
A systematic mapping on usability and user experience evaluation of Learning Management Systems

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Abstract: This technical report presents further details regarding the systematic mapping conducted to identify the usability and UX evaluation techniques in the context of LMSs. It provides the following materials: (i) results from the first filter; (ii) results from the second filter; (iii) final results of the systematic mapping; (iv) extraction forms used; (v) mapping of the studies. From an initial set of 190 publications, 62 were accepted and extracted at the end of the selection process.

Keywords: Usability Evaluation, User Experience Evaluation, Learning Management Systems, Systematic Mapping Study.

1. Results from the first filter

#	Year	Title	Authors	Criteria
1	2016	<i>Exploring user satisfaction for e-learning systems via usage-based metrics and system usability scale analysis</i>	Harrati, N.a and Bouchrika, I.b and Tari, A.a and Ladjailia, A.b	IC1
2	2016	<i>Usability evaluation of a course management system based on Lingweb platform [Evaluación de usabilidad de un sistema de administración de cursos basado en la plataforma Lingweb]</i>	Reyes Vera, J.M.a and Berdugo Torres, M.I.b and Villegas, L.M.c	IC1
3	2016	<i>Eshu: An extensible web editor for diagrammatic languages</i>	Leal, J.P. and Correia, H. and Paiva, J.C.	EC1
4	2016	<i>Usability Assessment of Moodle by Brazilian and Portuguese Nursing Students</i>	Seixas, C.A.a and De Godoy, S.a and Martins, J.C.A.b and Mazzo, A.a and Baptista, R.C.N.b and Mendes, I.A.C.a	IC1
5	2016	<i>Framework to Evaluate M-Learning Systems: A Technological and Pedagogical Approach</i>	Navarro, C.X.a and Molina, A.I.b and Redondo, M.A.b and Juárez-Ramírez, R.c	IC1

6	2016	<i>The usability evaluation concerning emotional responses of users on learning management system</i>	Phongphaew, N. and Jiamsanguanwong, A.	IC1
7	2016	<i>Usability software engineering testing experimentation for android-based web applications: Usability engineering testing for online learning management system</i>	Saeeda, H.a and Arif, F.a and Minhas, N.M.b	IC1
8	2016	<i>New moodle blocks for knowledge management</i>	Silva Sprock, A.a and Vicari, R.M.b	IC1
9	2016	<i>User evaluation of language websites as a way of students' engagement into blended learning process case study</i>	Černá, M.	IC1
10	2016	<i>2016 6th International Workshop on Computer Science and Engineering, WCSE 2016</i>		EC1
11	2016	<i>A semantic MediaWiki-based approach for the collaborative development of pedagogically meaningful learning content annotations</i>	Zander, S.a and Swertz, C.b and Verdú, E.c and Pérez, M.J.V.d and Henning, P.e	IC1
12	2016	<i>12th International Baltic Conference on Databases and Information Systems, DB and IS 2016</i>		EC1
13	2015	<i>Testing usability in Moodle: When and How to do it</i>	Ternauciuc, A. and Vasiu, R.	IC1
14	2015	<i>Energy transformation in everyday devices taught to primary school children, using web-based software</i>	Garyfallidou, D.M. and Ioannidis, G.S.	IC1
15	2015	<i>Usability Evaluation by Experts of a Learning Management System</i>	Medina-Flores, R.a and Morales-Gamboa, R.b	IC1
16	2015	<i>Inviting citizen designers to design digital interface for the democratization of web online environments</i>	Panthee, R.K.	IC1
17	2015	<i>Personalized context-aware recommendations in 3D virtual learning environments</i>	Granić, A.a and Maratou, V.b and Mettouris, C.c and Papadopoulos, G.A.c and Xenos, M.b	EC3
18	2015	<i>Effective user experience in online technical communication courses: Employing multiple methods within organizational contexts to assess usability</i>	Hovde, M.R.	IC1
19	2015	<i>Towards a Model for Evaluating the Usability of M-learning Systems: From a Mapping Study to an Approach</i>	Navarro, C.X.a and Molina, A.I.b and Redondo, M.A.b	IC1

20	2015	<i>Usability evaluation of the student centered e-Learning environment</i>	Junus, I.S. and Santoso, H.B. and Isal, R.Y.K. and Utomo, A.Y.	IC1
21	2015	<i>Using WCAG 2.0 and heuristic evaluation to evaluate accessibility in educational web based pages</i>	Debevc, M.a and Kožuh, I.a and Hauptman, S.a and Klembas, A.a and Lapuh, J.B.b and Holzinger, A.c	EC4
22	2015	<i>Research-in-progress: User experience evaluation of Student Centered E-Learning Environment for computer science program</i>	Santoso, H.B.a and Isal, R.Y.K.a and Basaruddin, T.a and Sadira, L.a and Schrepp, M.b	IC1
23	2015	<i>Design and usability evaluation of adaptive e-learning systems based on learner knowledge and learning style</i>	Alshammari, M.a and Anane, R.b and Hendley, R.J.a	IC1
24	2015	<i>Development of the learning analytics dashboard to support students' learning performance</i>	Park, Y. and Jo, I.-H.	EC1
25	2015	<i>A study on usability of mobileschool system for secondary school: Role-based questionnaire method</i>	Hashim, A.S. and Ahmad, W.F.W.	IC1
26	2015	<i>Observatory of studentsg uses of computer-based tools</i>	Van Der Linden, J. and Van De Leemput, C.	IC1
27	2015	<i>Usability evaluation of Tadarus: Student perceptions</i>	Alkhattabi, M.	IC1
28	2015	<i>Heuristics for evaluating usability of Learning Management Systems in Africa</i>	Mtebe, J.S. and Kissaka, M.M.	IC1
29	2015	<i>Perceived usability evaluation of learning management systems: Empirical evaluation of the system usability scale</i>	Orfanou, K.a and Tselios, N.a and Katsanos, C.b c	IC1
30	2015	<i>Merlin-know, an interactive virtual teacher for improving learning in Moodle</i>	Hijon-Neira, R.a and Velazquez-Iturbide, A.a and Pizarro-Romero, C.a and Carrico, L.b	IC1
31	2015	<i>Augmented reality in e-learning review of prototype designs for usability evaluation</i>	Satpute, T. and Pingale, S. and Chavan, V.	EC3
32	2015	<i>The usability analysis of an E-learning environment</i>	Torun, F.a and Tekedere, H.b	IC1
33	2015	<i>9th Research Conference on Metadata and Semantics Research, MTSR 2015</i>		EC1
34	2015	<i>The usefulness of usability and user experience evaluation methods on an e-Learning platform development from a developer's perspective: A case study</i>	Gordillo, A. and Barra, E. and Aguirre, S. and Quemada, J.	IC1

35	2015	<i>Identifying interaction problems on web applications due to the change of input modality</i>	Da Silva, A.C. and Viana, A.L.C. and De Lima, S.G.	EC1
36	2015	<i>Clustering students based on motivation to learn: A blended learning approach</i>	Rentroia-Bonito, M.A.a and Gonçalves, D.b and Jorge, J.A.b	IC1
37	2015	<i>The collaborative logical framework: Approach and improvements based on instructors' and learners' needs</i>	Chacón-Rivas, M.a and Santos, O.C.b and Boticario, J.G.b	IC1
38	2014	<i>Evaluation framework for m-learning systems: Current situation and proposal</i>	Cota, C.X.N.a and Díaz, A.I.M.b and Duque, M.A.R.b	IC1
39	2014	<i>Inviting citizen designers to design digital interface for the democratization of web online environments</i>	Panthee, R.K.	EC7
40	2014	<i>The emotion component on usability testing human computer interface of an inclusive learning management system</i>	Ulbricht, V.R. and Berg, C.H. and Fadel, L. and Quevedo, S.R.P.	IC1
41	2014	<i>Design and evaluation of Collaborative Learning Management System (CLMS) framework for teaching technical subject</i>	Yusoff, S.R.M. and Mat Zin, N.A.	IC1
42	2014	<i>An approach in the design of virtual environment for e-learning based on usability studies</i>	Blažič, B.J.a b and Arh, T.b and Blažič, A.J.b	IC1
43	2014	<i>Designing and reflecting on disability-aware E-learning systems: The case of ONTODAPS</i>	Nganji, J.T.a and Brayshaw, M.b	EC4
44	2014	<i>Development and Usability assessment of tablet-based synchronous mobile learning system</i>	Lee, J.H.	IC1
45	2014	<i>Prototyping m-learning course on the basis of puzzle learning methodology</i>	Szklanny, K. and Wichrowski, M.	IC1
46	2014	<i>A streamlined mobile user-interface for improved access to LMS services</i>	Ssekakubo, G. and Suleman, H. and Marsden, G.	IC1
47	2014	<i>Evaluating E-learning platforms for schools: Use and usability, user acceptance, and impact on learning</i>	Stergioulas, L.a and Abassi, M.a and Xydopoulos, G.a and Fakhimi, M.a and Margineanu, R.b and Rifon, L.A.c and Iglesias, M.J.F.c	IC1
48	2014	<i>A usability evaluation of graphical modelling languages for authoring adaptive 3D virtual learning environments</i>	Ewais, A.a b and De Troyer, O.a	EC3

