

Online Appendix of

Unbundling the App Advantage: Evaluating

How Specific Mobile Learning App

Functionalities Boost Accounting Exam

Scores

Completed Research Paper

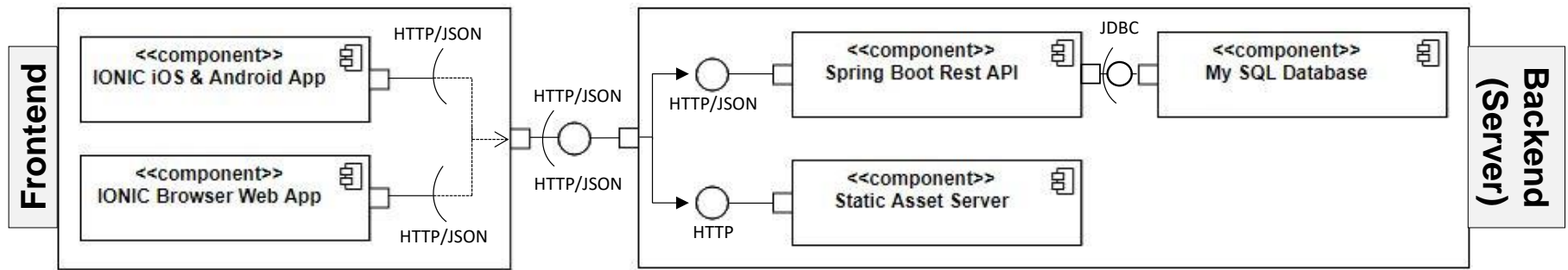
Variables	Definition
<i>Exam Score</i>	Exam score is a continuous measure of performance in the financial accounting course, equalling the total number of points (max. 60) earned on the final exam. An exam score of at least 25 points indicates the successful completion of the course.
<i>Exam Score Part 1</i>	Exam score part 1 is a continuous measure of the performance in the first part of the final exam, equalling the number of points (max. six) earned. The first part of the final exam consists of questions on fundamental knowledge.
<i>Exam Score Part 2</i>	Exam score part 2 is a continuous measure of the performance in the second part of the final exam, equalling the number of points (max. 27) earned. The second part of the final exam consists of journal entries.
<i>Exam Score Part 3</i>	Exam score part 3 is a continuous measure of the performance in the third part of the final exam, equalling the number of points (max. 27) earned. The third part of the final exam consists of the compilation and analysis of financial statements.
<i>App Exercise Score</i>	Continuous and non-limited measure equal to the total cumulated number of points achieved in the app by correctly answering exam-related exercises.
<i>App Quiz Score</i>	Continuous and non-limited measure equal to the total cumulated number of points achieved in the app by correctly answering quiz questions.
<i>App Self-Organization Score</i>	Continuous and non-limited measure equal to the total cumulated number of points achieved in the app by using the self-organization functions of the app (i.e., learning time tracking and self-monitoring by QR-code based sign-in).
<i>App User</i>	Indicator variable equal to one if a student has an app account, and zero otherwise.
<i>App Exercise User</i>	Indicator variable equal to one if a student has scored most of the points in the app using the exercise function (i.e., $App\ Exercise\ Score > App\ Quiz\ Score$ and $App\ Exercise\ Score > App\ Self-Organization\ Score$), and zero otherwise.
<i>App Quiz User</i>	Indicator variable equal to one if a student has scored most of the points in the app using the quiz function (i.e., $App\ Quiz\ Score > App\ Exercise\ Score$ and $App\ Quiz\ Score > App\ Self-Organization\ Score$), and zero otherwise.
<i>App Self-Organization User</i>	Indicator variable equal to one if a student has scored most of the points in the app using the self-organization functions (i.e., $App\ Self-Organization\ Score > App\ Exercise\ Score$ and $App\ Self-Organization\ Score > App\ Quiz\ Score$), and zero otherwise.
<i>All Functions User</i>	Indicator variable equal to one if a student has scored at least one point in each of the app functions (i.e., exercise, quiz, and self-organization), and zero otherwise.
<i>DP 1 Score</i>	Continuous and non-limited measure equal to the total cumulated number of points achieved in the app by using the app's self-organization functionalities, which address Design Principle 1 of 'Fostering Course Attendance Management'. For analytical comparability, the <i>DP 1 Score</i> is standardized to have a mean of zero and a standard deviation of one, allowing for uniform comparison with the differently scaled <i>DP 2 Score</i> .
<i>DP 2 Score</i>	Continuous and non-limited measure equal to the aggregated and total cumulated number of points achieved in the app by using functionalities related to self-learning control, which address Design Principle 2 of 'Using Self-Learning Control Functionalities'. These functionalities include quizzes and exercises. The <i>DP 2 Score</i> , thus, combines the total of <i>App Quiz Score</i> and <i>App Exercise Score</i> . For analytical comparability, the <i>DP 2 Score</i> is standardized to have a mean of zero and a standard deviation of one, allowing for uniform comparison with the differently scaled <i>DP 1 Score</i> .
<i>Female</i>	Indicator variable equal to one if a student is female, and zero otherwise.
<i>A-Level Grade</i>	Continuous measure of pre-university school performance equal to the grade on best = 4.0 to worst = 1.0 basis.
<i>Vocational Training</i>	Indicator variable equal to one if a student completed vocational training before entering university, and zero otherwise.
<i>Attempt</i>	Attempts indicates the number of times a student has participated in the final examination (max. eight). A value greater than one indicates repeating students.
<i>Attendance (relative)</i>	The number of a student's attendance (both online and face-to-face) at the tutorials throughout the semester scaled by the total number of tutorials (12).
<i>International</i>	Indicator variable equal to one if a student is an international student, and zero otherwise.
<i>Course_of_Study</i>	Course of study variable coded one for business studies, two for economics, three for economics in complementary subject, four for engineering and management - production

engineering, five for electrical engineering with management, six for information systems and management, and seven for others, respectively. Used as fixed effect.

