Card Sorting Assessing User Attitude in E-Learning

Ghada R. El Said

Business Information Technology, Future University in Egypt (FUE),
90th street, Fifth settlement, New Cairo
`Ghada.refaat@fue.edu.eg`,
`Ghadarefaat_04@hotmail.com`

Abstract. Various undergraduate and post graduate educational bodies, now a day, employ blended learning systems to complement the face to face communication between educator and learner. While E-learning tools in general have been found to improve access to resources, these tools need to be reliable and usable; the ease of use of E-learning would have a meaningful impact on the learning experience.[1]

This paper investigates learners' perception of quality and willingness to use of E-learning environments. It also explores the attitude of users from two different cultural groups towards a number of E-learning sites. The paper aims to reveal some of the perception of quality for these groups of users in interacting with learning virtual communities.

In September/ October 2013, series of card sorting sessions were conducted with number of learners enrolled in a joint venture European-Arab Master Program. In the individual sessions, each participant was asked to look at card of selected E-Learning sites, and to choose a single criterion by which the E-learning main pages could be differentiated from one another. Cards were then sorted based on different categories under each criterion. Participants repeated sorting the cards according to criteria and categories they generated. A second round of sorting sessions were conducted by the same participants, where they sorted the same cards according to the Willingness to Use criterion, and provided a reason for the sorting decisions made.

The analysis of the card sorting sessions reveals some interesting findings concerning interface elements which seem to be salient for users in E-learning environment, such as: Interface Comprehensibility and Obviousness, Content Usefulness, and Site Affiliation and Reputation. Some differences in quality perception were also found between the two cultural groups.

This paper makes a contribution to universal access in HCI by describing the quality perception, preferences, and general attitude for different group of users in the context of E-learning environment.

Keywords: E-learning, Assessing User Attitude, Card Sorting.

1   Introduction

Recent E-learning environments employs Internet communication technology to add the feature of asynchronous learning activities, and customization of instruction and

assessment, it serves to facilitate a simultaneous independent and collaborative learning experience.[2] Bended learning environment can build an online community where forums can be held to better support the learning process.

Modern E- learning education programs enable learners to gain knowledge, at least in part, through online delivery of materials and instructions, while empowering learners with some components of individual control over time, path, and/or pace.[2]

Nevertheless, little study looked at learners' attitude and satisfaction in E-learning environments or their subsequent use. Additionally, while online communities are a suitable venue for assessing Multi-Cultural user attitudes, little research has looked into this issue in the learning context.

This paper looks at the case of a Multi-Cultural Blended Leaning community, a European-Arab Master's Program, jointly provided by an Educational Institute in central Europe and a faculty of Education in an Arab country. The purpose of the master program is to develop and to provide managerial skills as well as competencies for cross-cultural challenges in education management. The paper aims to unfold some general user attitude matters for different cultural groups of users in the context of E-learning environment.

2   Method

2.1   The Card Sorting Technique

Some researchers [3] suggested that studying human perception of information systems starts with exploratory studies to generate hypotheses based on authentic participants' preferences. Card sorting technique is a recommended method for investigating criteria by which users evaluate web pages; it discovers users' understanding of quality features and design of interactive web-based systems.[4] Categories based on which cards are sorted highlight what seems to be significant for the users, hence generating mature research hypotheses.

Repeated Single Criterion Sort Sessions were conducted, where participants are asked to select a criterion by which the main page could be distinguished from one another, using the main page cards. Having named the sorting criterion, categories for this criterion are identified and cards are sorted accordingly. This sequence is repeated until the participants could think of no more criteria. Criteria and categories that are most frequently selected by the participants reveal which web site design features are most noticed, hence reflect participants' perception about web site evaluation.[5]

Forced Sort Sessions were conducted by the same participants, where they sorted the same cards according to the criterion: "I would/would not use this site". Having sorted the cards according to this criterion, participants were asked to provide a reason for the sorting decisions made.