49	2014	<i>Proceedings - 2014 3rd International Conference on User Science and Engineering: Experience. Engineer. Engage, i-USER 2014</i>		EC1
50	2014	<i>Guidelines for assessing virtual learning environments (VLE) usability [Guía para la evaluación de la usabilidad en los entornos virtuales de aprendizaje (EVA)]</i>	Alarcón-Aldana, A.C.a and Díaz, E.L.a b and Callejas-Cuervo, M.a	IC1
51	2013	<i>A Voice-Enabled framework for recommender and adaptation systems in E-learning</i>	Azeta, A.A.a and Ayo, C.K.a and Ikhu-Omoregbe, N.A.b	IC1
52	2013	<i>A machine learning-based usability evaluation method for eLearning systems</i>	Oztekin, A.a and Delen, D.b and Turkyilmaz, A.c and Zaim, S.d	IC1
53	2013	<i>An interactive virtual environment for teaching 'triangulations and coordinates calculations' to surveying students</i>	Dib, H.a and Adamo-Villani, N.b and Garver, S.b	IC1
54	2013	<i>CrowdLearn: Crowd-sourcing the creation of highly-structured e-learning content</i>	Tarasowa, D. and Khalili, A. and Auer, S. and Unbehauen, J.	IC1
55	2013	<i>User testing for moodle application</i>	Tee, S.S. and Wook, T.S.M.T. and Zainudin, S.	IC1
56	2013	<i>Interaction problems accessing e-learning environments in multi-touch mobile devices: A case study in teleduc</i>	Da Silva, A.C.a and Freire, F.M.P.b and De Arruda, A.V.P.c and Da Rocha, H.V.d	IC1
57	2013	<i>Design and evaluation of a learner-centric immersive virtual learning environment for physics education</i>	Pirker, J.a and Gütl, C.a b and Belcher, J.W.c and Bailey, P.H.c	EC3
58	2013	<i>Design and implementation of C-iLearning: A cloud-based intelligent learning system</i>	Xiao, J.a and Wang, M.b and Wang, L.a and Zhu, X.a	IC1
59	2013	<i>Visual metaphors in learning management systems: How professors understand and use this feature</i>	De Almeida Pacheco, B.a and Souza-Concílio, I.A.a and Kfourri, E.M.b	EC1
60	2013	<i>Identifying cross-platform and cross-modality interaction problems in e-learning environments</i>	Da Silva, A.C.a and Freire, F.M.P.b and Da Rocha, H.V.c	IC1
61	2013	<i>Usability evaluation of an adaptive 3d virtual learning environment</i>	Ewais, A. and De Troyer, O.	EC3
62	2012	<i>Architecture for collaborative learning activities in hybrid learning environments</i>	Ibáñez, M.B. and Maroto, D. and García Rueda, J.J. and Leony, D. and Delgado Kloos, C.	EC3

63	2012	<i>Learning outcomes assessment via electronic portfolios</i>	Applegate, R. and Irwin, M.M.	EC1
64	2012	<i>Perceived usability evaluation of learning management systems: A first step towards standardization of the system usability scale in Greek</i>	Katsanos, C.a c and Tselios, N.b and Xenos, M.a c	IC1
65	2012	<i>Usability of a personalized online learning environment [Uporabnost personaliziranega spletnega ucnega okolja]</i>	Kožuh, I.a and Sarjaš, A.a and Jeremic, Z.b and Debevc, M.a	IC1
66	2012	<i>I-UxSED 2012 - Proceedings of the 2nd International Workshop on the Interplay Between User Experience Evaluation and Software Development, In Conjunction with the 7th Nordic Conference on Human-Computer Interaction, NordiCHI 2012</i>		EC1
67	2012	<i>LingoSnacks: M-Learning platform for language learning</i>	Erradi, A. and Nahia, S. and Almerekhi, H. and Al-Kailani, L.	IC1
68	2012	<i>Usability of an interactive educational website for statistics</i>	Hoyle, S. and Peres, S.C. and Bruton, K. and Gutierrez, T.	IC1
69	2012	<i>Rapid authoring platform for instructional design of scenarios (RAPIDS)</i>	Liew, B.T.a c and Tsui, E.a and Fong, P.S.W.b and Lau, A.S.M.a d	IC1
70	2012	<i>Evaluating usability and efficaciousness of an e-learning system: A quantitative, model-driven approach</i>	Theng, Y.-L. and Sin, J.	IC1
71	2012	<i>Usability evaluation of a LMS mobile web interface</i>	Ivanc, D. and Vasiu, R. and Onita, M.	IC1
72	2012	<i>A mobile course management system: Case study</i>	Koc, Y.a and Cikrikcili, O.a and Yucel, A.a and Cheng, H.-I.b and Salman, Y.B.a	IC1
73	2012	<i>A literature review about usability evaluation methods for e-learning platforms</i>	Freire, L.L.a and Arezes, P.M.a and Campos, J.C.b	IC1
74	2011	<i>A mobile flight case learning system for ATC miscommunications</i>	Su, K.-W.a and Liu, C.-L.b and Lee, C.-C.c	IC1
75	2011	<i>Work in progress - Open source usability evaluation: The case of Moodle</i>	Baytiyeh, H.	IC1
76	2011	<i>Comparative study of efficiency among the developed MLUAT methodology in comparison with qualitative user</i>	Fetaji, B. and Fetaji, M. and Kaneko, K.	IC1

*testing method and heuristics
evaluation*

77	2011	<i>Devising M-learning usability framework</i>	Fetaji, M. and Fetaji, B.	IC1
78	2011	<i>Establishment of the genetic/genomic competency center for education</i>	Calzone, K.A.a and Jerome-D'Emilia, B.b and Jenkins, J.c and Goldgar, C.d and Rackover, M.e and Jackson, J.f and Chen, Y.f and Voss, J.g and Feero, W.G.h i	IC1
79	2011	<i>Heuristic evaluation of e-learning courses: A comparative analysis of two e-learning heuristic sets</i>	Zaharias, P.a and Koutsabasis, P.b	IC1
80	2011	<i>Work in progress - Alternative interfaces for e-learning platforms used in remote areas</i>	Oliveira, L.S.a and Oliveros, D.V.a and Da Graça Pimentel, M.a and Queiroz-Neto, J.P.b	IC1
81	2011	<i>Experiences in visualizing the analysis of blended-learning interactions to support teachers</i>	Martín, M. and Álvarez, A. and Fernández-Castro, I. and Reina, D. and Urretavizcaya, M.	IC1
82	2011	<i>Audio folios management system for foreign language learning</i>	Lousado, J.P.a and Costa, C.M.M.b and Oliveira, I.P.a and Roberto, M.T.G.c	IC1
83	2011	<i>Usability testing and expert inspections complemented by educational evaluation: A case study of an e-learning platform</i>	Granić, A.a and Ćukušić, M.b	IC1
84	2011	<i>The usability evaluation of web-based 3D medical image visualization</i>	Settapat, S.a and Achalakul, T.b and Ohkura, M.c	EC3
85	2011	<i>The usability assessment of web-based learning systems</i>	Hsieh, C.-W. and Chen, H.-X. and Hsu, Y.-C. and Chen, S.Y.	IC1
86	2011	<i>Shadow Expert Technique (SET) for interaction analysis in educational systems</i>	Stickel, C.a and Ebner, M.a and Holzinger, A.b	IC1
87	2011	<i>User experience of social bookmarking tools</i>	Mor, E.a and Ferran, N.b and Garreta-Domingo, M.c and Mangas, J.-A.c	EC1
88	2011	<i>The Need For Rules: Determining the Usability of Adding Audio to the MOO</i>	Arduser, L.a b and Davis, J.M.a c and Evans, R.a and Hubbell, C.a and Mascle, D.a d and Mullins, C.e and Ryan, C.J.a f	EC2

89	2011	<i>An experimental study to measure mobile learning system usability at the aastmt</i>	Hamdi, N.a and Elbadrawy, R.b and Aziz, R.A.c	IC1
90	2011	<i>Evaluation of usability in a remote learning system utilizing Markov models</i>	Rodrigues, J.a and Diniz, M.a and Ferreira, S.B.L.a and Silveira, D.S.b and Capra, E.a	IC1
91	2011	<i>Proceedings of the IADIS International Conference WWW/Internet 2011, ICWI 2011</i>		EC1
92	2011	<i>Do patterns help novice evaluators? A comparative study</i>	Lanzilotti, R.a and Ardito, C.a and Costabile, M.F.a and De Angeli, A.b c	IC1
93	2010	<i>Supporting online learning system design with usability engineering</i>	Guo, Y.a and Zhu, Z.b and Qian, D.a	IC1
94	2010	<i>Spiral capability enhancement support system</i>	Nakamura, Y. and Tsuji, H.	EC1
95	2010	<i>Embedding interactivity into a university study portal by using social computing</i>	Todoran, I.	IC1
96	2010	<i>From usability to user experience: Evaluating the educational and motivational value of an augmented reality learning scenario</i>	Pribeanu, C. and Iordache, D.D.	EC3
97	2010	<i>The evaluation of an e-learning web-based platform</i>	Giannakos, M.N.	IC1
98	2010	<i>Accessibility and usability of a collaborative e-learning application</i>	Bozza, A.a and Mesiti, M.a and Valtolina, S.a and Dini, S.b and Ribaudò, M.c	IC1
99	2010	<i>Usability testing on a government training platform: A case study</i>	Guo, Y.a and Qian, D.a and Guan, J.a and Wang, J.b	IC1
100	2010	<i>Usability heuristics evaluation for child e-learning applications</i>	Alsumait, A.a and Al-Osaimi, A.b	IC1
101	2010	<i>A model of system re-configurability and pedagogical usability in an e-learning context: A faculty perspective</i>	Wang, J.a and Doll, W.J.b and Deng, X.c	IC1
102	2010	<i>UseLearn: A novel checklist and usability evaluation method for eLearning systems by criticality metric analysis</i>	Oztekin, A.a and Kong, Z.J.a and Uysal, O.b	IC1
103	2010	<i>The development of mobile learning system for local history and geography of Taiwan</i>	Shih, J.-L. and Chuang, C.-W. and Cheng, J.-J. and Hwang, G.-J.	IC1
104	2010	<i>Proceedings of the 43rd Annual Hawaii International Conference on System Sciences, HICSS-43</i>		EC1

