Saint Petersburg State University

Graduate School of Management

MASTER THESIS PAPER

ADOPTION OF LEARNING MANAGEMENT SYSTEMS AMONG FACULTY MEMBERS IN RUSSIA

Project done by

2nd year MiM GSOM student

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ЗАЯВЛЕНИЕ О САМОСТОЯТЕЛЬНОМ ХАРАКТЕРЕ ВЫПОЛНЕНИЯ ВЫПУСКНОЙ КВАЛИФИКАЦИОННОЙ РАБОТЫ

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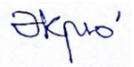

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I, Kriukov Erik, second year master student, program «Management», state that my master thesis on the topic «Adoption of learning management systems among faculty members in Russia», which is presented to the Master Office to be submitted to the Official Defense Committee for the public defense, does not contain any elements of plagiarism.

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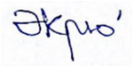

01.06.2023

ABSTRACT

Master Student's Name	Kriukov Erik
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Master Thesis Title	Adoption of learning management systems among faculty members in Russia
Description of the goal, tasks and main results the research	This study aimed at finding out how to predict and stimulate full-capacity usage of learning management systems among faculty members in Russia. In order to attain this goal, it was necessary to propose a model for LMS adoption among Russian faculty, empirically verify this model, and formulate recommendations for directors of universities and LMS providers based on empirically verified model. It turned out that user motivation part of technology acceptance model (TAM) held true for Russian context. On top of that, personal innovativeness, facilitating conditions and system quality were found to be significant predictors of cognitive response towards an LMS and eventually its actual usage. The most effective facilitating conditions are simple and reactive assistance, as well as negative motivation in a form of compulsion. The most important aspects of system quality are functionality, interface and effectiveness in tracking students’ performance.
Keywords	learning management system, technology acceptance, technology adoption, faculty members

АННОТАЦИЯ

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Описание цели, задач и основных результатов исследования	Целью этого исследования было выяснить, как прогнозировать и стимулировать полноценное использование систем дистанционного обучения преподавателями российских вузов. Для достижения этой цели необходимо было предложить модель освоения СДО среди российских преподавателей, эмпирически проверить эту модель и сформулировать рекомендации для директоров университетов и поставщиков СДО на основе эмпирически верифицированной модели.

	Оказалось, что мотивационная часть модели принятия технологии пользователями (TAM) верна для российского контекста. Кроме того, было обнаружено, что личная инновационность, стимулирующие условия и качество самой системы являются значимыми предикторами когнитивной реакции на СДО и, в конечном счете, ее фактического использования. Наиболее эффективными методами стимулирования являются простая и реактивная помощь, а также негативная мотивация в форме принуждения. Наиболее важными аспектами качества системы являются функциональность, интерфейс и эффективность отслеживания успеваемости учащихся.
Ключевые слова	система дистанционного обучения, принятие технологии, освоение технологии, преподаватели

CONTENTS

INTRODUCTION

It is undebatable at this point that digital technologies play a focal role in education [Harrison et al., 2018]. Even though teachers and students return to classes and offline education prevail again after COVID-19 pandemic, learning management systems, along with other educational technologies, serve as indispensable assistance for instructors, striving to provide uninterrupted access to education, create knowledge-sharing culture, and encourage students to participate in curriculum activities [Fathema et al., 2015; Waheed et al., 2016]. This study investigates adoption of this type of technology among faculty members in Russia – or, in other words, how Russian professors come to accept and use learning management systems.

Research gap, which defines theoretical significance, is in absence of empirically verified model of LMS adoption in Russian context. As long as existing models for other countries are highly contextual and need to be re-considered when applied to a different setting [Fathema et al., 2015], they are to serve as a base for the current study, but by no means as a substitute. Another aspect of theoretical significance revolves around the fact that existing studies on LMS adoption treat the dependent construct of actual usage as a unidimensional latent variable consisting of items reflecting extent of usage in general (e.g., 'To what extent do you use LMS?' [ibid.]). However, as long as current research is focused on faculty (who are to choose functions to be used themselves), and not on students (who operate in already predefined settings), it seems justifiable herein to approach actual usage as a multidimensional variable – consisting of usage intensiveness (frequency) and usage extensiveness (number of functions used).

