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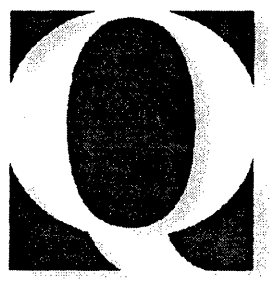

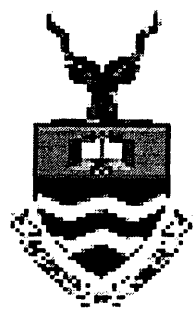

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Think different.

Preface

Philip Machanick, Overall Chair: SAICSIT'99

Running SAICSIT'99, the annual research conference of the South African Institute for Computer Scientists and Information Technologists, has been quite an experience.

SAICSIT represents Computer Science and Information Systems academics and professionals, mainly those with an interest in research. When I took over as SAICSIT president at the end of 1998, the conference had not previously been run as an international event. I decided that South African academics had enough international contacts to put together an international programme committee, and a South African conference would be of interest to the rest of the world.

I felt that we could make this transition at relatively low cost, given that we could advertise via mailing lists, and encourage electronic submission of papers (to reduce costs of redistributing papers for review).

The first prediction turned out to be correct, and we were able to put together a strong programme committee.

As a result, we had an unprecedented flood of papers: 100 submitted from 21 countries. As papers started to come in, it became apparent that we needed more reviewers. It was then that the value of the combination of old-fashioned networking (people who know people) and new-fashioned networking (the Internet) became apparent. While the Internet made it possible to convert SAICSIT into an international event at relatively low cost, the unexpected number of papers made it essential to find many additional reviewers on short notice. Without the speed of e-mail to track people down and to distribute papers for review, the review process would have taken weeks longer, and it would have been much more difficult to track down as many new reviewers in so little time.

Even so, the number of referees who were willing to help on short notice was a pleasant surprise.

The accepted papers cover an interesting range of subjects, from management-interest Information Systems, to theoretical Computer Science, with subjects including database, Java, temporal logic and implications of e-commerce for tax.

In addition, we were very fortunate in being able invite the president of the ACM, Barbara Simons as a keynote speaker. Consequently, the programme for SAICSIT'99 should be very interesting to a wide range of participants.

We were only able to find place in the proceedings for 36 papers out of the 100 submitted, of which only 24 are full research papers. While this number of papers is in line with our expectation of how many papers would be accepted in each category, we did not have a hard cut-off on the number of papers, but accepted all papers which were good enough, based on the reviews. Final selection was made by myself as Programme Chair, and Derrick Kourie, as editor of the *South African Computer Journal*. Additional papers are published via the conference web site.

We believe that we have put together a quality programme, and hope you will agree.

Acknowledgments

I would like to thank the *South African Computer Journal* production team, Andries Engelbrecht and Herna Viktor, respectively from the Department of Computer Science and Informatics, University of Pretoria, for their work on producing the proceedings.

The reviewers listed overleaf did an excellent job: many wrote very detailed reports, sometimes after being called in on very short notice. Inevitably, there were some glitches resulting from the unexpected workload, but the buck stops with the programme chair: I promise to do better next time.

I would also like to thank my own department for putting up with the extra work and expense that running a conference entails. I tried not to burden them with too much extra work, but our secretaries, Zahn Gowar and Leanne Reddy, inevitably had to take on some extra work. John Ostrowick provided valuable assistance with design of our web pages and call for papers poster. Carol Kernick, who handles our finances and membership records, did a fine job of keeping up with the demands of the conference.

Finally, I would like to thank our sponsors, whose contribution made this conference been possible:

- PricewaterhouseCoopers – sponsored generous prizes and the conference banquet
- National Research Foundation (NRF) – provided financial support
- University of the Witwatersrand – provided financial support
- Programme for Highly Dependable Systems, University of the Witwatersrand – provided financial support
- Standard Bank – provided financial support

- Apple Computer – provided equipment for the conference
- Qualica – provided technical support including helping with the conference web site

Web Site

For more information about SAICSIT, including a pointer to the conference site, see <http://www.saicsit.org.za>.

