Analysis of User Acceptance for Web Based Aptitude Tests with DART

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ABSTRACT

Web-based aptitude tests, which are a special category of aptitude tests, can be used for rather standardized test methods and for a large amount of users. The characteristics of web-based aptitude tests can have an impact on the result of the test. The aim of our research is to develop a method for the evaluation of the user acceptance for web-based aptitude tests. Negative influences when using a Human Computer Interface should be identified and minimized. After an analysis of existing acceptance models, the DART-approach is chosen as a basis for the adoption to web-based aptitude tests. Due to literature research and expert discussion, we identified twelve aggregated acceptance indicators. The use of the DART-approach helps to define a balanced set of measurable acceptance indicators for the evaluation of the user acceptance.

Keywords
Aptitude test, user acceptance, DART-approach

INTRODUCTION

Aptitude tests clarify the requirements for school, study, job, or even complex task. These tests are getting more and more popular in different fields of application. Aptitude tests can be divided into two groups; voluntary and compulsory tests. Voluntary career tests are mainly consulting services. Based on motivation, talents and aptitude, the user often gets a detailed career guidance report and a description of possible career steps. Besides, compulsory aptitude tests are used to select applicants for some professions.

Some tests are still making extensive use of paper and pencil; others use web-based methods whereas some others offer both methods. Due to the recent technology advances, web-based solutions are getting more and more important. Some reasons are the low costs; high effectiveness, overall availability and an easy distribution of these web-based aptitude tests (WBATs). They are used for rather standardized test methods and for a large amount of users. They differ in the following points: during the test execution queries are not possible; the data input is difficult to verify; a discussion of the test results is usually not supported.

Aptitude tests are often viewed more from the supplier’s perspective instead of the user’s perspective. In any case, both parties have an interest to give or get an aptitude statement, which is as much objective as possible. Due to the special characteristics of WBATs, the design of the Human Computer Interface is important: Are the content and the kind of questions acceptable? Is the design barrier free and non-discriminatory? Especially, developers need indications, how to adopt a test to achieve a high acceptance and spread of the WBAT.

To consider these issues, the analysis and evaluation of the user acceptance are helpful. After reviewing existing acceptance models, we select the DART-approach as the most appropriate one. In a first research cycle, DART is adapted to the requirements of WBATs. This is the starting point to develop a valid instrument for the user acceptance of WBATs. This instrument provides further insights for the implementation of WBATs.
STATE OF THE ART OF METHODS TO EVALUATE THE USER ACCEPTANCE

In general, acceptance is defined as an antagonism to the term refusal and means the positive decision to use an innovation. The acceptance research has its origin in both, industrial and business science. While industrial science focuses on the conditions of user friendly technologies and techniques, the business science discusses acceptance in a variety of disciplines (e.g., marketing, organisation and production theory as well as information management) (Amberg, Hirschmeier, Wehrmann, 2004). During the last years several, theories and models have been developed. Each of these models determines different factors to explain user acceptance. The following figure shows an overview of the most widely used acceptance models.

<table>
<thead>
<tr>
<th>Key influencing factors</th>
<th>Short summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Acceptance Model (TAM) (Davis, 1986)</td>
<td>(perceived) usefulness, (perceived) ease of use</td>
</tr>
<tr>
<td>Technology Task Fit Model (TTFM) (Goodhue, Thompson 1995)</td>
<td>Technology, Task, Individual</td>
</tr>
<tr>
<td>(Degenhardt, 1986)</td>
<td>Task, System, User Characteristics</td>
</tr>
<tr>
<td>Dynamic Acceptance Model (Kollmann, 1998)</td>
<td>attitude level, action level, utilisation level</td>
</tr>
<tr>
<td>Dynamic Acceptance Model for the Reevaluation of Technologies (DART) (Amberg, Hirschmeier, Wehrmann, 2002)</td>
<td>(perceived) usefulness, (perceived) ease of use, (perceived) network effects, (perceived) costs</td>
</tr>
</tbody>
</table>

Figure 1. Overview of common acceptance models and their key influencing factors (according to Amberg et al., 2004)

So far, the existing approaches are not sufficient with regard to the analysis and evaluation of the specific factors of innovative applications. Acceptance models should be understood as a methodology for quality assurance. Therefore, the user is often interpreted as an employee and not as a customer. The drivers and restraints, that are important to private users, have not been subject to examination. There is a lack of a general acceptance model that combines the perspectives of private and business users concerning the same technology. A valuable contribution in this context is an acceptance model, namely DART approach, which was introduced by (Amberg et al., 2004). It serves as a general model, which can be used for both user groups. Furthermore, evaluation methods for the user acceptance of WBATs do not exist.

Hence, our research design will be as follows: Within the first step, a method to evaluate the user acceptance is developed. The following tasks have to be carried out: select one method as a basis; adopt the method to the special requirements by identifying relevant acceptance indicators and evaluate the adopted method. During the second step the method is applied. Therefore, WBATs have to be evaluated; the results have to be to be analyzed. In a second cycle, validity of the factors has to be proven, considering the work of Moore and Benbasat (1991). Furthermore, the results of the two cycles have to be implemented in the WBAT to show the achieved improvements. In the following, we will focus on the first step the development of a method for the user acceptance of WBATs.

THE DART-APPROACH

Acceptance models should be understood as a methodology for quality assurance. A valuable contribution in this context is an acceptance model, namely DART-approach, which was introduced by (Amberg et al., 2004). DART is an instrument designed for the analysis and evaluation of the user acceptance of products or services. The fundamental design criteria are according to Amberg et al. (2004):
• Use as a permanent controlling instrument
• Balanced consideration of relevant influencing factors
• Applicability during the whole development/implementation process
• Adaptability to individual requirements of the research item

These design criteria are useful to integrate user acceptance analysis into the development and evaluation of products or services. In the following, we describe the architecture of DART (Amberg et al., 2004).