2.2   The Participants

Card sorting techniques can result valuable insights with a relatively small sample.[6] Thirty educators (fifteen Egyptians and fifteen Germans) doing their post graduate

studies using a Blended Learning joint program participated in card sorting sessions. Gender was equally distributed with fifty percent females in both groups. The sample age range varies from 30 to 45, with 50% under 40. All participants were regular Internet users, used the Internet for social networking, educational, and professional development purposes. All participants owned a very good English language, with which they communicate online, and use English language materials and web sites. English language proficiency is a requirement for joining the joint program, for both Germans and Egyptians.

2.3   The Instrument

In sorting techniques, working with higher hierarchy, such as site's main page, would generate more general categories.[6] In the current research, as general insights are acquired, pictures of main pages of educational sites were used for the sorting tasks. The main page illustrates major site's features and category of contents.

2.4   Selecting Educational Sites

Nine E-learning sites were chosen for the sorting study, this number complements the range of items, between eight and twenty, recommended in sorting sessions.[7] Selected E-learning sites includes Web 2.0 open access sites, such as: Khan Academy (khanacademy.org), UNESCO open training platform (opentraining.unesco-ci.org), and TrackStar4Teachers (http://trackstar.4teachers.org). Restricted access sites were also used, such as: Epsilen (corp.epsilen.com), AUC Blackboard+Learn (blackboard.aucegypt.edu). The nine sites included different options of materials categorization, search features, and different interface styles.

Images of the main page of selected sites were captured in November 2013, cropped on the same size and brightness, and high quality colored printed on A4 white paper. Pictures were numbered to make sorting results easier to record. Printed pictures were then covered with hard plastic covers. Participants are allowed to spread cards out wide on a large clear desk during the session.

2.5   Sorting Sessions Administration

During the months of November and December 2013, card sorting sessions were conducted by the researcher in individual sessions. Each session started with an orientation in which written instructions concerning the purpose, duration, and steps of the session were discussed with the participant. A short orientation on card sorting technique was introduced using cards from different domain. Each participant tried sorting until feeling comfortable to start the formal sorting session. Following, the nine E-learning main page cards were presented to the participant.

In the individual sessions, each participant was asked to look at the main page cards and to choose a single criterion by which the E-learning main pages could be differentiated from one another. Cards were then sorted based on different categories under each criterion. Participants repeated sorting the cards according to criteria and

categories they generated, until they could think of no more criteria. This procedure was repeated until the participants could think of no more criteria. Sorting criteria, categories, as well as comments on the perception towards the site were all noted by the researcher during the session.

A second sorting session was conducted with the same participants, where they sorted the same cards according to the criterion: "I would/would not use this site". Participants were asked to provide a reason for the sorting decisions made.

3   Data Analysis

Card sorting result analysis was based on the examination of criteria count, textual analysis, as well as cluster analysis.

3.1   Frequency Analysis for the Repeated Single Criterion Sort

Commonality of criteria is the main source for data analysis in card sorting. Commonly selected criteria are recommended to be most salient interface elements for participants.[7] Frequency analysis looked at criteria communality, where criteria names of same meaning were grouped into a common single super-ordinate construct. **Table 1** below shows super-ordinate constructs sorted descending by selection frequency.

Table 1. Super-ordinate constructs sorted by selection frequency

Super-Ordinate Construct	German Participants (total: 15)	Egyptian Participants (total: 15)	All Participants (total: 30)
General Interface Appearance	13 – 87%	14 – 93%	27 – 90%
Content Usefulness	13 – 87%	12 – 80%	25 – 83%
Site Affiliation and Reputation	8 – 53%	14 – 93%	22 – 73%
Content Quality	11 – 73%	7 – 47%	18 – 60%
Familiarity with the Site	4 – 27%	8 – 53%	12 – 40%
Online Help	4 – 27%	6 – 40%	10 – 33%
Search method	4 – 27%	1 – 7%	5 – 17%

According to Table 1, for the overall participants of the sorting session, the most salient E-learning site features were *General Interface Appearance, Content Usefulness, Site Affiliation and Reputation, and Content Quality.*