Referees

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Research Article

The Role of Experience in User Perceptions of Information Technology: An Empirical Examination

Meliha Handzic and Graham Low

The University of New South Wales, Sydney, Australia, {m.handzic,bg.low@unsw.edu.au

Abstract

This paper reports the results of an empirical examination of the effects of experience in using a multifunctional information technology on users' perceptions of its usefulness and ease of use in a university task context in which 143 undergraduate students from The University of New South Wales were surveyed. The study revealed a differential effect of an increased level of experience on subjects' perceptions. In particular, an initial increase in experience from low to moderate resulted in a significant increase in perceived usefulness, but not in ease of use. In contrast, there was no significant further increase in perceived usefulness, but only in perceived ease of use as a result of a further increase in experience from moderate to high. If not addressed, less favourable perceptions of usefulness and/or ease of use among users with low to moderate experience may impede their future usage intentions. Therefore, these findings may be useful to practitioners for both predicting and planning training measures for improving acceptance of information technology.

Keywords: *experience, perceived usefulness, perceived ease of use, information technology acceptance, computer education*

Computing Review Categories: *K3.2, K6.1, K8.1*

1 Introduction

The information systems literature reports that, despite increasing investment and proliferation of information technology in organisations, its potential to improve individual and organisational performance often remains unrealised due to poor user acceptance [15, 31, 34]. It is therefore not surprising that there is continual interest among researchers in what motivates people to sometimes accept and sometimes reject information technology.

A large number of studies on the implementation and acceptance of information technology have been reported in the information systems literature (for reviews see [21, 34]). In general, these studies applied the Technology Acceptance Model (TAM) as a theoretical framework for their investigation. Davis [5] developed the original TAM on the basis of the Theory of Reasoned Action by Fishbein and Ajzen [8]. The model has been tested in its original [6, 23] and revised forms [1, 35]. The revised form of the TAM is more concise as it excludes the attitude component found in the original model, and is generally considered to be easier to understand and use. Most previous empirical studies provide support for the core TAM variables of Perceived Usefulness and Perceived Ease of Use and their positive relationship with Behavioural Intention to Use a system [1, 5, 6, 23, 35].

Some earlier implementation studies extended the TAM model to include various external variables as potential determinants of user acceptance. For example, Jackson et al. [17] extended the model by including user involvement and also found that intrinsic involvement shaped perceptions. This provided additional support for earlier findings regarding the importance of user involvement [4, 29] and user representativeness [20] in systems development. Venkatesh [37] extended TAM to include the system usability variable. His results showed that system usability impacted people's perceptions after they had direct experience with the system. This provided further support for the earlier reported importance of system characteristics for user acceptance [3]. Other factors found to influence user acceptance of information technology included individual differences [2, 39], training [25, 26], implementation process [36], management support [20], organisational characteristics [7, 30], task complexity [24], and information characteristics [9, 10].

Recognising the need of managers to better understand factors influencing user acceptance, the main objective of this study is to determine the value and status of the experience factor in user acceptance. So far, the role of experience in technology acceptance has received little attention in the information systems literature. However, in a recent technology acceptance study, Szajna [35] suggested that it might be an interesting and important future research area. We argue that a better understanding of the role of a controllable factor such as experience in user acceptance would have important practical implications for organisations. It would enable firms not only to better predict user perceptions and intentions regarding system use before committing financial and other resources to the implementation effort, but more importantly, it would enable them to better plan the appropriate measures that would increase acceptance.

Szajna [35] also suggested that adding experience

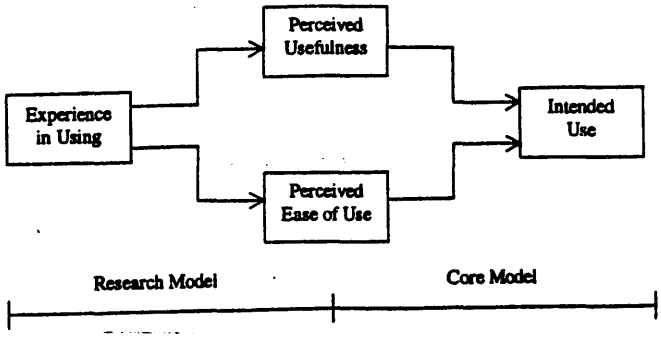

Figure 1: Enhanced Technology Acceptance Model

components might be a significant enhancement to Davis's [5] Technology Acceptance Model (TAM). In the enhanced TAM proposed in Figure 1, the experience factor may be viewed as an external or 'antecedent' variable that may affect system usage (intended or actual) by influencing users' perceptions of the system's usefulness and ease of use. Focusing on the left-hand side of the enhanced model as a theoretical framework for investigation, the present study intends to test empirically whether and how past experience in using a specific technology impacts people's perceptions of its usefulness and ease of use.