105	2010	<i>Usability evaluation of a learning management system</i>	Blecken, A.a and Brüggemann, D.a and Marx, W.b	IC1
106	2010	<i>Using a mobile learning system for field investigative learning about the local history and geography of southern Taiwan</i>	Shih, J.-L.a and Hwang, G.-J.b and Chuang, C.-W.c and Cheng, J.-J.d	EC7
107	2010	<i>Added value of eye tracking in usability studies: Expert and non-expert participants</i>	Pretorius, M.C. and Van Biljon, J. and De Kock, E.	IC1
108	2009	<i>New faculty orientation gets a facelift</i>	Walczyk, C. and Warren, S.	IC1
109	2009	<i>Seeing the system through the end users' eyes: Shadow expert technique for evaluating the consistency of a learning management system</i>	Holzinger, A.a b c and Stickel, C.d and Fassold, M.d and Ebner, M.d	IC1
110	2009	<i>Usability evaluation methods: Mind the gaps</i>	De Kock, E. and Van Biljon, J. and Pretorius, M.	IC1
111	2009	<i>Usability testing methods on e-learning environment</i>	Jókai, E.	IC1
112	2009	<i>Participatory design and evaluation of e-learning system for Korean language training</i>	Salman, Y.B.a and Ince, I.F.a and Kim, J.Y.a and Cheng, H.-I.a and Yildirim, M.E.b	IC1
113	2009	<i>Designers of different cognitive styles editing e-learning materials studied by monitoring physiological and other data simultaneously</i>	Hercegfı, K.a and Csillik, O.b and Bodnár,É.b and Sass, J.b and Izsó, L.a	EC1
114	2009	<i>A case study of usability testing on an asynchronous e-Learning platform</i>	Guo, Y.a and Wang, J.b and Moore, J.b and Liu, M.a and Chen, H.-L.b	IC1
115	2009	<i>Application of VoiceXML in e-learning systems</i>	Azeta, A.A.a and Ayo, C.K.a and Atayero, A.A.b and Ikhu-Omoregbe, N.A.c	IC1
116	2009	<i>Usability heuristics evaluation for child e-learning applications</i>	Alsumait, A.a and Al-Osaimi, A.b	EC7
117	2009	<i>An e-learning application on electrochemotherapy.</i>	Corovic, S. and Bester, J. and Miklavcic, D.	IC1
118	2009	<i>Measuring the usability of augmented reality e-learning systems: A user-centered evaluation approach</i>	Pribeanu, C. and Balog, A. and Iordache, D.D.	EC3
119	2009	<i>Usability testing of e-learning: An approach incorporating co-discovery and think-aloud</i>	Adebesin, T.F.a and De Villiers, M.R.b and Ssemugabi, S.b	IC1
120	2009	<i>Usability in the context of e-learning: A framework augmenting 'traditional'</i>	Zaharias, P.	IC1

usability constructs with instructional design and motivation to learn

121	2009	<i>Developing a usable mobile flight case learning system in air traffic control miscommunications</i>	Su, K.-W. and Lee, K.-Y. and Huang, P.-H. and Chen, I.-T.	IC1
122	2009	<i>A usability study on how non-technical students interact with a free-text computer assisted:Assessment system</i>	Pascual-Nieto, I. and Pérez-Marín, D. and Rodriguez, P.	EC1
123	2009	<i>Evolution by evaluation</i>	Mahlow, C. and Hess, M. and Grund, S.	IC1
124	2009	<i>Developing a usability evaluation method for e-learning applications: Beyond functional usability</i>	Zaharias, P.a b c and Poylymenakou, A.b	IC1
125	2008	<i>Performance evaluation of reusable learning objects in e-learning system-a blended approach to make-learning to work</i>	Jayanthi, M.K.a and Snavatsa, S.K.b and Ramesh, T.c	IC1
126	2008	<i>Usability metrics of time and stress - Biological enhanced performance test of a university wide learning management system</i>	Stickel, C. and Scerbakov, A. and Kaufmann, T. and Ebner, M.	IC1
127	2008	<i>Pattern-based usability evaluation of e-learning systems</i>	Zub, D. and Eessaar, E.	IC1
128	2008	<i>The research on usability evaluation of E-learning systems</i>	Chai, Z.a and Zhao, Y.a and Zhu, S.b	IC1
129	2008	<i>A comparative study of LMS usability for first-time users: Navigation concept, subjective evaluation, and task completion rate and time</i>	Sasaki, Y.a c and Taferner, L.b and Anker, G.J.b and Okamoto, T.c	IC1
130	2008	<i>HCI research for E-learning: Adaptability and adaptivity to support better user interaction</i>	Glavinić, V.a and Granić, A.b	IC1
131	2008	<i>Assessing the benefits of AJAX in mobile learning systems design</i>	Xie, F. and Parsons, D.	IC1
132	2008	<i>Overview and evaluation of usability evaluation methods for e-learning systems</i>	Doroodchi, M.a and Nikmehr, N.b	IC1
133	2008	<i>Design and implementation of IPMS web portal</i>	Martin, R. and Shi, H.	IC1
134	2008	<i>Usability evaluation of the Moodle system from the teachers' perspective</i>	Kirner, T.G. and De Custódio, C.A. and Kirner, C.	IC1
135	2008	<i>Evaluating the motivational value of an augmented reality system for learning chemistry</i>	Pribeanu, C. and Iordache, D.D.	EC3
136	2008	<i>MOBILE game based learning - the future of e-learning?</i>	Cisic, D.a and Tijan, E.a and Mistic, I.I.b	IC1

137	2008	<i>Towards exploring existing content analysis schemes for asynchronous small group collaborative cmc learning</i>	Oriogun, P.K.a and Cave, D.b	IC1
138	2008	<i>Adapting mobile access scheme for a legacy e-learning platform</i>	Sánchez-Chamochin, E.L. and Cambranes-Martínez, E. and Menéndez-Domínguez, V.	IC1
139	2008	<i>Usability study of an e-learning system for CME in occupational medicine: Preparatory analysis and remedial actions [Studio di usabilit� di un sistema di e-learning per l'educazione continua in Medicina del Lavoro: Analisi preliminare e azioni correttive]</i>	Mazzoleni, M.C.a h and Rognoni, C.b f and Finozzi, E.c and Giorgi, I.d and Raho, C.d and Nervi, D.d and Pugliese, F.e and Pagani, M.f and Imbriani, M.g	IC1
140	2008	<i>Usability testing and evaluation of a mobile software solution: A case study</i>	Fetaji, M. and Dika, Z. and Fetaji, B.	IC1
141	2008	<i>Evaluating usability in learning management system moodle</i>	Kakasevski, G.a and Mihajlov, M.b and Arsenovski, S.a and Chungurski, S.a	IC1
142	2008	<i>Cross-disciplinary contributions to e-learning design: A tripartite design model</i>	Hutchins, H.M.a and Hutchison, D.b	IC1
143	2008	<i>Cross-cultural differences in perceptions of E-learning usability: An empirical investigation</i>	Zaharias, P.	IC1
144	2008	<i>Development of an E-learning system for occupational medicine: Usability issues</i>	Mazzoleni, M.C.a b and Rognoni, C.c d and Finozzi, E.b and Giorgi, I.b and Pugliese, F.e and Pagani, M.d and Pimbriani, M.b	IC1
145	2008	<i>Experience with usability evaluation of e-learning systems</i>	Granić, A.	IC1
146	2007	<i>Development and evaluation of a web-based e-learning system</i>	Schmidt, L.	IC1
147	2007	<i>On the importance of the user interface for e-learning systems quality</i>	Costabile, M.F. and Lanzilotti, R. and Ardito, C.	IC1
148	2007	<i>A holistic approach to the evaluation of e-learning systems</i>	Costabile, M.F. and Roselli, T. and Lanzilotti, R. and Ardito, C. and Rossano, V.	IC1
149	2007	<i>Accessible and adaptive e-Learning materials: Considerations for design and development</i>	Debevc, M. and Stjepanovič, Z. and Povalej, P. and Verlič, M. and Kokol, P.	IC1

150	2007	<i>Usability and accessibility evaluations along the eLearning cycle</i>	Martin, L.a and Gutiérrez y Restrepo, E.b and Barrera, C.a and Ascaso, A.R.a and Santos, O.C.a and Boticario, J.G.a	IC1
151	2007	<i>Assessing the usability of a cookies-based access monitoring tool for a CMS</i>	Hijón-Neira, R. and Urquiza-Fuentes, J. and Domínguez-Mateos, F. and Velázquez-Iturbide, J.Á.	EC1
152	2007	<i>A comparative study of two usability evaluation methods using a web-based e-learning application</i>	Ssemugabi, S.a and De Villiers, R.b	IC1
153	2007	<i>Conceptual multi-device design on the transition between e-learning and m-learning</i>	De Oliveira, R. and Da Rocha, H.V.	IC1
154	2007	<i>Proceedings of SAICSIT 2007: Annual Research Confrence of the South African Information Technologists</i>		EC1
155	2007	<i>A practical experience of usage and evaluation of the USABLE course</i>	Sommaruga, L.a and Catenazzi, N.b	IC1
156	2007	<i>Usability assessment of an e-learning courseware for basic cataloging</i>	Chen, X.S.a and Lu, T.b	IC1
157	2006	<i>eLSE methodology: A systematic approach to the e-learning systems evaluation</i>	Lanzilotti, R.a and Ardito, C.a and Costabile, M.F.a and De Angeli, A.b	IC1
158	2006	<i>Design guidelines for e-learning systems</i>	Zambarbieri, D.a and Robino, C.a and Crespi, S.a and Calvi, L.a c and Luccini, A.M.b	IC1
159	2006	<i>Systematic evaluation of e-learning systems: An experimental validation</i>	Ardito, C.a and Costabile, M.F.a and De Angeli, A.b and Lanzilotti, R.a	IC1
160	2006	<i>Towards a framework for usability testing of interactive e-learning applications in cognitive domains, illustrated by a case study</i>	Masemola, S.S.a b and De Villiers, M.R.a b	IC1
161	2006	<i>Evaluation of interaction design in Web-based intelligent tutoring systems</i>	Granić, A.a and Glavinić, V.b	IC1
162	2006	<i>Proceedings - 2006 SIGED: IAIM 21st Annual Conference</i>		EC1
163	2006	<i>A usability evaluation method for e-learning: Focus on motivation to learn</i>	Zaharias, P.	IC1