The *General Interface Appearance* was the criterion selected by the highest majority (90%) of the overall participants (14 out of 15 Egyptians and 13 out of 15 Germans). This suggests that Interface is a highly salient feature for this group of users. In defining the *General Interface Appearance* criterion, most of the participants (21 out of 30) used two categories: *Comprehensive/ Straightforward/ Obvious* versus *Unclear/ Complicated/ Obscure*. Some participants (18 out of 30) used another two categories: *Neat/ Structured/ Organized* versus *Disordered/ Crowded/ Messy*. Few

participants (6 out of 30) used three categories: *Appealing Interface/ Attractive* versus *Acceptable/ Somehow Attractive* and versus *Poor/ Un-Attractive.* Other Few participants (4 out of 30) used two categories: *Professional* versus *Non-Professional*.

Two criteria selected by the participants are concerning the content of the E-learning main page; those are *Content Usefulness* and *Content Quality*. While *Content Usefulness* ranked the second most frequently selected criterion (chosen by twenty five, 83%, of participants, and almost equality selected by the two cultural group); *Content Quality* was ranked the forth most frequently selected criterion (chosen by eighteen, 60%, of participants, and seems to be of more importance to the German participants as it was selected by 73% of Germans and only 47% of Egyptians).

According to participants, *Content Usefulness* criterion refers to the participants' perception of how relevant is the displayed material to their work/ interest as well as their professional development goals. Most of participants defined the *Content Usefulness* criteria by using two categories: *Relevant Material/ Helpful Content/ Useful Information,* versus *Of Little Relevance/ Not Sufficiently Helpful/ Barely Useful*.

On the other hand, for the participants, *Content Quality* criterion refers to the participants' perception of how updated, well structured is the content, as well as the amount of advertisement embedded within. Most of participants defined the *Content Quality* criteria by using three categories: *Updated/ Well-Structured Materials* versus *Barely Updated/ Somehow Structured*, and versus *Outdated/ Junk.* Few participants (4 out of 30) used two different categories concerning the advertisements load in the site, such as: *Advertisement Free* versus *Distracting Advertisements.* It could be argued that there is a substantial overlap between the two criteria: *Content Usefulness* and *Content Quality*, as they are both concerned with the perception of quality of materials included in the E-learning site, and its relevance to the participants need.

The *Site Affiliation and Reputation* was the third most frequently selected criterion (chosen by twenty two, 73%, of participants, and seems to be of more importance to the Egyptian participants as it was selected by 93% of Egyptians and only 53% of Germans); *Site Affiliation and Reputation* criterion refers to the participants' perception of site reputation and its affiliation name and recognition. Most of participants defined the *Site/Affiliation Reputation* criteria by using two categories: *Well Known Site/ Site maintained by a Reputable Affiliation-Institute/ Trustworthy,* versus *Unheard of Site/ Unknown Owner of the Site/ Untruthful*.

When looking at differences between the German and Egyptian participants in terms of criteria and categorizations generated, it could be suggested that the Egyptian participants give more weight to the affiliation of the site, as well as the degree of their familiarity with using the site before. While it could be suggested that German participants focus more on content quality and usefulness.

Rag Bag categories, such as "not sure" and "don't know" appear rarely, same for the categories of "not applicable". This suggests that the uncertainty of participant was relatively low.[3]

On the other hand, there was a significant absence of some expected criteria, such as: *Level of Interactivity, User Control,* and *Feedback* features; such features are suggested to affect the user attitude towards E-learning sites.[8] This absence is one of

the limitations of static card sorting technique, where no interactive features can be explored by the participants during the session.

3.2   Frequency Analysis for the Forced Sort

In the forced session, participants were asked to sort the same cards based on the criterion: "Sites I am willing to use / Sites I am not willing to use", and to provide one or more reason(s) for their choice. Reasons of same meaning were grouped into a common title. Frequency and commonality of reasons provided by the participants for their sorting choices were analyzed, while distinguishing between the two cultural groups of participants.

As listed in Table 2 below, main page *Interface Obviousness and Comprehensibility* was the most common reason for willingness to use the site, for thirteen out of fifteen of Germans and for thirteen out of fifteen of Egyptians. In total, for 87% of the thirty participants, the obviousness and comprehensibility of the interface of the main page card, was the factor that generates a willingness to use the E-learning site.