2 Prior Research

The review of past empirical studies on the impact of experience on user perceptions, attitudes or behaviour towards information technology reveals mixed findings. Two laboratory studies found a positive effect of experience. In an experiment using 45 manager-users in a simulated business environment, King and Rodriguez [18] discovered that users exhibited a significant positive change in their perceptions of the impact of the system on job performance as a result of their direct experience with the system studied. In addition, users perceived the value of the system to be greater in terms of their own likelihood of using the system and in terms of an overall assessment of its worth than did non-users. In another laboratory experiment conducted with 64 managers classified according to their previous computer experience, Mykytyn and Green [24] discovered that all managers had at least a positive attitude towards using computers regardless of their computer familiarity. However, those who were more familiar with computers expressed more positive attitudes.

In contrast, a number of field studies conducted in university contexts reported mixed results. In one of these studies involving 133 female undergraduate psychology students, Hill et al. [14] found that previous computer experience was significantly correlated with belief of personal efficacy regarding computers. However, the correlation with the belief about the usefulness of learning computers was not significant. Similarly, in a study involving 212 undergraduate commerce students Handzic et al. [12] found that previous experience significantly affected students' perceptions of ease of use of the word-processing system studied. However, it did not exert any direct effect on students' perceptions of its usefulness. Instead, there was an indirect effect through ease of use. Finally, in a survey of 776 non-student knowledge workers from the university, Harrison and Rainer [13] found that personnel with more experience with computers demonstrated higher levels of perceived self-efficacy.

Studies from organisational contexts also report mixed findings. Lawrence and Low [20] explored user satisfaction with two application systems (product sales performance, and service performance monitoring and reporting) within an organisation employing user-led development. They found that previous experience with computers and information systems had no impact on the users' satisfaction with the two systems studied. On the other hand, in a study of the impact of previous experience on a person's usage and performance behaviour with end-user computing software, Olfman and Bostrom [28] found a strong effect of previous experience with software on self-reported usage. Experienced users reported a significantly greater level of spreadsheet usage than novices.

In summary, the findings are relatively few and somewhat inconclusive. One potential explanation for different findings from previous research may be in the different range of experience levels investigated. Mixed results could also be potentially attributed to differences in settings, task contexts, and types of technology studied. Small number of mixed findings suggests the need for further investigation. Therefore, the main purpose of this study is to empirically examine the effect of a full range of experience levels varying from low, through moderate to high, on perceived usefulness and perceived ease of use of a multifunctional technology in the context of a complex task, student users, and university environment.

Compared to many past studies of user acceptance, the main focus of the present study is on the impact of an external variable on the perception variables. We argue that, due to the moderating effect of perceptions on use, it is important for theory and its practical implications to better understand how an antecedent variable such as past experience in using information technology may influence users' perceptions of its usefulness and ease of use. A small number of inconclusive prior findings also suggests a need to further investigate the issue.

The current investigation was carried out in the context of a multifunctional technology including data-modelling and word-processing components, and a series of data management tasks that could be well supported by the available technology. Many previous studies examined the acceptance of quite simple technologies such as e-mail or

voice-mail [1, 33] in rather simple communication tasks. In comparison, we argue that a multifunctional technology used in this study is by definition more complex in terms of component and coordinative complexity [38] and better reflects the essential nature of today's knowledge worker's task environment.

Users chosen for the present study were undergraduate students who represented voluntary users of information technology in the university environment. Some researchers have questioned the appropriateness of using students as subjects in information systems research [16]. Most of the criticized research relied on students as surrogates for real-world knowledge workers. However, when the academic environment is the field setting, students do not represent surrogates, but actual end-users who use computer tools to support their day-to-day work [1].

3 Method

3.1 Research design and variables

The study applied a quasi-experimental research design with experience in using information technology as the only independent, and perceived usefulness and perceived ease of use as the dependent variables.

For the purpose of the current investigation 'experience' was defined in terms of the extent of past use of the specific information technology studied. It was measured at three levels: low, moderate and high. Subjects were classified into respective groups based on their responses to a two-item instrument. The items included: 'indicate your level of use of the data-modelling technology', and 'indicate your level of use of the word-processing technology', compared to the alternative manual way of preparing subject assignments during the past (first) half of the semester. Some researchers have questioned the validity of self-reported measures of use adopted by this study [35]. However, in the case of anonymous respondents and the absence of any response contingent incentives, we believe that self-reported measure could be used as a valid indicator of an individual's actual experience. The subjects' responses were captured on five point Likert scales with 1 (extremely light) and 5 (extremely heavy) as end points. Subjects with average scores less than 2.5 were categorised into low, those with scores between 2.5 and 3.5 into moderate, and the remaining ones with scores greater than 3.5 into high experience groups.