164	2006	<i>An approach to usability evaluation of e-learning applications</i>	Ardito, C.a and Costabile, M.F.a and De Marsico, M.b and Lanzilotti, R.a and Levialedi, S.b and Roselli, T.a and Rossano, V.a	IC1
165	2006	<i>Determining effective distance learning designs through usability testing</i>	Miller-Cochran, S.K.	IC1
166	2005	<i>An interface usability test for the editor musical</i>	Ficheman, I.K. and Pereira, A.R. and Adamatti, D.F. and De Oliveira, I.C.A. and Lopes, R.D. and Sichman, J.S. and De Almeida Amazonas, J.R. and Filgueiras, L.V.L.	IC1
167	2005	<i>On the usability evaluation of e-learning applications</i>	Costabile, M.F. and De Marsico, M. and Lanzilotti, R. and Plantamura, V.L. and Roselli, T.	IC1
168	2005	<i>Designing simplicity: Usability perspectives on Learning Management Systems</i>	Mastoras, T. and Fotaris, P. and Politis, A. and Manitsaris, A.	IC1
169	2005	<i>Questionnaire for evaluation of usability and learning outcomes in on-line instruction</i>	Meiselwitz, G.a and Lu, C.b	IC1
170	2005	<i>Evaluation into the usability of a virtual learning environment</i>	Cole, I.J.a and Lewis, D.b	IC1
171	2004	<i>Usability of e-learning tools</i>	Ardito, C.a and De Marsico, M.b and Lanzilotti, R.a and Levialedi, S.b and Roselli, T.a and Rossano, V.a and Tersigni, M.b	IC1
172	2004	<i>Simulation of patient encounters using a virtual patient in periodontology instruction of dental students: Design, usability, and learning effect in history-taking skills</i>	Janda, M.S.a and Mattheos, N.a and Nattestad, A.b and Wagner, A.a and Nebel, D.a and Färbom, C.a and Lê, D.-H.c and Attström, R.a d	IC1
173	2004	<i>Mobile versus desktop facilities for an e-learning system: Users' perspective</i>	Virvou, M. and Alepis, E.	IC1

174	2004	<i>Towards guidelines for usability of e-learning applications</i>	Ardito, C.a and Costabile, M.F.a and De Marsico, M.b and Lanzilotti, R.a and Levialdi, S.b and Plantamura, P.a and Roselli, T.a and Rossano, V.a and Tersigni, M.b	IC1
175	2004	<i>Expanding the concept of usability</i>	Koohang, A.a b	IC1
176	2003	<i>Evaluation of the interactivity of Web-based learning systems: Principles and process</i>	Evans, C.a b and Sabry, K.a	IC1
177	2000	<i>Lectern: A digital desk system for video-free course-lecture capturing and playback</i>	Chiueh, T.-C. and Deng, P.	EC1
178	2014	<i>Development and Usability assessment of tablet-based synchronous mobile learning system</i>	Lee, Jang Ho	EC7
179	2014	<i>Guia para la evaluacion de la usabilidad en los entornos virtuales de aprendizaje (EVA)</i>	Alarcon-Aldana, Andrea C. and Diaz, Edilma L. and Callejas-Cuervo, Mauro	IC1
180	2008	<i>Usability metrics of time and stress - Biological enhanced performance test of a university wide learning management system</i>	Stickel, Christian and Scerbakov, Alexei and Kaufmann, Thomas and Ebner, Martin	EC7
181	2011	<i>An experimental study to measure mobile learning system usability at the aastmt</i>	Hamdi, Nourhan and Elbadrawy, Rehaballah and Aziz, Rasha Abdel	EC7
182	2011	<i>Experiences in visualizing the analysis of blended-learning interactions to support teachers</i>	Martin, Maite and Alvarez, Ainhoa and Fernandez-Castro, Isabel and Reina, David and Urretavizcaya, Maite	EC7
183	2014	<i>The emotion component on usability testing human computer interface of an inclusive learning management system</i>	Ulbricht, Vania R. and Berg, Carlos Henrique and Fadel, Luciane and Quevedo, Silvia R. P.	EC7
184	2010	<i>The development of mobile learning system for local history and geography of Taiwan</i>	Shih, Ju-Ling and Chuang, Chien-Wen and Cheng, Jia-Jia and Hwang, Gwo-Jen	EC7
185	2011	<i>User experience of social bookmarking tools</i>	Mor, Enric and Ferran, Nuria and Garreta-Domingo, Muriel and Mangas, Juan-Antonio	EC7

186	2007	<i>A holistic approach to the evaluation of e-learning systems</i>	Costabile, M.F. and Roselli, T. and Lanzilotti, R. and Ardito, C. and Rossano, V.	EC7
187	2015	<i>A study on usability of mobileschool system for secondary school: Role-based questionnaire method</i>	Hashim, Ahmad Sobri and Ahmad, Wan Fatimah Wan	EC7
188	2015	<i>Energy transformation in everyday devices taught to primary school children, using web-based software</i>	Garyfallidou, D.M. and Ioannidis, G.S.	EC7
189	2008	<i>Experience with usability evaluation of e-learning systems</i>	Granic, Andrina	EC7
190	2011	<i>Proceedings of the IADIS International Conference WWW/Internet 2011, ICWI 2011</i>		EC7

2. Results from the second filter

#	Year	Title	Authors	Criteria
1	2016	<i>Exploring user satisfaction for e-learning systems via usage-based metrics and system usability scale analysis</i>	Harrati, N.a and Bouchrika, I.b and Tari, A.a and Ladjailia, A.b	IC1
2	2016	<i>Usability evaluation of a course management system based on Lingweb platform [Evaluación de usabilidad de un sistema de administración de cursos basado en la plataforma Lingweb]</i>	Reyes Vera, J.M.a and Berdugo Torres, M.I.b and Villegas, L.M.c	EC5
3	2016	<i>Usability Assessment of Moodle by Brazilian and Portuguese Nursing Students</i>	Seixas, C.A.a and De Godoy, S.a and Martins, J.C.A.b and Mazzo, A.a and Baptista, R.C.N.b and Mendes, I.A.C.a	EC6
4	2016	<i>Framework to Evaluate M-Learning Systems: A Technological and Pedagogical Approach</i>	Navarro, C.X.a and Molina, A.I.b and Redondo, M.A.b and Juárez-Ramírez, R.c	IC1
5	2016	<i>The usability evaluation concerning emotional responses of users on learning management system</i>	Phongphaew, N. and Jiamsanguanwong, A.	EC6
6	2016	<i>Usability software engineering testing experimentation for android-based web applications: Usability engineering testing for online learning management system</i>	Saeeda, H.a and Arif, F.a and Minhas, N.M.b	EC6
7	2016	<i>New moodle blocks for knowledge management</i>	Silva Sprock, A.a and Vicari, R.M.b	EC6
8	2016	<i>User evaluation of language websites as a way of students' engagement into blended learning process case study</i>	Černá, M.	EC6
9	2016	<i>A semantic MediaWiki-based approach for the collaborative development of pedagogically meaningful learning content annotations</i>	Zander, S.a and Swertz, C.b and Verdú, E.c and Pérez, M.J.V.d and Henning, P.e	EC1
10	2015	<i>Testing usability in Moodle: When and How to do it</i>	Ternauciuc, A. and Vasii, R.	IC1
11	2015	<i>Energy transformation in everyday devices taught to primary school children, using web-based software</i>	Garyfallidou, D.M. and Ioannidis, G.S.	EC1
12	2015	<i>Usability Evaluation by Experts of a Learning Management System</i>	Medina-Flores, R.a and Morales-Gamboa, R.b	IC1
13	2015	<i>Inviting citizen designers to design digital interface for the</i>	Panthee, R.K.	EC6

		<i>democratization of web online environments</i>		
14	2015	<i>Effective user experience in online technical communication courses: Employing multiple methods within organizational contexts to assess usability</i>	Hovde, M.R.	EC1
15	2015	<i>Towards a Model for Evaluating the Usability of M-learning Systems: From a Mapping Study to an Approach</i>	Navarro, C.X.a and Molina, A.I.b and Redondo, M.A.b	EC5
16	2015	<i>Usability evaluation of the student centered e-Learning environment</i>	Junus, I.S. and Santoso, H.B. and Isal, R.Y.K. and Utomo, A.Y.	IC1
17	2015	<i>Research-in-progress: User experience evaluation of Student Centered E-Learning Environment for computer science program</i>	Santoso, H.B.a and Isal, R.Y.K.a and Basaruddin, T.a and Sadira, L.a and Schrepp, M.b	IC1
18	2015	<i>Design and usability evaluation of adaptive e-learning systems based on learner knowledge and learning style</i>	Alshammari, M.a and Anane, R.b and Hendley, R.J.a	EC1
19	2015	<i>A study on usability of mobileschool system for secondary school: Role-based questionnaire method</i>	Hashim, A.S. and Ahmad, W.F.W.	EC6
20	2015	<i>Observatory of studentsg uses of computer-based tools</i>	Van Der Linden, J. and Van De Leemput, C.	IC1
21	2015	<i>Usability evaluation of Tadarus: Student perceptions</i>	Alkhatabi, M.	IC1
22	2015	<i>Heuristics for evaluating usability of Learning Management Systems in Africa</i>	Mtebe, J.S. and Kissaka, M.M.	IC1
23	2015	<i>Perceived usability evaluation of learning management systems: Empirical evaluation of the system usability scale</i>	Orfanou, K.a and Tselios, N.a and Katsanos, C.b c	IC1
24	2015	<i>Merlin-know, an interactive virtual teacher for improving learning in Moodle</i>	Hijon-Neira, R.a and Velazquez-Iturbide, A.a and Pizarro-Romero, C.a and Carrico, L.b	IC1
25	2015	<i>The usability analysis of an E-learning environment</i>	Torun, F.a and Tekedere, H.b	IC1
26	2015	<i>The usefulness of usability and user experience evaluation methods on an e-Learning platform development from a developer's perspective: A case study</i>	Gordillo, A. and Barra, E. and Aguirre, S. and Quemada, J.	IC1
27	2015	<i>Clustering students based on motivation to learn: A blended learning approach</i>	Rentroia-Bonito, M.A.a and Gonçalves, D.b and Jorge, J.A.b	EC6