Content Usefulness was ranked as the second highest reason for willingness to use, selected by 73% (twenty two out of thirty) of overall participants; followed by *Site Affiliation and Reputation*, selected by 67% (twenty out of thirty); While *Content Quality* was selected by only 57% (seventeen out of thirty) of overall participants.

Some differences were found while comparing the preference of use between the two cultural groups. For the German participants, *Content Usefulness* was ranked as the second highest reason for willingness to use, selected by 80% (twelve out of fifteen) German participants; Followed by *Content Quality*, selected by 67% (ten out of fifteen) participants of this cultural group; While *Site Affiliation and Reputation* was selected by only 53% (eight out of fifteen) German participants.

Table 2. Reasons for Willingness to Use

Stated Reasons for Willing to Use an E-Learning Site from a Site	German Participants (total: 15)	Egyptian Participants (total: 15)	All Participants (total: 30)
Interface Obviousness and Comprehensibility	13 – 87%	13 – 87%	26 – 87%
Content Usefulness	12 – 80%	10 – 67%	22 – 73%
Site Affiliation and Reputation	8 – 53%	12 – 80%	20 – 67%
Content Quality	10 – 67%	7 – 47%	17 – 57%

For the Egyptian participants, *Site Affiliation and Reputation* was ranked as the second highest reason for willingness to use, selected by 80% (twelve out of fifteen) Egyptian participants; Followed by *Content Usefulness*, selected by 67% (ten out of fifteen) participants of this cultural group; while *Content Quality* was selected by only 47% (seven out of fifteen) Egyptian participants.

3.3   Cluster Analysis

A complementary qualitative analysis technique for card sorting results was conducted using cluster analysis. Custer analysis establishes categories based on commonalities between categories selected by multiple participants.[7] In this research, cluster analysis was done using computer aided software that indicates the degree of category relatedness between items by a tree structure. The shorter the path traced between two items through the tree, the more likely the items are to belong to the same category. *This is done by providing a means of calculating the strength of the perceived relationship between pairs of cards based on how often members of each possible pair of cards are sorted into a common group by multiple participants.*[7]

Fig. 1 illustrates the cluster analysis of the forced sort "Willing/ Not Willing to Use". Each branch on the left hand side connecting two sites indicates that the majority participants grouped the sites together. The branch on the right hand side connecting groups of sites indicates that no participants grouped the items together. According to the current results, clusters are classified as following: *Cluster 1:* Khan Academy, UNESCO Open Training and Epsilen. *Cluster 2:* TrackStar, IEarn, AUC Learn+, Google for Educators, BCIT, and MIT OpenCourseWare.
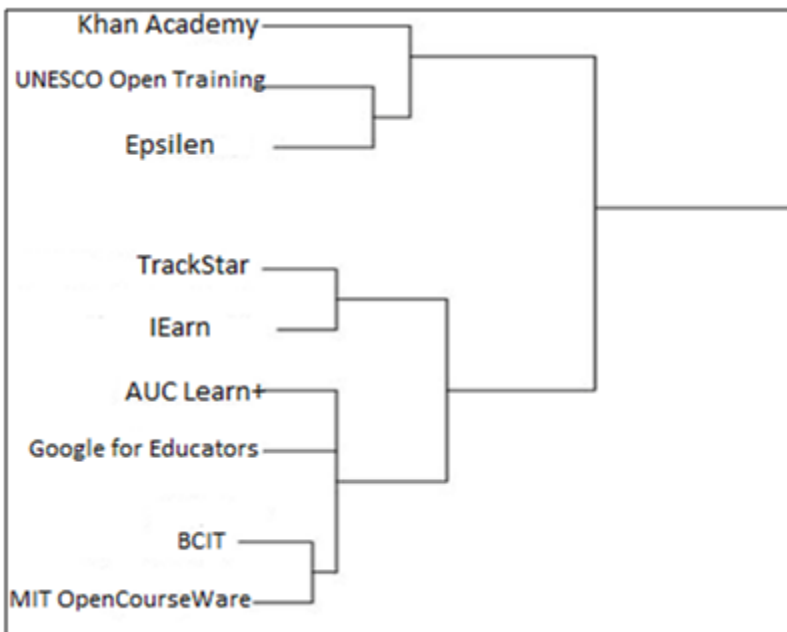
Fig. 1. Cluster Analysis for Forced Card Sorting