Perceived usefulness of a given technology (compared to handwritten work) was measured by four items: 'information technology enables faster preparation', 'enhances quality', 'makes preparation easier', and 'is useful in preparation of subject assignments'. Items for measuring perceived ease of use were: 'information technology is easy to learn how to use', 'clear and understandable how to use', 'easy to get to do what is wanted', and 'easy to use in preparation of subject assignments'. The subjects' responses to these items were given on five point Likert scales with 1 (strongly disagree) to 5 (strongly agree) as anchor points.

The measuring instrument used in this study was based on instruments previously tested and widely accepted in the literature [1, 5, 6, 32]. Modification in wording was made to reflect the specifics of the task and technology of interest in this study. Variables were constructed from individual items using factor analysis. The Cronbach alpha coefficients were 0.68 for experience, 0.86 for perceived usefulness, and 0.88 for perceived ease of use variables. All the reliability scores are above 0.6 recommended by Nunnally [27].

3.2 Subjects and Procedure

A total of 143 subjects participated in the study. The participants were drawn from the pool of the first year undergraduate students attending a business data management subject at the University of New South Wales. These students had to prepare weekly tutorial assignments each consisting of a data-modelling exercise and a related discussion question. The students were informed about the availability and free access to personal computers with data-modelling (MetaEdit) and word-processing (Microsoft-Word) software to support their work. No formal demonstration of these products was performed in class. The students were told that they could use as little or as much of the available support as they wished. Alternatively, they could submit handwritten work. Individual assignments were marked and contributed to each student's overall performance in the subject. It was assumed that students were motivated to perform well in these tasks.

Data were collected by a survey questionnaire. Copies of the questionnaire were distributed to the participants during a mid-term lecture session. The subjects volunteered to participate in the survey in response to the lecturer's announcement. After reading the instructions contained in the questionnaire, the participants were asked to answer questions regarding their past experience in using a given information technology and their perceptions of its usefulness and ease of use in a given task.

4 Results

4.1 Analysis Method

For analysis purposes subjects were classified into low, moderate and high experience groups as explained in section 3.1. The sample consisted of 44% of subjects in the low, 46% in the moderate and 10% in the high experience categories. To ensure that the design really supported these categories, the mean scores of the subjects' self reported experience by these groups were calculated and analysed using ANOVA followed by the Scheffe test. An alpha level of 0.05 was used to establish significance for all statistical tests. The analysis found significant differences in the mean experience scores among all three groups (1.6 vs. 3.0 vs. 4.3, $F(2,140)=333.63$, $p<0.05$) thus indicating appropriate grouping into low, moderate and high experience

Experience Group	N	Perceived Usefulness	Perceived Ease of Use
Low	64	3.5	3.3
Moderate	67	3.9	3.5
High	12	4.1	4.2
Combined	143	3.8	3.7

Table 1: Means of perceived usefulness and perceived ease of use by experience groups

Dependent Variable	MS between (df=2)	MS within (df=140)	F
Perceived Usefulnes	4.06	0.59	6.82*
Perceived Ease of Use	3.76	0.73	5.10*

*p<0.05

Table 2: Summary results of ANOVAs for perceived usefulness and perceived ease of use

respectively.

For each experience group, means of perceived usefulness and perceived ease of use were calculated. These are presented in Table 1.

As before, data were further analysed using ANOVAs (and Scheffe tests where appropriate) on each of the two dependent variables. Summary results are presented in Table 2. Since groups varied in size, the assumption of equal variances was tested using a Bartlett-Box F test. The test indicated no significant violation of homogeneity for either perceived usefulness ($F(2,140)=2.83$, $p>0.05$) or ease of use ($F(2,140)=2.20$, $p>0.05$).

4.2 Perceived Usefulness

We hypothesised that more experienced users would have more favourable perceptions of the usefulness of information technology. It is argued that through direct use of a given technology individuals gain knowledge about its potential value. It is expected that more experienced users are likely to be more knowledgeable about the availability of various helpful system features for task performance than less experienced users. As a result, they are likely to perceive information technology as more useful, and consequently form more favourable intentions regarding its use.

