

Figl, K., Kriglstein, S. (2008). Investigating Essential Usability Factors of Online Course Registration Systems. Proceedings of IADIS International Conference Interfaces and Human Computer Interaction 2008 (IHCI 2008). Amsterdam: IADIS.

INVESTIGATING ESSENTIAL USABILITY FACTORS OF ONLINE COURSE REGISTRATION SYSTEMS

Kathrin Figl

*Research Lab for Educational Technologies, University of Vienna, Austria
kathrin.figl@univie.ac.at*

Simone Kriglstein

*Department of Knowledge and Business Engineering, University of Vienna, Austria
simone.kriglstein@univie.ac.at*

ABSTRACT

The aim of this study was to investigate the usability factors of online course registration systems. Two pattern systems from universities of Austria were subject of investigation. Their user interfaces were analysed with respect to layout, navigation menu, colors and structure of the course listings. According to the results of a usability evaluation performed by means of a questionnaire based on ISONORM 9241/10, the systems differ in self-descriptiveness and conformity with user expectations. The study showed how interface design of course registration systems influences the users' experience and that usability evaluation can provide designers with useful hints for improvement.

KEYWORDS

Online Course Registration Systems, Usability, Interface Design, ISONORM 9241/10

1. INTRODUCTION

The use of the Internet enabled universities to provide online educational services like course information and registration systems to their students and staff. These systems allow students to register for courses by means of an online interface, which makes administration more efficient and reduces the faculty's and students' effort.

There is a wide variety of books, web pages, guidelines and standards explaining how to design web pages in a user-friendly way (International Organization for Standardization, 2006; Krug, 2005; Lynch & Horton, 2002; Nielsen, 2007). Nevertheless, literature or guidelines dealing with the design of online course registration systems are rare. We are interested in how those systems have to look like in order to be user friendly, easy to understand and easy to learn for every student. There can be found a lot of specifications of online course registration systems (Ahmad, Mansor, & Jalil, 2001; Allen, 2006; Korpinen, Havunen, & Loimio, 1999); some of them also integrate mobile devices like mobile phones or PDAs in their architecture (Chen & Kinshuk, 2005; Pramsane & Sanjaya, 2006). Yet all these specifications just modify the general user interface design and usability guidelines to suit their special needs. This was our motivation for investigating whether general design guidelines are also adaptable to online course registration systems. For this reason, we analysed two online course registration systems used at the University of Vienna and the Vienna University of Technology – PISWI (www.pri.univie.ac.at/piswi, Retrieved 04.04.2008) and TUWIS⁺⁺ (www.tuwis.tuwien.ac.at, Retrieved 04.04.2008). Our research evaluations were based on ISONORM 9241 (International Organization for Standardization, 2006) - an international standard on usability.

Section 2 covers the theoretical aspects of the paper. It reviews usability theories relevant to the design of online course registration systems. In Section 3 - the empirical part - we describe the two online course registration systems PISWI and TUWIS⁺⁺. Their user interfaces will be analysed with respect to layout, navigation menu, colors and the structure of the course listings. Finally, we present the results of the evaluation of both systems and draw general conclusions.

2. THEORY

Usability in general can be described as the "...measure of the quality of the user experience when interacting with something - whether a Web site, a traditional software application, or any other device the user can operate in some way or another." (Nielsen, 1998)

According to this ISONORM 9241/11 usability is defined by the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (International Organization for Standardization, 1998). ISONORM 9241 is a multi-part international standard, originally titled "Ergonomic requirements for office work with visual display terminals" and retitled "Ergonomics of Human System Interaction" (International Organization for Standardization, 2006). It consists of 17 main parts, but in the context of this paper sub part 110 is especially of interest; it focuses on general usability heuristics for design. Part 110 contains the following "dialogue principles", referring to the interaction between user and system:

- Suitability for the task: The interface should meet the user's skill level and should be appropriate for the task.
- Self-descriptiveness: It has to be clear to the user at every point of time what to do next.
- Controllability: The interaction has to be controllable as far as sequence and pace are concerned.
- Conformity with user expectations: The interface should be consistent.
- Error tolerance: The interface should be as much forgiving as possible with respect to the errors of the user's behaviour.
- Suitability for individualization: It should be possible to customize the dialogue to suit the user's needs.
- Suitability for learning: Learning should be supported by the user interface.