According to cluster analysis of the forced sorting session, three E-learning sites are more likely to be used. The remaining E-learning sites are less likely to be used. The following section examines the reasons provided by the participants for their

willingness to use these three sites. The following section also analysis the results of the two sorting sessions together to investigate whether these three E-Learning sites, which are more likely to be used, share some categories and criteria in the first sorting session.

4   Results

Sorting results from both sessions were examined to investigate whether there were any features that distinguished the sites where participants were more likely to use, from those which participants were less likely to use. This is done by examining the commonality of categories and criteria associated with the three sites participants were more likely to use, and whether these three sites were categorized together according to any of the other sort criteria. As indicated in Table 3, the "Willing to Use" sites appeared to share a lot of the same salient features. These sites generally are Comprehensive, Organized, with Helpful Content and Well Known sites. Features such as Appealing Interface, Attractive, Professional, and Updated are shared in the "Willing to Use" and "Not Willing to Use" sites without any suggested effect on the willingness to use.

The *General Interface Appearance* criterion wholly predicted membership of the "Willing to Use" and "Not Willing to Use" category. This criterion correctly predicted the outcome for all sites. Participants were willing to use sites categorized as Comprehensive and organized, and they were unwilling to use any of the sites categorized as Unclear and Messy.

The *Site Affiliation and Reputation* criterion correctly predicted the outcome for all but one of the sites. Participants were willing to use all of the sites categorized as Well Known Site and Trustworthy, and they were unwilling to use any of the sites categorized as Unheard of Site, except one site.

Table 3. Analysis of the Site Willingness to Use versus Criteria and Categories

Site	Willing/ Not willing to use	General Inter-face Appearance	Site Affiliation/Reputation	Content Usefulness
Khan Academy	Willing to Use	Comprehensive	Well known	Helpful
UNESCO Open Training	Willing to Use	Comprehensive	Well known	Helpful
Epsilen	Willing to Use	Organized	Trustworthy	Helpful
TrackStar	Not Willing to Use	Messy	Unheard of	Not Helpful
IEarn	Not Willing to Use	Unclear	Unheard of	Not Helpful
AUC Learn +	Not Willing to Use	Unclear	Unknown	Not Helpful
Google for Educators	Not Willing to Use	Messy	N/A	N/A
BCIT	Not Willing to Use	Messy	Unknown	Not Helpful
MIT OpenCourseWare	Not Willing to Use	Unclear	Unknown	Not Helpful

The *Content Usefulness* criterion correctly predicted the outcome for all but one of the sites. Participants were willing to use all of the sites categorized as Helpful Content, and they were unwilling to use any of the sites categorized as Not Sufficiently Helpful, except one site.

Although some differences were suggested between the German and Egyptian participants when analyzing the two sorting sessions separately, no differences was found when analyzing the results of the two sorting sessions together. Thus the systematic integration of the two sorting session results can not suggest any effect of participant's culture on the willingness to use. Still, such cultural difference is highlighted in Table 2, based on the reasons given by the participants themselves for their willingness to use an E-learning site.

5   Discussion

This paper explores the attitude of users from two different cultural groups towards E-learning environment. Two card sorting techniques were conducted to investigate criteria by which users evaluate web sites. First: Repeated Single Criterion Sort Sessions, where participants selected a criterion to differentiate between cards of main pages, categories for this criterion are identified and cards are sorted accordingly. Second: Forced Sort Sessions, where same participants sorted the same cards according to the criterion: "I would/would not use this site", reasons for this decision were given.