28	2015	<i>The collaborative logical framework: Approach and improvements based on instructors' and learners' needs</i>	Chacón-Rivas, M.a and Santos, O.C.b and Boticario, J.G.b	EC6
29	2014	<i>Evaluation framework for m-learning systems: Current situation and proposal</i>	Cota, C.X.N.a and Díaz, A.I.M.b and Duque, M.A.R.b	IC1
30	2014	<i>The emotion component on usability testing human computer interface of an inclusive learning management system</i>	Ulbricht, V.R. and Berg, C.H. and Fadel, L. and Quevedo, S.R.P.	EC6
31	2014	<i>Design and evaluation of Collaborative Learning Management System (CLMS) framework for teaching technical subject</i>	Yusoff, S.R.M. and Mat Zin, N.A.	IC1
32	2014	<i>An approach in the design of virtual environment for e-learning based on usability studies</i>	Blažič, B.J.a b and Arh, T.b and Blažič, A.J.b	EC6
33	2014	<i>Development and Usability assessment of tablet-based synchronous mobile learning system</i>	Lee, J.H.	EC6
34	2014	<i>Prototyping m-learning course on the basis of puzzle learning methodology</i>	Szklanny, K. and Wichrowski, M.	EC6
35	2014	<i>A streamlined mobile user-interface for improved access to LMS services</i>	Ssekakubo, G. and Suleman, H. and Marsden, G.	IC1
36	2014	<i>Evaluating E-learning platforms for schools: Use and usability, user acceptance, and impact on learning</i>	Stergioulas, L.a and Abassi, M.a and Xydopoulos, G.a and Fakhimi, M.a and Margineanu, R.b and Rifon, L.A.c and Iglesias, M.J.F.c	IC1
37	2014	<i>Guidelines for assessing virtual learning environments (VLE) usability [Guía para la evaluación de la usabilidad en los entornos virtuales de aprendizaje (EVA)]</i>	Alarcón-Aldana, A.C.a and Díaz, E.L.a b and Callejas-Cuervo, M.a	EC5
38	2013	<i>A Voice-Enabled framework for recommender and adaptation systems in E-learning</i>	Azeta, A.A.a and Ayo, C.K.a and Ikhu-Omoregbe, N.A.b	IC1
39	2013	<i>A machine learning-based usability evaluation method for eLearning systems</i>	Oztekin, A.a and Delen, D.b and Turkyilmaz, A.c and Zaim, S.d	IC1
40	2013	<i>An interactive virtual environment for teaching 'triangulations and coordinates calculations' to surveying students</i>	Dib, H.a and Adamo-Villani, N.b and Garver, S.b	EC1
41	2013	<i>CrowdLearn: Crowd-sourcing the creation of highly-structured e-learning content</i>	Tarasowa, D. and Khalili, A. and Auer, S. and Unbehauen, J.	EC1

42	2013	<i>User testing for moodle application</i>	Tee, S.S. and Wook, T.S.M.T. and Zainudin, S.	IC1
43	2013	<i>Interaction problems accessing e-learning environments in multi-touch mobile devices: A case study in teleduc</i>	Da Silva, A.C.a and Freire, F.M.P.b and De Arruda, A.V.P.c and Da Rocha, H.V.d	IC1
44	2013	<i>Design and implementation of C-iLearning: A cloud-based intelligent learning system</i>	Xiao, J.a and Wang, M.b and Wang, L.a and Zhu, X.a	EC6
45	2013	<i>Identifying cross-platform and cross-modality interaction problems in e-learning environments</i>	Da Silva, A.C.a and Freire, F.M.P.b and Da Rocha, H.V.c	IC1
46	2012	<i>Perceived usability evaluation of learning management systems: A first step towards standardization of the system usability scale in Greek</i>	Katsanos, C.a c and Tselios, N.b and Xenos, M.a c	IC1
47	2012	<i>Usability of a pesonalized online learning environment [Uporabnost personaliziranega spletnega ucnega okolja]</i>	Kožuh, I.a and Sarjaš, A.a and Jeremic, Z.b and Debevc, M.a	EC5
48	2012	<i>LingoSnacks: M-Learning platform for language learning</i>	Erradi, A. and Nahia, S. and Almerekhi, H. and Al-Kailani, L.	EC1
49	2012	<i>Usability of an interactive educational website for statistics</i>	Hoyle, S. and Peres, S.C. and Bruton, K. and Gutierrez, T.	EC1
50	2012	<i>Rapid authoring platform for instructional design of scenarios (RAPIDS)</i>	Liew, B.T.a c and Tsui, E.a and Fong, P.S.W.b and Lau, A.S.M.a d	EC1
51	2012	<i>Evaluating usability and efficaciousness of an e-learning system: A quantitative, model-driven approach</i>	Theng, Y.-L. and Sin, J.	IC1
52	2012	<i>Usability evaluation of a LMS mobile web interface</i>	Ivanc, D. and Vasiu, R. and Onita, M.	IC1
53	2012	<i>A mobile course management system: Case study</i>	Koc, Y.a and Cikrikcili, O.a and Yucel, A.a and Cheng, H.-I.b and Salman, Y.B.a	EC6
54	2012	<i>A literature review about usability evaluation methods for e-learning platforms</i>	Freire, L.L.a and Arezes, P.M.a and Campos, J.C.b	IC1
55	2011	<i>A mobile flight case learning system for ATC miscommunications</i>	Su, K.-W.a and Liu, C.-L.b and Lee, C.-C.c	EC1
56	2011	<i>Work in progress - Open source usability evaluation: The case of Moodle</i>	Baytiyeh, H.	IC1

57	2011	<i>Comparative study of efficiency among the developed MLUAT methodology in comparison with qualitative user testing method and heuristics evaluation</i>	Fetaji, B. and Fetaji, M. and Kaneko, K.	IC1
58	2011	<i>Devising M-learning usability framework</i>	Fetaji, M. and Fetaji, B.	IC1
59	2011	<i>Establishment of the genetic/genomic competency center for education</i>	Calzone, K.A.a and Jerome-D'Emilia, B.b and Jenkins, J.c and Goldgar, C.d and Rackover, M.e and Jackson, J.f and Chen, Y.f and Voss, J.g and Feero, W.G.h i	IC1
60	2011	<i>Heuristic evaluation of e-learning courses: A comparative analysis of two e-learning heuristic sets</i>	Zaharias, P.a and Koutsabasis, P.b	IC1
61	2011	<i>Work in progress - Alternative interfaces for e-learning platforms used in remote areas</i>	Oliveira, L.S.a and Oliveros, D.V.a and Da Graça Pimentel, M.a and Queiroz-Neto, J.P.b	EC6
62	2011	<i>Experiences in visualizing the analysis of blended-learning interactions to support teachers</i>	Martín, M. and Álvarez, A. and Fernández-Castro, I. and Reina, D. and Urretavizcaya, M.	EC6
63	2011	<i>Audio folios management system for foreign language learning</i>	Lousado, J.P.a and Costa, C.M.M.b and Oliveira, I.P.a and Roberto, M.T.G.c	EC6
64	2011	<i>Usability testing and expert inspections complemented by educational evaluation: A case study of an e-learning platform</i>	Granić, A.a and Ćukušić, M.b	IC1
65	2011	<i>The usability assessment of web-based learning systems</i>	Hsieh, C.-W. and Chen, H.-X. and Hsu, Y.-C. and Chen, S.Y.	EC6
66	2011	<i>Shadow Expert Technique (SET) for interaction analysis in educational systems</i>	Stickel, C.a and Ebner, M.a and Holzinger, A.b	IC1
67	2011	<i>An experimental study to measure mobile learning system usability at the aastmt</i>	Hamdi, N.a and Elbadrawy, R.b and Aziz, R.A.c	IC1
68	2011	<i>Evaluation of usability in a remote learning system utilizing Markov models</i>	Rodrigues, J.a and Diniz, M.a and Ferreira, S.B.L.a and Silveira, D.S.b and Capra, E.a	IC1

69	2011	<i>Do patterns help novice evaluators? A comparative study</i>	Lanzilotti, R.a and Ardito, C.a and Costabile, M.F.a and De Angeli, A.b c	IC1
70	2010	<i>Supporting online learning system design with usability engineering</i>	Guo, Y.a and Zhu, Z.b and Qian, D.a	EC7
71	2010	<i>Embedding interactivity into a university study portal by using social computing</i>	Todoran, I.	IC1
72	2010	<i>The evaluation of an e-learning web-based platform</i>	Giannakos, M.N.	EC1
73	2010	<i>Accessibility and usability of a collaborative e-learning application</i>	Bozza, A.a and Mesiti, M.a and Valtolina, S.a and Dini, S.b and Ribauda, M.c	EC1
74	2010	<i>Usability testing on a government training platform: A case study</i>	Guo, Y.a and Qian, D.a and Guan, J.a and Wang, J.b	IC1
75	2010	<i>Usability heuristics evaluation for child e-learning applications</i>	Alsumait, A.a and Al-Osaimi, A.b	EC1
76	2010	<i>A model of system re-configurability and pedagogical usability in an e-learning context: A faculty perspective</i>	Wang, J.a and Doll, W.J.b and Deng, X.c	EC6
77	2010	<i>UseLearn: A novel checklist and usability evaluation method for eLearning systems by criticality metric analysis</i>	Oztekin, A.a and Kong, Z.J.a and Uysal, O.b	IC1
78	2010	<i>The development of mobile learning system for local history and geography of Taiwan</i>	Shih, J.-L. and Chuang, C.-W. and Cheng, J.-J. and Hwang, G.-J.	EC1
79	2010	<i>Usability evaluation of a learning management system</i>	Blecken, A.a and Brüggemann, D.a and Marx, W.b	IC1
80	2010	<i>Added value of eye tracking in usability studies: Expert and non-expert participants</i>	Pretorius, M.C. and Van Biljon, J. and De Kock, E.	EC7
81	2009	<i>New faculty orientation gets a facelift</i>	Walczyk, C. and Warren, S.	EC6
82	2009	<i>Seeing the system through the end users' eyes: Shadow expert technique for evaluating the consistency of a learning management system</i>	Holzinger, A.a b c and Stickel, C.d and Fassold, M.d and Ebner, M.d	IC1
83	2009	<i>Usability evaluation methods: Mind the gaps</i>	De Kock, E. and Van Biljon, J. and Pretorius, M.	IC1
84	2009	<i>Usability testing methods on e-learning environment</i>	Jókai, E.	IC1