Besides these standards, there are also other criteria relevant to the usability of online course registration systems, for example Jacob Nielsen's usability heuristics (Nielsen, 1994). One main point is that interfaces should be as simple as possible and every additional feature of information could be a reason for misunderstanding. Adding needless information to the interface can distract users from the primary information. Therefore, Nielsen (1994) recommended designing a single screen with the relevant information rather than designing a set of screens with all information split up, so that the user has to switch between different screens for a simple task. This aspect was a factor which we studied in order to see if this criterion was also significant for online course registration systems. Furthermore, it was interesting to find out if these systems made differences between less experienced students and students who used them more frequently. Generally, a system has two aims for an interface. First of all the interface has to "achieve speed and conveniences of use for practiced user" and secondly it has to "achieve ease of learning and use" (Draper & Norman, 1985). The major challenge for designers and engineers is to choose the best trade off between these two aims.

Another interesting point is the question of color. Galitz (2002) says that an interface should not be overloaded with different colors. It is recommended to use only four different colors because it is difficult for the user to realize the information and the eyes are faster tired and overstrained. Therefore, it is recommended to use similar color-coding with different variations of saturations. Furthermore, it is important that colors and their meanings are used consistently. Another point which plays a significant role is the combination of colors. Galitz (2002) explained that the contrast between colors was crucial as far as the quality of the combination was regarded. For example, a yellow text on a white background has a low contrast and is very difficult to read. It follows that the combination yellow with white is not a suitable combination. It is very important that colors should have a high contrast.

Burrell and Sodan (2006) tried to find out which style of navigation menu users prefer. In their work, they presented how important navigation style was in order to find significant information easily and to keep users satisfied with the interaction. They found out that users prefer tabbed navigation style over top navigation bar and the combination of top and left navigation bars. These results are also interesting with respect to online course registration systems, since the style of the navigation menu may influence students' satisfaction.

3. EMPIRICAL STUDY

3.1 Description of Student Course Registration Systems

Computer science students at the University of Vienna have the possibility to attend courses of the Vienna University of Technology and vice versa. However, both universities have their own system to register for courses. Students can use both online course registration systems via a web browser. Figure 1 shows the main page of the system of University of Vienna (PISWI) und Figure 2 shows the main page of the system of the Vienna University of Technology (TUWIS++).

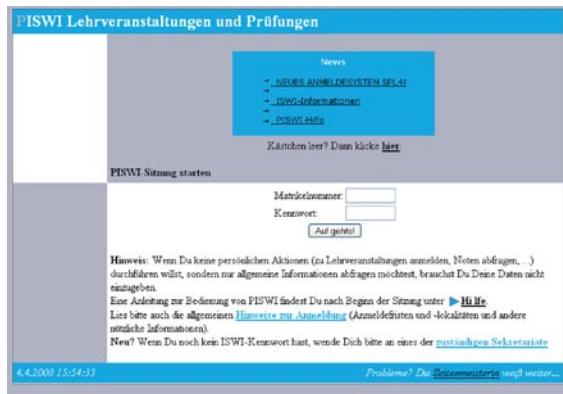


Figure 1 : Main page of PISWI



Figure 2: Main page of TUWIS++

Both figures show that already the main pages (login page) are completely different and have no similar characteristics at first sight. Generally, it can be said that TUWIS++ is newer and therefore has the advantage to integrate newer technical expertise. In the following subchapters, we describe in detail the design which both online course registration systems use. We focus on layout, navigation menu, color, course listings and the general impression.

3.2 PISWI

3.2.1 Layout

PISWI is designed in strong visible areas which are highlighted in different colors. The arrangement of areas and their colors look like a chessboard pattern. The design of the online course registration system is based on the Law of Closure, which is one of the principles of gestalt perception that helps user understand the relationship between different elements.

3.2.2 Navigation Menu

The students see no main navigation menu on this page. Furthermore, the user sees two edit boxes (for username and password) in the middle white area. Above the middle white area there are three links (an information link about the time for applications, “ISWI information” link and a “PISWI help” link) in the middle blue box.