As reported in the previous sections of this paper, the analysis was done on four steps, while distinguishing between the two cultural groups of participants. First: Frequency analysis of commonly selected criteria as illustrated in Table 1. Second: Frequency analysis of commonly given reasons for willingness to use as illustrated in Table 2. Third: Cluster analysis to identify categories commonalities for cards where participants are willing to use as showed in Fig. 1. Forth: Analyzing the commonality of criteria associated with the sites more likely to be used as listed in Table 3.

The results of the four types of analysis consistently suggest that for the overall participants the most salient E-Learning site feature is *General Interface Appearance*, namely *Interface Obviousness and Comprehensibility*. The obviousness and comprehensibility of the interface are the factors generating a willingness to use an E-Learning site. Participants were willing to use all sites categorized as *Comprehensive* and *organized*, and they were unwilling to use any of the sites categorized as *Unclear* and *Messy*.

Content Usefulness is the second most salient feature, ranked as the second highest reason for willingness to use an E-Learning site. Participants are more willing to use sites with *Helpful Content*.

The *Site Affiliation and Reputation* was the third most frequently selected criterion, and the third most cited reason for using an E-Learning site. It refers to the participants' perception of site reputation and its affiliation name and recognition. Participants were willing to use all of the sites categorized as *Well Known Site* and *Trustworthy*.

These finding are consistent with one of the most influential and widely used model of IT adoption, the Technology Acceptance Model (TAM).[9] The model posits that perceived usefulness and perceived ease of use are significantly correlated with systems use. Where perceived ease of use is defined as *the degree to which a person believes that using a particular system would be free of effort* and perceived usefulness is *the degree to which a person believes that using a particular system would enhance his or her performance*.[9]

On a similar context, TAM was used to understand factors that lead to technology adoption in five Arab countries. [10] This research suggested that the two main variables of TAM, ease of use and perceived usefulness, might aid in the adoption of IT in the Arab world.

Other features were reported of importance to participants also affecting the willingness to use decisions, such as *Content Quality*, and *Familiarity* with the web site. Nevertheless, these two features were not consistently confirmed by the four types of results analysis.

On the other hand, some differences were found between the German and Egyptian respondents. While the Egyptian participants give more weight to the affiliation of the site, as well as the degree of their familiarity with using the site before; German participants focus more on Content quality and Usefulness. Still, these differences were not confirmed by the four types of results analysis, which contradicts with some previous research [11, 12] suggesting cross-cultural differences of systems use, especially within cultures from different cultural groups.[13]

6   Conclusion

The various analysis techniques employed in this study consistently suggest that the *Interface Obviousness and Comprehensibility*, followed by the *Content Usefulness*, and finally *the Site Affiliation and Reputation*, represent respectively the most salient features affecting the participants' attitude towards E-learning sites. These features, with the same order of importance, are suggested to be driving reasons for the participants' willingness to use the sites.

The fact that same findings have been acquired with different sorting sessions and with various analysis techniques, suggests that these features shape learners' attitude and satisfaction in E-learning environments and their subsequent use of such tools.

While some differences were highlighted concerning the preferences of participants from two cultural groups; nevertheless, the current study could not suggest a consistent effect of culture on user attitudes and preferences. Future research would like to address such important factor in the E-learning context.

In summary, the results of the current study suggest some important factors that tend to be associated with E-learning sites for the targeted group of participants. *Ease of Use*, *Content Usefulness* and *Site Reputation* are suggested as salient components of building positive attitude and willingness to use towards an E-learning site. Future research would build on these findings to investigate any possible inter-relationships between them.

7   Limitations

The use of static images of selected sites as sorting materials could be considered as limitation of card sorting technique in general. The use of images excludes many effects of the dynamic aspects of a web site such as Interactivity. Some interface features may only become important to users once they interact with the site. Some studies suggest an effect of Interactivity on user attitude and performance improvement in E-Learning context.[8] Therefore, a future research, allowing participants to interact with the E-learning sites, would complement the finding of the current study.

On the other hand, in this study, while cluster analysis was done using computer aided software; collecting participants' data during card sorting sessions were administered manually by the researchers. To eliminate bias, a computer program would be used by card sort participants to sort digital cards instead of physical cards. This computer program can also generate card list and enter existing card sort result from individual participants.

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