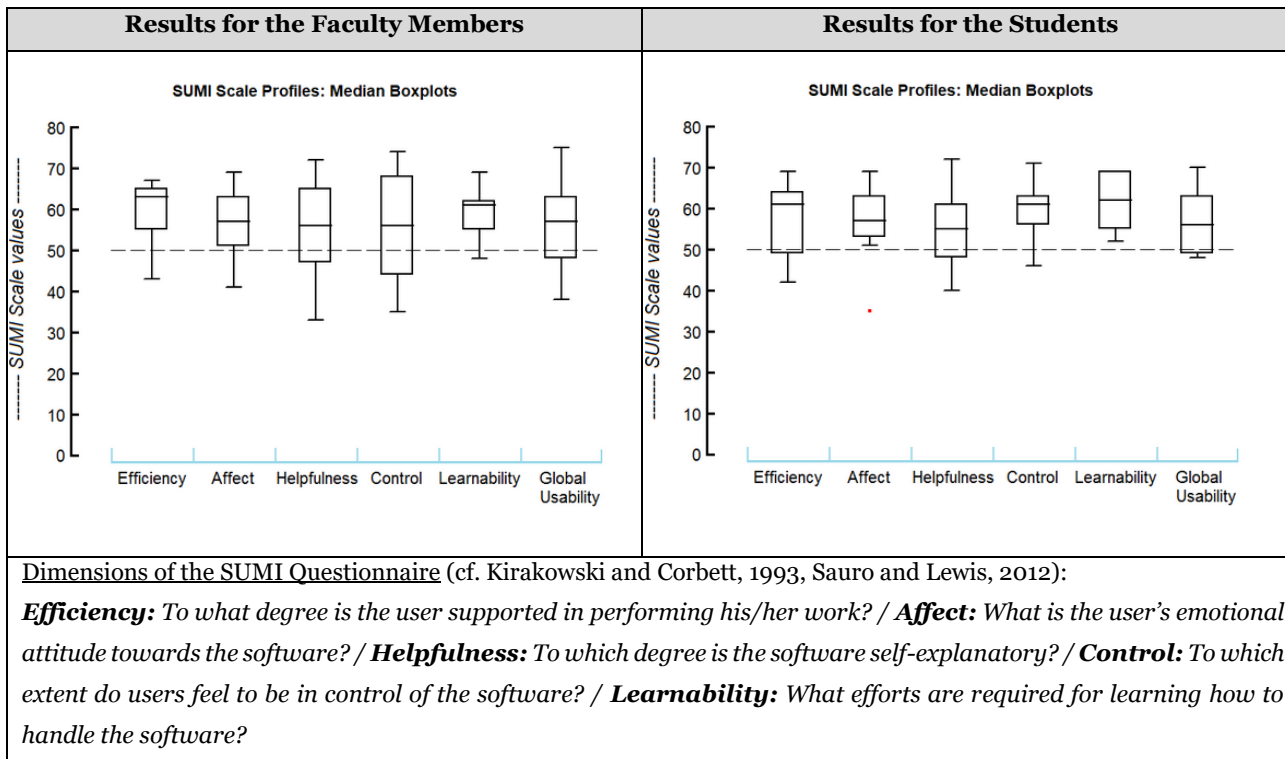
Appendix A. Variable Definitions.

Category	Design Requirement (DR)	Student factors addressed by the DR			Primary source of the DR
		Students' experience	Learning strategies	Self-organization	
Course attendance/ reminders	DR 1: Tracking and monitoring of course attendance	☉	-	●	I, III(s, ft), IV(s)
	DR 2: Pop-up messages with reminders of lectures and important academic events (advanced timetable planning)	☉	☉	●	I, III(s, ft), IV(s)
Support of study phases	DR 3: Provision of training and exam-oriented exercises for learning control and training purposes	☉	●	●	I, II, III(s, ft), IV(s, ft)
	DR 4: Performance tests via quizzes	-	●	☉	I, II, III(s, ft), IV(s)
	DR 5: Control of learning process and comparison with a peer group	●	●	●	I, III(s, ft), IV(s)
Technical requirements	DR 6: Design as a hybrid app	-	-	-	II, III(ft), IV(ft)
	DR 7: Separation between front-/back-end, with an easy management of the content in the back-end.	-	-	-	III(ft), IV(ft)
	DR 8: Data transfer via HTTP and JSON	-	-	-	III(ft), IV(ft)
Legend: ●: fully supported; ☉: partly supported; -: little supported; I: user story; II: market research; III(s/ft): user requirement student/faculty member & teaching staff; IV(s/ft): user journey student/faculty member & teaching staff					

Appendix B. Requirements for the Mobile Learning App.



Appendix C. General Architecture of the Mobile Learning App.



Appendix D. Results of a SUMI Usability Study.

(graphics provided by the Human Factors Research Group)