ABSTRACT

In the last decade, the use of different mobile products such as mobile phones and personal digital assistant (PDA) devices has increased rapidly. In parallel, the use of computerized adaptive testing (CAT) has expanded mainly due to the advancements in communication and information technology. The introduction of mobile devices into the learning pedagogy can complement e-learning and e-testing by creating an additional channel of assessment with mobile devices. Although mobile computing has become an important and interesting research issue, little research has been done on the implementation of CAT using mobile devices. The current study describes the design issues that were considered for the development and the implementation of a CAT on mobile devices, CAT-MD (computerized adaptive testing on mobile devices).

Keywords: computerized adaptive testing; mobile learning

COMPUTERIZED ADAPTIVE TESTING

In recent years, computer-based testing (CBT) has been widely used in education and training as there are a number of perceived benefits in using computers for assessing performance, such as (a) large numbers can be marked quickly and accurately, (b) students’ responses can be monitored, (c) assessment can be offered in an open-access environment, (d) assessments can be stored and reused, (e) immediate feedback can be given, and (f) assessment items can be randomly selected to provide a different paper to each student (Harvey & Moge, 1999). Moreover, another benefit of CBT would be its ability to bring the assessment environment closer to the learning environment. Software tools and Web-based sources are frequently used to support the learning process, so it seems reasonable to use similar computer-based technologies in the assessment process (Baklavas, Economides, & Roumeliotis, 1999; Lilley & Barker, 2002).

Most types of CBT are based on fixed-length computerized assessment that presents the same number of items to each examinee in
a specified order; the score usually depends on
the number of items answered correctly, giv-
ing little or no attention to the ability of each
individual examinee. However, in computer-
ized adaptive testing (CAT), a special case of
computer-based testing, each examinee takes a
unique test that is tailored to his or her ability
level. As an alternative to giving each examinee
the same fixed test, CAT item selection adapts to
the ability level of individual examinees; after
each response, the ability estimate is updated
and the next item is selected to have optimal
properties at the new estimate (van der Linden
& Glas, 2003). The CAT presents first an item
of moderate difficulty in order to initially assess
each individual’s level. During the test, each
answer is scored immediately. If the examinee
answers correctly, the test statistically estimates
her or his ability as higher and then presents
an item that matches this higher ability. The
opposite occurs if the item is answered incor-
rectly. The computer continuously reevaluates
the ability of the examinee until the accuracy
of the estimate reaches a statistically acceptable
level or when some limit is reached, such as a
maximum number of test items. The score is
determined from the level of difficulty, and as
a result, while all examinees may answer the
same percentage of questions correctly, the
high-ability ones will get a better score as they
answer correctly more difficult items.

Regardless of some disadvantages reported
in the literature—for example, the high cost of
development, item calibration, item exposure
(Boyd, 2003; Eggen, 2001), the effect of a
flawed item (Abdullah, 2003), or the use of
CAT for summative assessment (Lilley & Barker,
2002)—CAT has several advantages. Testing on
demand can be facilitated so that an examinee can take the test whenever and
wherever he or she is ready. Multiple media
can be used to create innovative item formats
and more realistic testing environments. Other
possible advantages are the flexibility of test
management, immediate availability of scores,
increased test security, increased motivation,
and so forth. However, the main advantage of
CAT over any other computerized test is effi-
ciency. Since fewer items are needed to achieve
a statistically acceptable level of accuracy,
significantly less time is needed to administer
a CAT compared to fixed-length computerized
testing (Linacre, 2000; Rudner, 1998).

Since the mid ‘80s when the first CAT
systems became operational, that is, the Armed
Services Vocational Aptitude Battery for the
U.S. Department of Defense account (van der
Linden & Glas, 2003) using adaptive tech-
niques to administer multiple-choice items,
much research and many technical challenges
have made new assessment tools possible. The
availability of advanced mobile technologies
have started to extend e-learning by creating an
additional channel of assessment with mobile
devices such as cell phones, personal digital
assistants (PDAs), and pocket PCs (personal
computers).

MOBILE LEARNING
In the last decade, the use of different mobile
products such as mobile phones and PDA de-
vices has increased rapidly. Moreover, much
attention has been paid to mobile computing
within the information technology industry. The
availability of advanced mobile technologies,
such as high-bandwidth infrastructure, wireless
technologies, and handheld devices, has started
to extend e-learning toward mobile learning (m-
learning; Sharples, 2000). M-learning intersects
mobile computing with e-learning; it combines
individualized (or personal) learning with any-
time and anywhere learning. The advantages of
m-learning include flexibility, low cost, small
size, ease of use, and timely application (Jones
& Jo, 2004).

The introduction of mobile devices into
the learning pedagogy can complement e-
learning by creating an additional channel of
assessment with mobile devices such as PDAs,
mobile phones, and portable computers. Due to
their convenient size and reasonable comput-
ing power, mobile devices have emerged as a
potential platform for computer-based testing.
Although mobile computing has become an
important and interesting research issue, little
research has been done on the implementation of

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