85	2009	<i>Participatory design and evaluation of e-learning system for Korean language training</i>	Salman, Y.B.a and Ince, I.F.a and Kim, J.Y.a and Cheng, H.-I.a and Yildirim, M.E.b	EC1
86	2009	<i>A case study of usability testing on an asynchronous e-Learning platform</i>	Guo, Y.a and Wang, J.b and Moore, J.b and Liu, M.a and Chen, H.-L.b	IC1
87	2009	<i>Application of VoiceXML in e-learning systems</i>	Azeta, A.A.a and Ayo, C.K.a and Atayero, A.A.b and Ikhu-Omoregbe, N.A.c	IC1
88	2009	<i>An e-learning application on electrochemotherapy.</i>	Corovic, S. and Bester, J. and Miklavcic, D.	EC1
89	2009	<i>Usability testing of e-learning: An approach incorporating co-discovery and think-aloud</i>	Adebesin, T.F.a and De Villiers, M.R.b and Ssemugabi, S.b	EC1
90	2009	<i>Usability in the context of e-learning: A framework augmenting 'traditional' usability constructs with instructional design and motivation to learn</i>	Zaharias, P.	IC1
91	2009	<i>Developing a usable mobile flight case learning system in air traffic control miscommunications</i>	Su, K.-W. and Lee, K.-Y. and Huang, P.-H. and Chen, I.-T.	EC6
92	2009	<i>Evolution by evaluation</i>	Mahlow, C. and Hess, M. and Grund, S.	EC1
93	2009	<i>Developing a usability evaluation method for e-learning applications: Beyond functional usability</i>	Zaharias, P.a b c and Poylymenakou, A.b	IC1
94	2008	<i>Performance evaluation of reusable learning objects in e-learning system-a blended approach to make-learning to work</i>	Jayanthi, M.K.a and Snavatsa, S.K.b and Ramesh, T.c	EC1
95	2008	<i>Usability metrics of time and stress - Biological enhanced performance test of a university wide learning management system</i>	Stickel, C. and Scerbakov, A. and Kaufmann, T. and Ebner, M.	IC1
96	2008	<i>Pattern-based usability evaluation of e-learning systems</i>	Zub, D. and Eessaar, E.	IC1
97	2008	<i>The research on usability evaluation of E-learning systems</i>	Chai, Z.a and Zhao, Y.a and Zhu, S.b	EC7
98	2008	<i>A comparative study of LMS usability for first-time users: Navigation concept, subjective evaluation, and task completion rate and time</i>	Sasaki, Y.a c and Taferner, L.b and Anker, G.J.b and Okamoto, T.c	EC6
99	2008	<i>HCI research for E-learning: Adaptability and adaptivity to support better user interaction</i>	Glavinić, V.a and Granić, A.b	EC1

100	2008	<i>Assessing the benefits of AJAX in mobile learning systems design</i>	Xie, F. and Parsons, D.	EC6
101	2008	<i>Overview and evaluation of usability evaluation methods for e-learning systems</i>	Doroodchi, M.a and Nikmehr, N.b	EC6
102	2008	<i>Design and implementation of IPMS web portal</i>	Martin, R. and Shi, H.	EC6
103	2008	<i>Usability evaluation of the Moodle system from the teachers' perspective</i>	Kirner, T.G. and De Custódio, C.A. and Kirner, C.	EC6
104	2008	<i>MOBILE game based learning - the future of e-learning?</i>	Cisic, D.a and Tijan, E.a and Mistic, I.I.b	EC1
105	2008	<i>Towards exploring existing content analysis schemes for asynchronous small group collaborative cmc learning</i>	Oriogun, P.K.a and Cave, D.b	EC1
106	2008	<i>Adapting mobile access scheme for a legacy e-learning platform</i>	Sánchez-Chamochin, E.L. and Cambranes-Martínez, E. and Menéndez-Domínguez, V.	IC1
107	2008	<i>Usability study of an e-learning system for CME in occupational medicine: Preparatory analysis and remedial actions [Studio di usabilit� di un sistema di e-learning per l'educazione continua in Medicina del Lavoro: Analisi preliminare e azioni correttive]</i>	Mazzoleni, M.C.a h and Rognoni, C.b f and Finozzi, E.c and Giorgi, I.d and Raho, C.d and Nervi, D.d and Pugliese, F.e and Pagani, M.f and Imbriani, M.g	EC6
108	2008	<i>Usability testing and evaluation of a mobile software solution: A case study</i>	Fetaji, M. and Dika, Z. and Fetaji, B.	IC1
109	2008	<i>Evaluating usability in learning management system moodle</i>	Kakasevski, G.a and Mihajlov, M.b and Arsenovski, S.a and Chungurski, S.a	IC1
110	2008	<i>Cross-disciplinary contributions to e-learning design: A tripartite design model</i>	Hutchins, H.M.a and Hutchison, D.b	EC1
111	2008	<i>Cross-cultural differences in perceptions of E-learning usability: An empirical investigation</i>	Zaharias, P.	IC1
112	2008	<i>Development of an E-learning system for occupational medicine: Usability issues</i>	Mazzoleni, M.C.a b and Rognoni, C.c d and Finozzi, E.b and Giorgi, I.b and Pugliese, F.e and Pagani, M.d and Pimbriani, M.b	IC1
113	2008	<i>Experience with usability evaluation of e-learning systems</i>	Granić, A.	EC1

114	2007	<i>Development and evaluation of a web-based e-learning system</i>	Schmidt, L.	EC6
115	2007	<i>On the importance of the user interface for e-learning systems quality</i>	Costabile, M.F. and Lanzilotti, R. and Ardito, C.	EC6
116	2007	<i>A holistic approach to the evaluation of e-learning systems</i>	Costabile, M.F. and Roselli, T. and Lanzilotti, R. and Ardito, C. and Rossano, V.	EC7
117	2007	<i>Accessible and adaptive e-Learning materials: Considerations for design and development</i>	Debevc, M. and Stjepanovič, Z. and Povalej, P. and Verlič, M. and Kokol, P.	IC1
118	2007	<i>Usability and accessibility evaluations along the eLearning cycle</i>	Martin, L.a and Gutiérrez y Restrepo, E.b and Barrera, C.a and Ascaso, A.R.a and Santos, O.C.a and Boticario, J.G.a	IC1
119	2007	<i>A comparative study of two usability evaluation methods using a web-based e-learning application</i>	Ssemugabi, S.a and De Villiers, R.b	IC1
120	2007	<i>Conceptual multi-device design on the transition between e-learning and m-learning</i>	De Oliveira, R. and Da Rocha, H.V.	EC1
121	2007	<i>A practical experience of usage and evaluation of the USABLE course</i>	Sommaruga, L.a and Catenazzi, N.b	EC6
122	2007	<i>Usability assessment of an e-learning courseware for basic cataloging</i>	Chen, X.S.a and Lu, T.b	EC1
123	2006	<i>eLSE methodology: A systematic approach to the e-learning systems evaluation</i>	Lanzilotti, R.a and Ardito, C.a and Costabile, M.F.a and De Angeli, A.b	IC1
124	2006	<i>Design guidelines for e-learning systems</i>	Zambarbieri, D.a and Robino, C.a and Crespi, S.a and Calvi, L.a c and Luccini, A.M.b	EC1
125	2006	<i>Systematic evaluation of e-learning systems: An experimental validation</i>	Ardito, C.a and Costabile, M.F.a and De Angeli, A.b and Lanzilotti, R.a	EC7
126	2006	<i>Towards a framework for usability testing of interactive e-learning applications in cognitive domains, illustrated by a case study</i>	Masemola, S.S.a b and De Villiers, M.R.a b	EC1
127	2006	<i>Evaluation of interaction design in Web-based intelligent tutoring systems</i>	Granić, A.a and Glavinić, V.b	EC1
128	2006	<i>A usability evaluation method for e-learning: Focus on motivation to learn</i>	Zaharias, P.	IC1

129	2006	<i>An approach to usability evaluation of e-learning applications</i>	Ardito, C.a and Costabile, M.F.a and De Marsico, M.b and Lanzilotti, R.a and Levialedi, S.b and Roselli, T.a and Rossano, V.a	IC1
130	2006	<i>Determining effective distance learning designs through usability testing</i>	Miller-Cochran, S.K.	IC1
131	2005	<i>An interface usability test for the editor musical</i>	Ficheman, I.K. and Pereira, A.R. and Adamatti, D.F. and De Oliveira, I.C.A. and Lopes, R.D. and Sichman, J.S. and De Almeida Amazonas, J.R. and Filgueiras, L.V.L.	EC1
132	2005	<i>On the usability evaluation of e-learning applications</i>	Costabile, M.F. and De Marsico, M. and Lanzilotti, R. and Plantamura, V.L. and Roselli, T.	EC7
133	2005	<i>Designing simplicity: Usability perspectives on Learning Management Systems</i>	Mastoras, T. and Fotaris, P. and Politis, A. and Manitsaris, A.	EC1
134	2005	<i>Questionnaire for evaluation of usability and learning outcomes in on-line instruction</i>	Meiselwitz, G.a and Lu, C.b	EC6
135	2005	<i>Evaluation into the usability of a virtual learning environment</i>	Cole, I.J.a and Lewis, D.b	EC6
136	2004	<i>Usability of e-learning tools</i>	Ardito, C.a and De Marsico, M.b and Lanzilotti, R.a and Levialedi, S.b and Roselli, T.a and Rossano, V.a and Tersigni, M.b	EC7
137	2004	<i>Simulation of patient encounters using a virtual patient in periodontology instruction of dental students: Design, usability, and learning effect in history-taking skills</i>	Janda, M.S.a and Mattheos, N.a and Nattestad, A.b and Wagner, A.a and Nebel, D.a and Färbom, C.a and Lê, D.-H.c and Attström, R.a d	EC6
138	2004	<i>Mobile versus desktop facilities for an e-learning system: Users' perspective</i>	Virvou, M. and Alepis, E.	EC1

139	2004	<i>Towards guidelines for usability of e-learning applications</i>	Ardito, C.a and Costabile, M.F.a and De Marsico, M.b and Lanzilotti, R.a and Levialdi, S.b and Plantamura, P.a and Roselli, T.a and Rossano, V.a and Tersigni, M.b	EC7
140	2004	<i>Expanding the concept of usability</i>	Koochang, A.a b	IC1
141	2003	<i>Evaluation of the interactivity of Web-based learning systems: Principles and process</i>	Evans, C.a b and Sabry, K.a	EC6
142	2014	<i>Guia para la evaluacion de la usabilidad en los entornos virtuales de aprendizaje (EVA)</i>	Alarcon-Aldana, Andrea C. and Diaz, Edilma L. and Callejas-Cuervo, Mauro	EC5