After the login was successfully performed, students see their registered courses (see Figure 3), and navigation bars appear. PISWI provides the main navigational links for courses, exams, settings, logout and help on the top of the web page. The secondary links are on the left side, which is reserved for specific content depending on the main navigation link. For example under the navigation link “Courses”, the student can select “Register” to add in his list courses in which he wants to graduate.

3.2.3 Color

White and grey are the basic background colors. Lists, special information boxes, main navigation bar and titles in the left navigation have blue as background color. Furthermore, PISWI uses two different link colors (blue and black). In addition, the text colors are black for the white/ grey background and white for the blue background.

3.2.4 Course Listings

Courses can be retrieved by curriculum via a combo box. Additionally the students have the possibility to refine the course listing. For example, a student can display only the courses for the summer semester 2006 or only the courses for which he is registered. Figure 3 shows a typical course listing in PISWI.

If the student wants to register for a course, he only has to click on the course title and a symbol appears. This symbol shows the student the actual status of his registration. For example, if the symbol is red the student is waitlisted until the course leader accepts his registration. A yellow symbol (smiley) shows the student that his registration was successful.

Symbol	Kennzahl	Punkte	Titel	Status
<input type="radio"/>	050090/1	2SE	Methodenseminar fuer Diss.	7/15
<input type="radio"/>	040163/1	2SE	Forschungsprivatissimum.	0/24
<input checked="" type="radio"/>	050006/1	2SE	Forschungsprivatissimum.	10/13/15 084
<input type="radio"/>	050091/1	2SE	Forschungsprivatissimum.	6/15
<input type="radio"/>	050092/1	2SE	Forschungsprivatissimum.	2/15
<input checked="" type="radio"/>	050009/1	2SE	Literaturseminar fuer Diss.	5/12/15 084
<input type="radio"/>	040591/1	2SE	Wirtschaftstheoretisches Forschungsseminar.	0/24
<input type="radio"/>	040046/1	2SE	Stochastik Kolloquium.	0/24
<input type="radio"/>	040281/1	2SE	Literaturseminar.	0/24
<input type="radio"/>	040080/1	2SE	Forschungsprivatissimum.	2/24
<input type="radio"/>	040279/1	2SE	Forschungsprivatissimum.	0/24

Figure 3: Course Listings of PISWI

3.2.5 General Impression

The design is very simple and not cluttered with irrelevant information. The advantage of this online course registration system is that students can see all their courses at first glance and very fast get a list of courses based on their preselection without additional steps. The contrast between text and background color is mostly high and easily readable.

3.3 TUWIS⁺⁺

3.3.1 Layout

The layout design of TUWIS⁺⁺ is divided into three main areas. The first area is the header with the cooperative logo of the university. The second one is the main navigation area. This also includes an edit box for login on the main page and after the successful login the name of the student appears in conjunction with a logout button. The last area is for special content. On the main page there is general information about TUWIS⁺⁺ and help. Furthermore, the web page is centered.



Figure 4: Subscribed course listing and starting point of the registration process



Figure 5: Search mask for courses

Nr.	Typ	Titel	Stunden	Sem.	Vertragender	Grp. Pl.	Abn.
015.011	VO	Techn. Französisch I	W 2.0h	2007W	SKALICKY		<input type="checkbox"/>
015.035	VO	Technisches Spanisch I	W 2.0h	2007W	SAEZ GARCIA	0/100	<input type="checkbox"/>
015.046	UE	Computerunterstütztes Japanisch	W 3.0h	2007W	SIMONCSICS		<input type="checkbox"/>
015.053	PV	Strategien d. Streßbewältigung u. Studienerfolg	W 2.0h	2007W	BURGDORFER		<input type="checkbox"/>
015.067	VO	Technisches Russisch I	W 2.0h	2007W	HALANIEK		<input type="checkbox"/>
015.076	VO	Einführung in die Wissenschaftstheorie I	W 2.0h	2007W	KOENNE		<input type="checkbox"/>
015.077	VO	Technologieverwertung	W 1.0h	2007W	BEREUTER	18/55	<input type="checkbox"/>
015.079	SE	Was hat Gender mit dem Technikstudium zu tun?	W 2.0h	2007W	KNOLL		<input type="checkbox"/>
015.088	SE	Technisches Deutsch für Ausländer	W 2.0h	2007W	PITZEK		<input type="checkbox"/>
015.089	SE	Technisches Englisch	W 2.0h	2007W	CROWDER	0/49	<input type="checkbox"/>
015.090	SE	Kursentwicklung und Qualitätsmanagement im E-Learning	W 2.0h	2007W	CSANTY	2/20	<input type="checkbox"/>
015.093	VO	Operative Management-Tools für innovative Unternehmen	W 2.0h	2007W	RAUHOFER		<input type="checkbox"/>
015.096	VO	Technisches Französisch, Hohes Niveau I	W 2.0h	2007W	SKALICKY	25/40	<input type="checkbox"/>