Summarizing on theoretical significance, current research is intended to contribute to theory via proposing empirically verified model of LMS adoption among faculty members in Russia, with the outcome construct of actual usage being treated multidimensionally. If proved statistically, the latter approach may bring new revelations into the theory of edtech adoption – for example, positive attitude towards particular technology might positively affect actual intensiveness of its usage, but not extensiveness.

Practical significance (relevance) is emphasized by the current trend on the Russian market, where organizations (and universities in particular) have to switch from foreign technologies to local ones, as long as substantial number of foreign solutions are no longer available in Russia. Hence a lot of faculty members are adopting new learning management systems now or will do it soon, when licenses for foreign LMS are expired. This fact makes the issue of edtech adoption increasingly relevant and topical in Russia, with heads of higher educational institutions drastically

needing a contextually verified model to understand and foster adoption of local LMS among teaching staff.

Consequently, in terms of expected practical contribution, the final model is to be used by the management of Russian universities, who invest substantial funds and efforts into learning management systems and are interested in its intensive and extensive usage. The verified model will help provide directors with recommendations on what to consider in the first place when fostering adoption of LMS among faculty members (especially when switched from foreign to local, as can be expected now). Moreover, local providers of learning management systems might also be interested in the results, as long as the longevity of cooperation with an institution seems to depend on the extent of the technology adoption among target users (professors). For example, if a new system is not accepted by academicians, it is likely to be changed for another one. Thus, the findings might be useful for local LMS providers who need to shape their product and its promotion in a way that it will be accepted vastly by users, the majority of whom were forced to change from a foreign one.

Consequently, the current research aims to find out how to predict and stimulate full-capacity usage of learning management systems among faculty members in Russia.

The stated goal can be achieved via accomplishing the following tasks:

1. To propose a model that could explain LMS adoption in Russia based on existing studies and local context
2. To empirically verify proposed model of LMS adoption in Russia
3. To formulate practical recommendations for directors of universities and providers of LMS based on verified model of LMS adoption in Russia

In terms of structure of the work, chapter 1 will provide theoretical background for an empirical study in chapter 2. Chapter 1 starts with introducing the phenomenon of learning management systems and existing findings on peculiarities of their usage. Then we make and justify the choice of the model that is meant to explain the adoption of those technologies. With the aim of specifying the model correctly in given settings, we proceed to the analysis of similar studies, followed by proposing a research model that illustrates a set of research hypotheses. In chapter 2, we begin with describing the methodology of current research, then outline the characteristics of sample obtained. After that, measurement model is introduced and refined, so that it is possible to safely proceed with structural model and report its findings in paths analysis further on, accepting or rejecting formulated hypotheses. Subsequently, some additional statistical tests are made based on obtained findings, leading to more precise practical recommendations along with theoretical

implications. The chapter ends with outlining limitations of the current research, and suggesting directions for further studies on LMS adoption among faculty members.

Current study will employ quantitative research methods, mainly PLS-SEM (partial least squares structural equation modeling), which is generally used to model chain of effects with presence of latent variables (measured indirectly in a set of observed items). Additionally, correlation analysis will be used in order to specify SEM findings.

As for the sources of information to be used, this work is based firmly on the seminal paper of Fred Davis called ‘Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology’, where he finalized his technology acceptance model (TAM), firstly introduced in his doctoral dissertation, and suggested directions on its usage. Additionally, current research builds on numerous studies that have utilized the concept of TAM to model adoption of educational technologies: particularly, learning management systems among faculty members. On top of that, a number of computer studies dedicated to learning management systems and their usage are reviewed as well, with the aim of grasping peculiarities of technology in question, its functionality and overall perception among target users (professors).

CHAPTER 1. THEORETICAL ASPECTS OF LEARNING MANAGEMENT SYSTEMS ADOPTION

1.1. Learning management system as educational technology and peculiarities of its usage

Learning management system (LMS) is a «self-contained webpage with embedded instructional tools that permit faculty to organize academic content and engage students in their learning» [Gautreau, 2011, p. 2]. This tool belongs to a broad category of educational technology (EdTech), which comprises digital technology used to facilitate learning [Oxford Languages]. Some popular examples of LMS are Blackboard, Brightspace, Moodle, Canvas, iSpring and StartExam. They generally presuppose the following functions available for teachers [Janossy, 2008; Rhode et al., 2017; Dahlstrom et al., 2014; Jaschik et al., 2014]:

- posting materials (syllabus, lecture slides etc.)
- one-way communicating with students (making announcements with possible automated mailing)
- two-way communicating with students (creating forums for students' public interactions with each other and with a teacher)
- collecting assignments (creating directory for students to submit their assignment files)
- evaluating assignments (providing students with grades and possibly feedback on the submitted assignments)
- conducting tests (using system's functionality to create and run quizzes for exams or other evaluations with a possibility of automatically verifying answers on multiple-choice questions)
- entering student progress information (storing all grades within the system)
- analyzing student progress information (investigating data on student performances – means and deviations for conducted tests, overall distribution of student performances)

An example of LMS (Blackboard) is presented in the figure below:

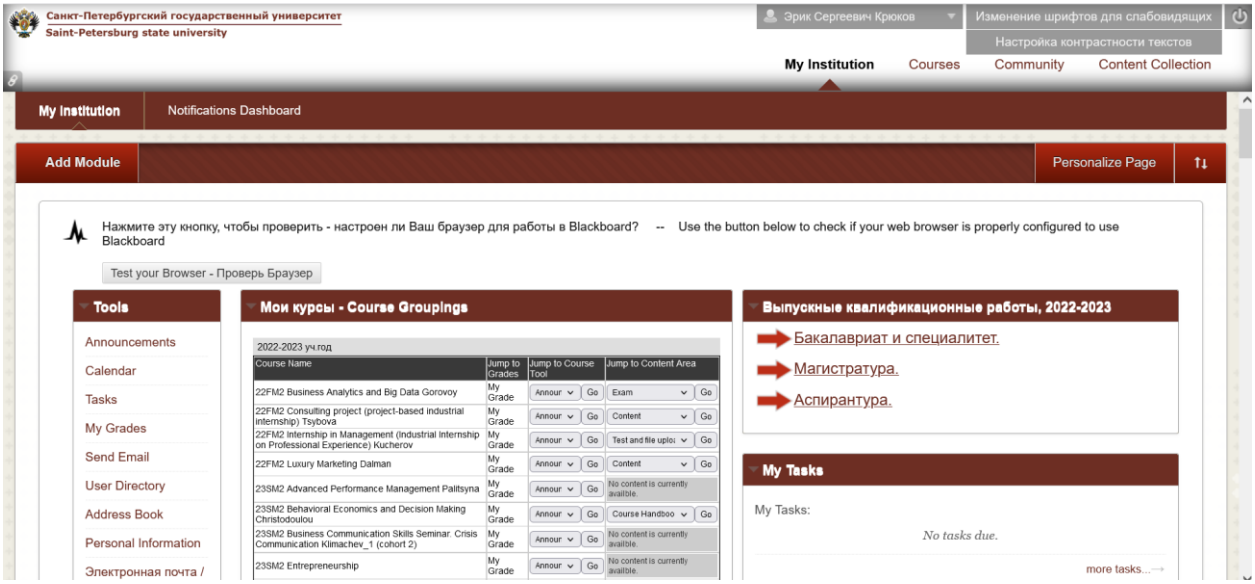

Figure 1. *Example of LMS interface (Blackboard)*

A number of research underline considerable investments into LMS and its insufficient extensiveness of usage [Jaschik et al., 2014; Dahlstrom et al., 2014; Allen & Seaman, 2010], meaning that the majority of faculty do not take advantage of advanced LMS functions, using only the basic ones, such as posting course syllabus (78%), recording grades (58%), communicating with students (52%) [Jaschik et al., 2014]. Indeed, [Hustad & Arntzen, 2013] confirm that most academicians use LMS just as a supplement to their lectures.

In Russia particularly, pattern of LMS usage among faculty seems to be compliant with foreign peculiarities. [Мухаметзянова и др., 2016] report that learning management systems are becoming more and more popular in Russian higher education institutions, with numerous options available for implementation. Nonetheless, [Скурихина, 2021] emphasizes that more than 70% of LMS functionality is left unused by Russian faculty, which unites them with their foreign colleagues. In the mentioned study, 78% of surveyed academicians explained their resistance to full-capacity usage by an absence of stimulating conditions [ibid.]. Moreover, poor workability (disruptions) was found to be the main reason for LMS undervaluation [ibid.]. The researcher also revealed a negative correlation between faculty's usage of different information technologies and their difficulties in adopting an LMS, meaning that those who are willing to try out new systems are more prone to using an LMS [ibid.].