3. Final result

ID	Title	Authors
S01	<i>Expanding the concept of usability</i>	Koohang, A.
S02	<i>Determining effective distance learning designs through usability testing</i>	Miller-Cochran, S.K.
S03	<i>An approach to usability evaluation of e-learning applications</i>	Ardito, C.; Costabile, M.F.; De Marsico, M.; Lanzilotti, R.; Leviardi, S.; Roselli, T.; Rossano, V.
S04	<i>A usability evaluation method for e-learning: Focus on motivation to learn</i>	Zaharias, P.
S05	<i>eLSE methodology: A systematic approach to the e-learning systems evaluation</i>	Lanzilotti, R.; Ardito, C.; Costabile, M.F.; De Angeli, A.
S06	<i>A comparative study of two usability evaluation methods using a web-based e-learning application</i>	Ssemugabi, S.; De Villiers, R.b
S07	<i>Usability and accessibility evaluations along the eLearning cycle</i>	Martin, L.; Gutiérrez y Restrepo, E.; Barrera, C.; Ascaso, A.R.; Santos, O.C.; Boticario, J.G.
S08	<i>Accessible and adaptive e-Learning materials: Considerations for design and development</i>	Debevc, M.; Stjepanović, Z.; Povalej, P.; Verlič, M.; Kokol, P.
S09	<i>Development of an E-learning system for occupational medicine: Usability issues</i>	Mazzoleni, M.C.; Rognoni, C.; Finozzi, E.; Giorgi, I.; Pugliese, F.; Pagani, M.; Pimbriani, M.
S10	<i>Cross-cultural differences in perceptions of E-learning usability: An empirical investigation</i>	Zaharias, P.
S11	<i>Evaluating usability in learning management system moodle</i>	Kakasevski, G.; Mihajlov, M.; Arsenovski, S.; Chungurski, S.
S12	<i>Usability testing and evaluation of a mobile software solution: A case study</i>	Fetaji, M.; Dika, Z.; Fetaji, B.
S13	<i>Adapting mobile access scheme for a legacy e-learning platform</i>	Sánchez-Chamochin, E.L.; Cambranes-Martínez, E.; Menéndez-Domínguez, V.
S14	<i>Pattern-based usability evaluation of e-learning systems</i>	Zub, D.; Eessaar, E.
S15	<i>Usability metrics of time and stress - Biological enhanced performance test of a university wide learning management system</i>	Stickel, C.; Scerbakov, A.; Kaufmann, T.; Ebner, M.
S16	<i>Developing a usability evaluation method for e-learning applications: Beyond functional usability</i>	Zaharias, P.; Poylymenakou, A.
S17	<i>Usability in the context of e-learning: A framework augmenting 'traditional' usability constructs with instructional design and motivation to learn</i>	Zaharias, P.

S18	<i>Application of VoiceXML in e-learning systems</i>	Azeta, A.A.; Ayo, C.K.; Atayero, A.A.; Ikhu-Omoregbe, N.A.
S19	<i>A case study of usability testing on an asynchronous e-Learning platform</i>	Guo, Y.; Wang, J.; Moore, J.; Liu, M.; Chen, H.-L.
S20	<i>Usability testing methods on e-learning environment</i>	Jókai, E.
S21	<i>Usability evaluation methods: Mind the gaps</i>	De Kock, E.; Van Biljon, J.; Pretorius, M.
S22	<i>Seeing the system through the end users' eyes: Shadow expert technique for evaluating the consistency of a learning management system</i>	Stickel, C.; Fassold, M.; Holzinger, A.; Ebner, M.
S23	<i>Usability evaluation of a learning management system</i>	Blecken, A.; Bruggemann, D.; Marx, W.
S24	<i>UseLearn: A novel checklist and usability evaluation method for eLearning systems by criticality metric analysis</i>	Oztekin, A.; Kong, Z.J.; Uysal, O.
S25	<i>Usability testing on a government training platform: A case study</i>	Guo, Y.; Qian, D.; Guan, J.; Wang, J.
S26	<i>Embedding interactivity into a university study portal by using social computing</i>	Todoran, I.
S27	<i>Do patterns help novice evaluators? A comparative study</i>	Lanzilotti, R.; Ardito, C.; Costabile, M.F.; De Angeli, A.
S28	<i>Evaluation of usability in a remote learning system utilizing Markov models</i>	Rodrigues, J.; Diniz, M.; Ferreira, S.B.L.; Silveira, D.S.; Capra, E.
S29	<i>An experimental study to measure mobile learning system usability at the aastmt</i>	Hamdi, N.; Elbadrawy, R.; Aziz, R.A.
S30	<i>Shadow Expert Technique (SET) for interaction analysis in educational systems</i>	Stickel, C.; Ebner, M.; Holzinger, A.
S31	<i>Usability testing and expert inspections complemented by educational evaluation: A case study of an e-learning platform</i>	Granić, A.; Čukušić, M.
S32	<i>Heuristic evaluation of e-learning courses: A comparative analysis of two e-learning heuristic sets</i>	Zaharias, P.; Koutsabasis, P.
S33	<i>Establishment of the genetic/genomic competency center for education</i>	Calzone, K.A.; Jerome-D'Emilia, B.; Jenkins, J.; Goldgar, C.; Rackover, M.; Jackson, J.; Chen, Y.; Voss, J.; Feero, W.G.
S34	<i>Devising M-learning usability framework</i>	Fetaji, M.; Fetaji, B.
S35	<i>Comparative study of efficiency among the developed MLUAT methodology in comparison with qualitative user testing method and heuristics evaluation</i>	Fetaji, B.; Fetaji, M.; Kaneko, K.
S36	<i>Work in progress - Open source usability evaluation: The case of Moodle</i>	Baytiyeh, H.

S37	<i>A literature review about usability evaluation methods for e-learning platforms</i>	Freire, L.L.; Arezes, P.M.; Campos, J.C.
S38	<i>Usability evaluation of a LMS mobile web interface</i>	Ivanc, D.; Vasiu, R.; Onita, M.
S39	<i>Evaluating usability and efficaciousness of an e-learning system: A quantitative, model-driven approach</i>	Theng, Y.-L.; Sin, J.
S40	<i>Perceived usability evaluation of learning management systems: A first step towards standardization of the system usability scale in Greek</i>	Katsanos, C.; Tselios, N.; Xenos, M.
S41	<i>Identifying cross-platform and cross-modality interaction problems in e-learning environments</i>	Da Silva, A.C.; Freire, F.M.P.; Da Rocha, H.V.
S42	<i>Interaction problems accessing e-learning environments in multi-touch mobile devices: A case study in teleduc</i>	Da Silva, A.C.; Freire, F.M.P.; De Arruda, A.V.P.; Da Rocha, H.V.
S43	<i>User testing for moodle application</i>	Tee, S.S.; Wook, T.S.M.T.; Zainudin, S.
S44	<i>A machine learning-based usability evaluation method for eLearning systems</i>	Oztekin, A.; Delen, D.; Turkyilmaz, A.; Zaim, S.
S45	<i>A Voice-Enabled framework for recommender and adaptation systems in E-learning</i>	Azeta, A.A.; Ayo, C.K.; Ikhu-Omoregbe, N.A.
S46	<i>Evaluating E-learning platforms for schools: Use and usability, user acceptance, and impact on learning</i>	Stergioulas, L.; Abassi, M.; Xydopoulos, G.; Fakhimi, M.; Margineanu, R.; Rifon, L.A.; Iglesias, M.J.F.c
S47	<i>A streamlined mobile user-interface for improved access to LMS services</i>	Ssekakubo, G.; Suleman, H.; Marsden, G.
S48	<i>Design and evaluation of Collaborative Learning Management System (CLMS) framework for teaching technical subject</i>	Yusoff, S.R.M.; Mat Zin, N.A.
S49	<i>Evaluation framework for m-learning systems: Current situation and proposal</i>	Cota, C.X.N.; Díaz, A.I.M.; Duque, M.A.R.
S50	<i>The usefulness of usability and user experience evaluation methods on an e-Learning platform development from a developer's perspective: A case study</i>	Gordillo, A.; Barra, E.; Aguirre, S.; Quemada, J.
S51	<i>The usability analysis of an E-learning environment</i>	Torun, F.; Tekedere, H.
S52	<i>Merlin-know, an interactive virtual teacher for improving learning in Moodle</i>	Hijon-Neira, R.; Velazquez-Iturbide, A.; Pizarro-Romero, C.; Carrico, L.
S53	<i>Perceived usability evaluation of learning management systems: Empirical evaluation of the system usability scale</i>	Orfanou, K.; Tselios, N.; Katsanos, C.
S54	<i>Heuristics for evaluating usability of Learning Management Systems in Africa</i>	Mtebe, J.S.; Kissaka, M.M.

S55	<i>Usability evaluation of Tadarus: Student perceptions</i>	Alkhattabi, M.
S56	<i>Observatory of studentsg uses of computer-based tools</i>	Van Der Linden, J.; Van De Leemput, C.
S57	<i>Research-in-progress: User experience evaluation of Student Centered E-Learning Environment for computer science program</i>	Santoso, H.B.; Isal, R.Y.K.; Basaruddin, T.; Sadira, L.; Schrepp, M.
S58	<i>Usability evaluation of the student centered e-Learning environment</i>	Junus, I.S.; Santoso, H.B.; Isal, R.Y.K.; Utomo, A.Y.
S59	<i>Usability Evaluation by Experts of a Learning Management System</i>	Medina-Flores, R.; Morales-Gamboa, R.
S60	<i>Testing usability in Moodle: When and How to do it</i>	Ternauciuc, A.; Vasiiu, R.
S61	<i>Framework to Evaluate M-Learning Systems: A Technological and Pedagogical Approach</i>	Navarro, C.X.; Molina, A.I.; Redondo, M.A.; Juárez-Ramírez, R.
S62	<i>Exploring user satisfaction for e-learning systems via usage-based metrics and system usability scale analysis</i>	Harrati, N.; Bouchrika, I.; Tari, A.; Ladjailia, A.