Figure 6: Course listing for registration

3.3.2 Navigation Menu

The navigation bar is always on top of the page and the navigation links are in one row. On the main page the student can select between “Main” (start page), “Institutes” (list of all institutes), “Lectures” (general search page, where student can search for lectures, courses et cetera), “Curricula” (list of all curricula programs), “Auditorium occupation” (show the reservation of lecture-rooms and seminar-areas), “Messages” (list of all message sheets) and “Help”. The navigation bar also has an edit box for username and a login button. This navigation bar style is very similar to the tapped navigation bar. The only difference is that the tab style is based on file-folder organization (Burrell & Sodan, 2006). Furthermore, Burrell and Sodan describe that the general idea of this navigation style is that users first look at the top of the screen, especially if the content of page is large and users have to scroll. After a successful login of the user, the navigation links change to “Setting”, “Registration of Courses”, “Exams”, “Agenda”, “Date”, “Information about the university” and “Help”.

3.3.3 Color

The main colors are blue and white, whereas text color is black and the color of the links is blue. Furthermore, labels for forms, search masks and filter elements are designed in a blue box. In addition, the navigation bar, the header area and lists of the page are in blue. Colors and their meaning are used consistently and the color combination is harmonized.

3.3.4 Course Listings

After the successful login, students have to select the main navigation link for course registration. The next page (see Figure 4) shows an edit box for adding the course number which students want to register for

and a list of all courses which students have registered for. If a student wants to register for another course and he does not know the exact number of the course, he can select the link for detail search. Figure 5 shows the detail search page, where the student can search for a special courses, lectors, titles, institutes, course types, semesters, curricula and so on. After a successful search, there appears a list (see Figure 6) with all courses. Every course item in the list has a checkbox on the right side for registering. After the student selects the register button on the end of the list, all courses will be found in his list on the main page of course registration (see Figure 4, but in this figure the student has no courses he has registered for. In case a student has courses he has registered for, it would be displayed after the text box).

3.3.5 General Impression

The design is clear and concise. However, on the main page the edit box for login could be misinterpreted, because the position is typically reserved for the search function. Furthermore, the web pages are structured and self-descriptive. TUWIS⁺⁺ subdivides the online course registration into three steps. If the student knows only the course name, he has to follow these steps. For getting a general overview of all courses for a special curriculum, the same steps are also necessary.

3.4 Research Questions and Questionnaire

The main research question we addressed in our study was how students perceived the usability of the online course registration systems and whether they rated one system as being better. Further research questions dealt with specific aspects of course registration systems, e.g. if students wanted to get/receive emails with the latest grades. Furthermore, we wanted to know which functionalities of course registration systems students perceived as meaningful.

The questionnaire used for evaluating the two registration systems was mainly based on the German usability questionnaire ISONORM 9241/10. The questionnaire was designed to evaluate software prototypes and to generate concrete recommendations for enhancements (Prümper, 1997, p. 253). It was developed to be filled out by users. The scales represent an operationalization of the seven dialogue principles. It consists of 35 items, whereas five items belong to each of the 7 sub-scales (Bräutigam, 1999). The items are presented in the form of bi-polar statements that have to be evaluated by the users on a 7-point scale from very negative ("---") to very positive ("+++"). With respect to questionnaire quality factors like reliability and validity there already exist studies with over 170 programmes (Prümper, 1997, p. 253). This was also a reason why we chose this questionnaire. By means of the ISONORM 9241/10 questionnaire there can be measured changes between different versions. In general, the scale "Individualization" usually scores lowest, and the scale "Controllability" highest, independent of the investigated system.