DART, which is based on the idea of the balanced scorecard (BSC) (cf. Kaplan and Norten, 1996), helps to define a balanced set of measurable acceptance indicators for the evaluation of the user acceptance. The DART-approach uses a meta-structure, which consists of the following complementary and orthogonal categories:

• **Benefits** and **Efforts** comprise all positive and negative facets of the products or services under examination.
• **Products or Services** (e.g., Internet Applications) and **Contextual Conditions of Products or Services** include basic sociocultural and economic conditions, which also have a considerable impact on user acceptance.

**Figure 2. The DART-approach (Amberg et al., 2004)**

These categories lead to four dimensions (figure 2):

• **(Perceived) Usefulness**: The dimension build by the categories **Benefits** and **Products or Services** describes the perceived usefulness of a product or service. Indicators measuring this dimension might be perceived information quality and quantity or conformity of expectations.

• **(Perceived) Ease of Use**: The dimension characterized by the categories of **Products or Services** and **Efforts** can be identified with the perceived ease of use, the degree to which a person believes that using a particular service would be free of effort. Indicators measuring this dimension are for example the ease of configuration or first log-in, overall handling and menu navigation.

• **(Perceived) Network Effects**: The categories **Benefits** and **Contextual Conditions of Products or Services** lead to the dimension of perceived network effects. The dimension considers the contextual conditions of a product or a service, whose acceptance highly depends on the economical, social and technological perspectives (Galletta and Malhotra, 1999).

• **(Perceived) Costs**: This dimension is formed by the categories of **Efforts** and **General Conditions of Products or Services**. This dimension describes the monetary and non-monetary effort. Costs transparency or data security, which are not in correlation with the application, are considered as appropriate indicators.

These four dimensions emphasize the evaluation of a product or a service from the end user’s subjective point of view, because of the explicit consideration of the user’s perception. On the basis of these dimensions, it is possible to define specific acceptance indicators for the empirical evaluation of the user acceptance respectively.
The visualization approach is based on spider charts. A spider chart is composed of several radial spokes, one representing each acceptance indicator, which are structured by the DART dimensions (figure 2).

In order to evaluate the user acceptance, the developed indicators should be quantified and normalized on a scale from one to six. The value of one describes a high user acceptance and the value of six a low acceptance level respectively. The acceptance curve (bold black line in the figure) represents the average acceptance level of the interviewed persons (statistical median). The statistical spread resulting from the spread of the survey could be used to draw a surface (utilizing the lower and the upper quartile) (Amberg et al., 2004).

The used presentation is analogous to the popular dart game, where a dart hitting the centre of the disc denotes the highest possible score (the highest possible acceptance level respectively). By means of this visualization approach, potential acceptance challenges and resistances could easily be identified, focused and eventually even removed.

**KEY INFLUENCING FACTORS FOR WEB-BASED APTITUDE TESTS**

To adopt DART, it is necessary to identify the indicators, which influence the user acceptance of WBAT. The proposed DART dimensions are the basis for the examination. The intention is to find aggregated indicators, which show a high significance. The indicators must meet the requirements of sustainability, measurability, achievability, reasonability and timeliness (c. f. Kaplan and Norton, 1996). In addition, a general problem of social surveys is to translate the criteria into precisely measurable and linear independent variables. Due to the review of current literature (e. g., Amberg, Wehrmann, Zimmer, 2004; DIN33430, 2002; Kollmann, 1998; Reichwald, 1980; Schröder and Meszler, 2003; Schönecker, 1982; Stiftung Finanztest, 2004) and discussion with experts, we identified the following aggregated acceptance indicators (figure 3):
In a next step, these acceptance indicators are used to develop a standardized questionnaire. Each acceptance indicator supports the identification of suitable questions. With regard to the DART method, we choose a scale from 1 (absolute approval) to 6 (absolute denial) as measures. For evaluation, we select one external WBAT in the area of business. It supports applicants and students to choose their further working field. Therefore, we choose students with an appropriate subject (e.g., business administration, business information technology) for the sample. After a survey with 49 participants, we came to the following conclusions.

The DART-Chart clearly shows that the interviewees evaluated the indicators very differently. The sample size is relatively small, although we came to first assumptions. With this visualization in mind, we can identify which indicators are likely to play an important role for the user acceptance. Based on these results, dedicated measures and actions can be derived to improve the user acceptance, e.g., changing of the test location and a better offer of additional information. In general, there are different applications for this method: At first, the acceptance of aptitude tests can be evaluated for a single test. In addition, the visualization can help to compare two or more aptitude tests. Furthermore, cluster analysis can be carried out.

This practical example shows that the DART-approach can be adapted to analyze the user acceptance of WBATs. Positive and negative influences on the user acceptance can be quantified and visualized. Nevertheless, a forgery of the aptitude test, e.g., with false answers, is not prevented with the adapted method.

**SUMMARY AND OUTLOOK**

The aim of our research is to develop a method for the evaluation of WBATs. The method should help to analyze the user acceptance of WBATs comprehensively. The negative influences when using a Human Computer Interface should be identified and minimized. Our results show that with the use of the DART-approach a detailed analysis of the influencing factors is generally possible. It helps to define a balanced set of measurable acceptance indicators for the evaluation of the user acceptance. In a second research cycle, the validity of the items can be tested. Further open questions for this research are: To what extent does the identification of influencing factors on user acceptance depends on the specific WBAT? How can the results of such an evaluation be considered during the design process of a WBAT?
REFERENCES