As expected, Table 2 shows a significant overall effect of experience on perceived usefulness ($F(2,140)=6.82$, $p<0.05$). However, the Scheffe test revealed that significant differences (at $p=0.05$) existed only between low and moderate (3.5 vs. 3.9) and low and high (3.5 vs. 4.1) experience groups. No significant difference was found between moderate and high (3.9 vs 4.1) experience groups, but the means were in the expected direction. Results indicate that subjects in the moderate-to-high experience groups tended to perceive information technology as substantially more useful than those in low experience user group. These results provide partial support for our usefulness hypothesis, when moderate-to-high experience is compared to low experience.

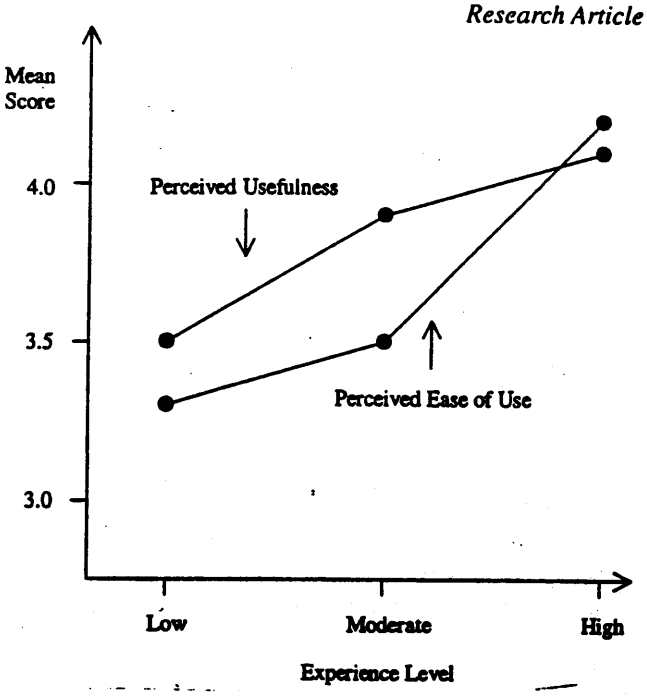

Figure 2: Perceived Usefulness and Perceived Ease of Use by Experience

4.3 Perceived Ease of Use

Furthermore, we hypothesised that more experienced users would have more favourable perceptions of ease of use of information technology. It is argued that through direct use of technology individuals develop skills for its effective use. It is expected that more experienced users are likely to be more skilful in using various system features than less experienced users. As a result, they are likely to perceive information technology as more easy to use, and consequently form more favourable intentions regarding its use.

As expected, the results of the analysis presented in Table 2 show a significant overall effect of experience on perceived ease of use ($F(2,140)=5.10$, $p<0.05$). Further analysis with the Scheffe test found that differences were significant at $p=0.05$ between low and high (3.3 vs. 4.2) and moderate and high (3.5 vs. 4.2) experience groups. No significant difference was found between low and moderate (3.3 vs 3.5) experience groups, although mean values were in the expected order. Results indicate that subjects in the high experience user group tended to perceive information technology substantially easier to use than those in the low-to-moderate experience user groups. These results provide partial support for our ease of use hypothesis when high experience is compared with low-to-moderate experience. The main results for perceived usefulness and ease of use are presented graphically in Figure 2.

5 Discussion

This study empirically tested the impact of previous experience in using a multifunctional information technology on people's perceptions of its usefulness and ease of use in a problem solving task context and university setting. The results of the research provide evidence of a differential effect of the experience factor on these two perceptions. In particular, the study demonstrated that an initial increase in experience from low to moderate resulted in significant increase in perceived usefulness, but not ease of use. In contrast, there was no significant increase in perceived usefulness, but only ease of use, as a result of further increase in experience from moderate to high. These findings provide an important insight into how experience may shape people's cognitive beliefs that, in turn, may drive their usage behaviour. The research also suggests ways in which these beliefs may be changed.

5.1 Experience Effects on Perceived Usefulness

With respect to usefulness, the study found that individuals with moderate and high experience tended to hold comparatively similar and quite favourable perceptions of usefulness of a given technology, as indicated by mean scores of 3.9 and 4.1 respectively (out of 5). In contrast to the other two groups, low experience users were found to hold significantly less favourable perceptions. A mean score of 3.5 indicates that these users tended to be less sure of the usefulness of information technology. The result seems to reflect the lack of relevant knowledge by these individuals necessary for technology acceptance. An encouraging result is that these individuals were not negative with respect to usefulness of information technology.