In the original version, filling out the ISONORM 9241/10 questionnaire takes about 10 minutes, in our version participants were asked to answer every item for both registration systems so that it took a little longer. Figure 7 depicts an example item of the scale "Suitability for the task" of the ISONORM 9241/10 questionnaire, adapted to our research questions.

<i>The registration system...</i>	---	--	-	-/+	+	++	+++	<i>The registration system...</i>
PISWI								
is difficult to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	is easy to use.
TUWIS⁺⁺								
is difficult to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	is easy to use.

Figure 7: Example item of the questionnaire

3.5 Sample

The sample comprised a total number of 28 participants; all of them were studying computer science at the University of Vienna and the Vienna University of Technology. The reason was that they had to be already familiar with both course registration systems in order to be able to evaluate the usability. About 29%

of the participants were female (8) and 71% male (20), which resembled the average gender rate for business informatics students. 18 participants (64%) were aged between 20 and 25, one participant was even younger. 6 participants (24%) were between 26 and 30 years old and one participant was even older.

3.6 Results

In general, both online course registration systems got medium up to good ratings on all of the seven ISONORM 9241/110 principles as can be seen in Figure 8.

The systems PISWI and TUWIS++ were evaluated as being equally good in most dimensions with two exceptions: First, self-descriptiveness ($t_{df=27}=-2.82, p=0.009$) and conformity with user expectations ($t_{df=27}=-2.46, p=0.020$) were rated higher for TUWIS++ than for PISWI. Secondly, there was a tendency that suitability for learning was also better in TUWIS++ than in PISWI ($t_{df=27}=-2.06, p=0.056$). For finding out why self-descriptiveness and conformity with user expectations were rated higher for TUWIS++ there were also analysed answers to single items. It seems that users got a better overview of functions in TUWIS++ and orientation in general was easier thanks to the consistent design. Furthermore, terms, abbreviations, symbols and menus were easier to understand in TUWIS++, and users got better information on necessary inputs and could clearly understand if inputs were successful. Generally there was a trend that the overall rating of usability was slightly higher for TUWIS++ than for PISWI with respect to sum scores ($t_{df=27}=-1.84, p=0.077$).

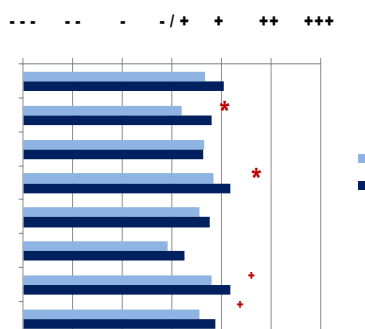


Figure 8: Usability of the two investigated course registration systems (n=28)

Further results of the study dealt with specific aspects of course registration systems. If too many students want to attend a class, course registration systems usually choose students according to a specific algorithm. In PISWI, students are chosen at random and 64% of participants think this is fair. In the TUWIS++ system students are chosen by temporal order of registration for a course; this was regarded as fair by 68% of them. Another question dealt with receiving grades per email. About 75% of the participants liked the fact that TUWIS++ automatically sent emails with their grades, whereas only 46% thought it was good that in PISWI there were sent emails merely notifying that a new grade was online. It can be summarized that students prefer to get emails with their grades; however this topic has also to comply with/ take into account the privacy policy of a university.

When asked which (further) functionalities of course registration systems were meaningful, 93% of participants answered they regarded complete course information as useful. About 82% perceived an overview of all completed courses as useful and 67% found that a personal class schedule for each term would be useful.

4. CONCLUSION

In this study we analysed online course registration systems from the University of Vienna (PISWI) and the Vienna University of Technology (TUWIS++) with respect to their usability. Generally, both online course registration systems are designed in a clear way. The advantage of TUWIS++ is that the system is newer and so the design is more up to date. TUWIS++ uses a tabbed style for the navigation menu bar and PISWI uses the top/left combination style for the navigation bar. The preferred color of both systems is blue

but PISWI combines it with grey and TUVIS⁺⁺ with white. As far as course listings and registration are regarded, both systems use different approaches. For example, TUVIS⁺⁺ splits the registration into three screens if students do not know the exact course number. On the other side, PISWI shows all courses on one screen and the students see all courses at first glance.

