systems have a longer road of development compared with artificial intelligence and e-Learning systems. Using an information retrieval model, where the basic tenets of the theory apply to the IRS on the construction of systems for automated assessment of knowledge offers the possibility of simulation of Boolean Functions of any criterion for evaluating the distractors and does not require their semantic analysis.

References