The significant results suggest that a relatively modest level of experience may be sufficient for individuals to be able to gain most of the relevant knowledge about various aspects of a given technology. These aspects are helpful for their task performance and consequently perceived as quite useful. Such a suggestion is consistent with the earlier finding by King and Rodriguez [18] who found a significant positive change in perceived usefulness after a short direct experience. Nonsignificant results suggest that prolonged experience would make no substantial further difference with respect to perceived usefulness. Such a suggestion seems to be consistent with some earlier finding by Hill et al. [14] who found no direct experience effect among student subjects, who, arguably, all might have had some previous computer experience.

We speculate that one plausible explanation for our findings may be due to a relationship of perceived usefulness with experience in the form of a saturation curve. There may be the declining incremental value of learning additional technology features with increased knowledge from experience. The Lens model of human judgement suggests a similar relationship between accuracy and cost of processing of additional information in decision making, while Pareto Law illustrates a similar distribution of product cost value in relation to number of parts [22]. However, we can not completely rule out an alternative explanation that these findings may be due to measurement instrument using narrow 5-point Likert scales with extreme anchors at the end points.

In general, these results imply that a relatively short training programme that provides mainly key relevant information may be sufficient to increase acceptance of information technology of inexperienced users. Improved technology related knowledge should result in more favourable perceptions about its usefulness and consequently lead to increased acceptance.

5.2 Experience Effects on Perceived Ease of Use

With respect to ease of use, the study found that individuals with high experience tended to express quite favourable perceptions of ease of use, as indicated by a mean score of 4.2 (out of 5). In contrast, those with moderate and low experience tended to hold comparatively similar and significantly less favourable perceptions of its ease of use, with mean scores of 3.5 and 3.3 respectively. Such scores indicate that these users are less convinced with respect to ease of use of information technology. These results seem to reflect the lack of relevant skills by these individuals necessary for acceptance. The lack of significant findings is contrary to those earlier reported in similar settings by Hill et al. [14] and Handzic et al. [12]. One potential reason for the difference may be the complexity of the technology studied. Many previous studies on user acceptance examined simple technologies (eg. e-mail or voicemail) that required very few skills. In the present study, subjects had to use a number of advanced features of both data-modelling and word-processing tools and integrate results from different technology components into a single final product.

The nonsignificant findings suggest that moderate experience may not be sufficient to adequately develop skills required to effectively use the various aspects of a complex multifunctional technology for task performance as reflected in perceived ease of use. The lack of perceived ease of use due to lack of skills may be a major contributing factor to the potentially unfavourable future intentions to use technology among low and moderate experience users. Indeed, perceived complexity from users' inability to handle information overload was found to impede utilisation of the information system in a decision making task context [11].

However, the significant findings are encouraging. They suggest that people can improve their skills through longer experience with the technology and subsequently perceive it as easier to use. Overall, the results for perceived ease of use by experience suggest that, when faced with complex technology, people's perception of ease of use with a technology does not increase until they have a substantial level of experience. This appears to be consistent with a large number of findings in psychology (for re-

view see [19]) which found a need for extensive experience to learn skills before achieving significant improvement in implementing complex task strategies.

The results imply that technology acceptance of insufficiently experienced users may be potentially increased further by training programmes that would aim at improving their technology related skills. This could be achieved by providing opportunity to practice. Improved technology skills should lead towards more favourable perceptions about its ease of use and subsequent increased use.

6 Conclusions

The main findings of this study indicate that experience is an important, but complex factor in information technology acceptance. This is evidenced by its differential effects on perceptions of usefulness and ease of use found among undergraduate student users of a specific technology in the university task context.

An insight provided into how experience may shape people's perceptions that, in turn, drive their usage behaviour may be valuable to practitioners for better predicting eventual resistance. More importantly, however, the results suggest that the practitioners may be able to intervene to increase the likelihood of acceptance by providing appropriate training programmes. Initial information sessions, followed by extensive hands-on experience may result in quite favourable perceptions of usefulness and ease of use, and this, in turn, may result in more favourable intentions towards technology.

Results of this research may be limited to a specific task, university context and a single group of student users in which the effect of the experience factor was investigated. In order to generalise the findings, further research is required involving other tasks, contexts and user groups. Future research is also required to study the impact of other contingency factors on user acceptance and how they relate to beliefs, intentions and actual use of information technology.

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