For evaluating the two registration systems, we conducted a questionnaire study, mainly based on the German usability questionnaire ISONORM 9241/10. There is a trend that TUVIS⁺⁺ is considered more usable than PISWI. The dimensions self-descriptiveness and conformity with user expectations are rated significantly higher for TUVIS⁺⁺. Students get a better overview of functions in TUVIS⁺⁺ and it is easier for them to orientate with the aid of a consistent design. The results of the usability questionnaire are in line with the user interface analysis. The design of TUVIS⁺⁺ is more attractive and students find that the terms, abbreviations, symbols and menus are easier to understand. Furthermore, the result shows that a consistent layout, like TUVIS⁺⁺ is preferable and leads to easier orientation for students.

Based on our results, it is necessary for online course registration systems to provide a clearly arranged overview and to guide students through the different processes in the context of course registration. In addition, it is recommended that the designs of the systems should be consistent and self-descriptive. Furthermore, it is important to design an online registration system in the language of the students.

Finally, it can be summarized that the study showed how usability evaluation of course registration systems can provide designers with useful hints for improving existing systems. Students as well as administrative staff will benefit from attractive and user-friendly designed interface designs.

REFERENCES

- Ahmad, N., Mansor, W., & Jalil, N. A. (2001). *Preliminary Results of a Pilot Project Internet Based Subject Registration System*. Paper presented at the World Conference on Educational Multimedia, Hypermedia and Telecommunications 2001, Norfolk, VA.
- Allen, H. (2006). *Online Course Registration*. Providence: Brown University.
- Bräutigam, L. (1999). Software-Ergonomie: Beurteilung der Software-Ergonomie anhand des ISONORM-Fragebogens. 2006, from <http://www.sozialnetz.de>
- Burrell, A., & Sodan, A. C. (2006). *Web Interface Navigation Design: Which Style of Navigation-Link Menus Do Users Prefer?* Paper presented at the 2nd International Conference on Data Engineering Workshops (ICDEW'06), Atlanta, Georgia.
- Chen, J., & Kinshuk. (2005). Mobile Technology in Educational Services. *Journal of Educational Multimedia and Hypermedia*, 14(1), 91-109.
- Draper, S. W., & Norman, D. A. (1985). Software engineering for user interfaces. *IEEE Transactions on Software Engineering*, 11(3), 252-258.
- Galitz, W. O. (2002). *Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques*. (2 ed.). New York: Wiley.
- ISO 9241-11:1998. Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 11: Guidance on usability (1998).
- International Organization for Standardization. (2006). *ISO 9241-110:2006 Ergonomics of human-system interaction -- Part 110: Dialogue principles*. Retrieved 01.12.2007. from http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=38009.
- Korpinen, L., Havunen, I., & Loimio, S. (1999). *Examination Registration and Course Feedback System for Students in the Intranet*. Paper presented at the WebNet.
- Krug, S. (2005). *Don't Make Me Think : A Common Sense Approach to Web Usability (2nd Edition)*: {New Riders Press}.
- Lynch, P., & Horton, S. (2002). *Web Style Guide: Basic design principles for creating Web sites* (2 ed.). New Haven: Yale University Press.
- Nielsen, J. (1994). *Usability Engineering*. San Francisco: Morgan Kaufmann.
- Nielsen, J. (1998). What is Usability? *ZDNET- Where Technology Means Business* Retrieved 1.6.2006, from <http://www.zdent.com/devhead/stories/articles/0,4413,2137671,00.html>
- Nielsen, J. (2007). useit.com: Jakob Nielsen's Website. Retrieved 02.12.2007, from <http://www.useit.com/>
- Pramsane, S., & Sanjaya, R. (2006). Mobile Education Services Based on SMS and Their Architecture Comparison. *International Journal of the Computer, the Internet and Management (IJCIM)*, 14(1).
- Prümper, J. (1997). *Der Benutzungsfragebogen ISONORM 9241/10: Ergebnisse zur Reliabilität und Validität*. Paper presented at the Software-Ergonomie '97, Stuttgart.