4. Extraction form for primary studies

ARTICLE: AUTHORS: PUBLICATION: YEAR:	
DATA EXTRACTION TABLE	
Technique description	Brief description of the technique (What does it do? What are its characteristics? How does it run?)
RESEARCH SUBQUESTION	ANSWERS
SQ1. What is the origin of the technique?	a) New b) Existing If new, what is the difference from the other existing techniques?
SQ2. What is the type of the technique?	a) Inspection b) Test c) Inquiry d) Analytical Modeling e) Simulation
SQ3. How is the technique performed?	a) Manual b) Semi-automatic c) Automatic Describe.
SQ4. Does the technique consider learning specific factors?	a) Yes. Which are? b) No
SQ5. Does the technique consider usability, UX or usability and UX?	c) Usability d) UX e) Both
SQ6. Does the technique provide some kind of feedback to the evaluator?	a) Yes. How? b) No
SQ7. Was the technique empirically evaluated?	a) Survey b) Case Study c) Controlled Experiment d) No If affirmative, what studies were performed?
SQ8. Does the technique have any kind of restriction/condition to perform?	a) Yes. Which are? b) No
SQ9. Is the technique available to download/consultation? Where?	a) Yes. Where? b) No
SQ10. In what kind of platform was the study performed?	a) Desktop b) Mobile c) Both

SQ11. Does the study perform a comparison between techniques?	a) Yes. Which technique have been compared? b) No		
STUDY QUALITY EVALUATION			
QUESTÃO	RESPOSTA		
Does the paper provide a detailed description of the usability assessment technique(s) used?	() Disagree	() Partially agree	() Totally agree
Does the paper provide a detailed description of how the authors applied the usability evaluation technique(s)?	() Disagree	() Partially agree	() Totally agree
Does the paper present clear results after the application of the usability evaluation technique(s)?	() Disagree	() Partially agree	() Totally agree

5. Extraction form for systematic mapping and systematic reviews

ARTICLE: AUTHORS: PUBLICATION: YEAR:	
SYSTEMATIC MAPPING AND SYSTEMATIC REVIEWS EXTRACTION TABLE	
Q1. What is the purpose of the research?	Description of the purpose of the research.
Q2. What are the research questions?	Description of the research questions which the SML/SRL aimed to answer.
Q3. Which string was used?	String used in the research.
Q4. In what fields has the string been searched?	Description of the fields in which the string was searched, such as title, abstract, or full-text.
Q5. Which databases have been queried?	Listing of databases in which the string was run.
Q6. What are the inclusion criteria?	Description of the inclusion criteria.
Q7. How many papers were included?	Total number of papers after the second filter.
Q8. What information is extracted from the papers?	Description of the fields used in the extraction form.
Q9. Describe the analysis of the results.	Description of how the analysis were performed and its results.
Q10. What are the limitations of this SML/SRL?	Description of the limitations of this SML/SRL.

6. Mapping of the selected primary studies

ID	Tech.	SQ1		SQ2					SQ3			SQ4		SQ5			SQ6		SQ7				SQ8		SQ9			SQ10			SQ11		
		a	b	a	b	c	d	e	a	b	c	a	b	a	b	c	a	b	a	b	c	d	a	b	a	b	a	b	c	a	b		
S01	1	X				X			X			X			X		X	X				X	X		X					X			
S02	1		X			X			X						X		X		X			X	X		X					X			
S03	1		X	X	X				X			X			X					X		X	X		X					X			
S05	1	X		X	X				X		X	X			X			X		X		X	X		X					X			
S06	1	X		X		X			X		X			X		X		X		X		X	X										
	2	X				X			X		X			X		X		X		X		X	X		X				X				
	3	X		X					X		X			X		X		X		X		X	X										
S07	1		X	X				X			X			X		X		X		X		X	X		X					X			
S08	1		X			X			X					X		X		X		X		X	X		X					X			
	2	X				X			X		X			X		X		X		X		X	X		X						X		
S09	1		X			X			X					X		X		X		X		X	X		X					X			
	2		X			X			X					X		X		X		X		X	X		X						X		
S11	1		X	X					X					X		X		X		X		X	X										
	2		X			X			X					X		X		X		X		X	X		X						X		
	3	X				X			X		X			X		X		X		X		X	X										
S12	1	X		X	X	X			X		X			X		X		X		X		X	X		X		X				X		
S13	1		X			X			X					X		X		X		X		X	X				X				X		
S14	1	X		X					X		X			X		X		X		X		X	X		X					X		X	
S15	1		X			X			X					X		X		X		X		X	X										
	2		X			X			X					X		X		X		X		X	X		X								
	3		X			X			X					X		X		X		X		X	X		X						X		
	4		X			X			X		X			X		X		X		X		X	X		X								
S16	1	X			X			X		X			X		X		X		X		X	X		X		X					X		
S17	1	X			X			X		X			X		X		X		X		X	X		X		X					X		
S18	1		X			X			X				X		X		X		X		X	X		X		X				X		X	

ID	Tech.	SQ1		SQ2					SQ3			SQ4		SQ5			SQ6		SQ7				SQ8		SQ9			SQ10			SQ11				
		a	b	a	b	c	d	e	a	b	c	a	b	a	b	c	a	b	a	b	c	d	a	b	a	b	a	b	c	a	b				
S19	2		X			X			X				X			X							X	X											
	1		X		X					X			X			X						X	X		X					X					
	2	X				X			X		X		X			X				X			X	X		X					X				
S20	1		X		X					X			X			X				X		X	X		X					X					
S21	1	X		X					X		X		X			X						X	X		X										
	2		X		X						X		X			X				X			X	X		X				X					
	3		X			X			X				X			X							X	X		X									
S22	1		X	X	X	X			X					X				X		X		X	X		X				X			X			
S23	1		X		X				X						X							X	X		X										
	2		X			X			X				X			X		X	X	X			X	X		X					X				
	3		X			X			X						X								X	X		X									
S24	1	X		X				X		X		X			X				X		X	X		X					X			X			
S25	1		X		X	X				X					X							X	X		X				X			X			
	2		X			X			X						X							X	X		X				X			X			
S26	1		X		X	X			X						X				X		X	X		X				X			X		X		
S27	1	X		X					X		X		X			X						X	X		X										
	2	X		X					X		X		X			X						X	X		X				X			X			
	3		X		X				X						X								X	X		X									
S28	1		X				X	X					X						X		X	X		X				X			X		X		
S29	1		X		X				X						X							X	X		X				X			X			
	2		X			X			X						X							X	X		X				X			X			
S30	1		X	X	X	X			X						X						X	X		X				X			X		X		
S31	1		X		X				X						X							X	X		X										
	2		X	X					X				X			X						X	X		X										
	3	X		X					X		X		X			X				X		X	X		X			X			X			X	
	4	X		X					X		X		X			X							X	X		X									
	5		X			X			X						X								X	X		X									

ID	Tech.	SQ1		SQ2					SQ3			SQ4		SQ5			SQ6		SQ7				SQ8		SQ9		SQ10			SQ11	
		a	b	a	b	c	d	e	a	b	c	a	b	a	b	c	a	b	a	b	c	d	a	b	a	b	a	b	c	a	b
	6	X			X			X				X			X			X				X	X								
S32	1	X		X				X			X	X			X				X		X	X			X				X		
	2	X		X				X			X	X			X			X		X		X	X			X				X	
S33	1		X			X		X			X	X			X		X	X			X	X			X				X		X
S34	1	X		X				X			X	X			X			X		X		X	X			X			X		X
S35	1	X		X	X	X		X			X	X			X			X		X		X	X			X			X		X
	2		X			X		X			X	X			X			X		X		X	X			X			X		X
	3		X	X				X			X	X			X			X		X		X	X			X			X		X
S36	1	X			X		X			X	X			X		X	X		X		X	X			X			X		X	
S38	1	X			X		X			X	X			X			X		X		X	X			X			X		X	
S39	1	X				X		X			X	X			X			X		X		X	X			X			X		X
S40	1		X			X		X			X	X			X		X	X		X		X	X			X			X		X
S41	1		X	X				X			X				X			X		X		X	X			X			X		X
S42	1		X		X			X			X	X			X			X		X		X	X			X			X		X
	2		X			X		X			X	X			X			X		X		X	X			X			X		X
S43	1		X			X		X			X	X			X			X		X		X	X			X			X		X
S44	1	X		X				X	X		X	X			X			X		X		X	X			X			X		X
S45	1		X			X		X			X	X			X		X	X		X		X	X			X			X		X
S46	1		X		X			X			X	X			X			X		X		X	X			X			X		X
	2		X			X		X			X	X			X			X		X		X	X			X			X		X
S47	1		X	X				X			X	X			X			X		X		X	X			X			X		X
	2		X			X		X			X	X			X			X		X		X	X			X			X		X
	3	X				X		X		X	X		X		X			X		X		X	X			X			X		X
S48	1		X		X			X			X	X			X			X		X		X	X			X			X		X
	2	X				X		X		X	X			X			X		X		X		X	X			X			X	
S50	1		X		X				X		X	X			X			X		X		X	X			X			X		X
	2		X		X				X		X	X			X			X		X		X	X			X			X		X

ID	Tech.	SQ1		SQ2					SQ3			SQ4		SQ5			SQ6		SQ7				SQ8		SQ9		SQ10			SQ11	
		a	b	a	b	c	d	e	a	b	c	a	b	a	b	c	a	b	a	b	c	d	a	b	a	b	a	b	c	a	b
	3	X				X			X					X								X		X							
	4	X	X						X			X										X		X							
	5	X		X	X				X					X								X	X								
S51	1	X		X					X			X										X	X								
	2	X			X				X			X		X								X	X		X						X
	3	X			X				X			X										X	X								
S52	1	X			X				X					X								X	X		X						X
S53	1	X			X				X					X				X				X	X		X						X
S54	1	X	X						X	X		X										X	X		X						X
S55	1	X			X				X		X			X								X	X		X						X
S56	1	X			X				X			X										X	X								
	2	X		X					X			X		X								X	X		X						X
	3	X			X				X	X		X										X		X							
S57	1	X			X				X			X										X	X		X						X
	2	X			X				X			X		X								X	X		X						X
S58	1	X			X				X	X				X								X	X		X						X
	2	X			X				X			X										X		X		X					X
S59	1	X	X						X	X		X										X	X		X						X
S60	1	X			X				X			X										X		X							
	2	X			X				X					X								X	X								
	3	X		X					X			X										X		X		X					X
	4	X	X						X			X										X	X								
	5	X		X						X		X										X		X							
S61	1	X			X				X	X				X								X	X		X						X
S62	1	X		X	X				X					X								X	X		X						X