Taking everything into consideration, it has become evident that both in Russia and in the rest of the world learning management systems are becoming increasingly popular, but their usage among faculty members is still far from being extensive, meaning that a lot of functions are not used. Existing works on the Russian market tend to associate this phenomenon primarily with poor

system quality, lack of faculty's innovativeness and absence of facilitating conditions. However, the whole process of adoption must be approached systematically in order for findings to be reliable and comprehensive enough. Hence it is necessary to choose a solid base to model this process of adoption and specify it accordingly.

1.2. Modeling adoption of learning management systems

The model to be used for investigating adoption is TAM – technology acceptance model by [Davis, 1986], which is considered to be the most ground tool for analyzing acceptance of educational technology [Abdullah & Ward, 2016; Šumak et al., 2011; Weerasinghe & Hindagolla, 2017]. [Šumak et al., 2011] provide an overview of the most prominent research on e-learning technology acceptance, which points out the total dominance of TAM as a methodological tool to model the mentioned process – 38 out of 42 studies (90%) featured this model, and very few based their work on other concepts (UTAUT – 2, 3-TUM – 1, TTF – 1).

In TAM [Davis, 1989] proposed the following depiction of adoption process:

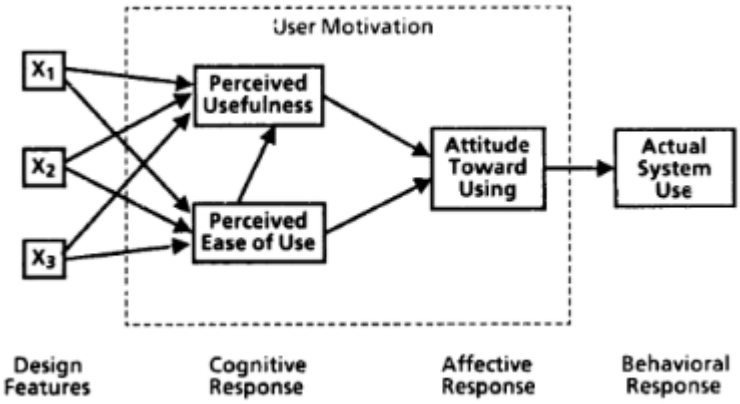

Figure 2. *Technology acceptance model (TAM) [Davis, 1989]*

In general, it is noticeable that according to the model a unique set of contextual 'design features' (often referred to as 'external variables' in future studies) cause a particular cognitive response (intellectual evaluation of the technology); this cognitive response forms affective response (emotional evaluation of the technology), which, in turn, determine behavioral response (target actions towards the technology) [ibid.].

In order to specify such kind of model in this study, it is thus necessary to identify contextual predictors of cognitive response variables (perceived usefulness and perceived ease of use), which are called 'design features' and are specific to the particular technology and geographical region.

No research has applied TAM for investigating adoption of LMS in Russia yet. Hence it seems relevant to review existing studies that used TAM to model LMS adoption among faculty members in other countries, and find which external variables were proved to be robust predictors for either PU (perceived usefulness) or PEOU (perceived ease of use) particularly for LMS.

[Fathema et al., 2015] in their research of American academicians identified significant positive effect of Perceived Self-Efficacy (PSE) on both PU and PEOU. Additionally, they proved System Quality (SQ) to be a robust predictor of PU and PEOU [ibid.]. [Fearnley & Amora, 2020] proved exactly the same on the Philippin market. [Lavidas et al., 2022], focusing on Greek sample, agreed with their American and Philippin colleagues on the effect of Perceived Self-Efficacy (PSE) on PEOU, and also revealed significant positive influence of Subjective Norms (SN) and Image (I) on PU, Facilitating Conditions (FC) and Technological Complexity (TC) on PEOU. [Waris & Hameed, 2022] worked with Pakistani faculty members and noticed significant positive influence of Innovativeness (INV) on PU, as well as the effect of User-Interface Design (UID) on both PU and PEOU. [Alharbi & Drew, 2014] showed that Job Relevance (JR) is a robust predictor of PU and PEOU in the Saudi Arabian context.

One can notice that all mentioned external variables fall into 3 categories, which are introduced and summarized in the table below:

Table 1. Categorization of external variables in previous studies on LMS adoption

Category	**External variable (proved predictor of cognitive response)**	**Significance level**
User characteristics	Perceived Self-Efficacy (PSE) on: • PU [Fathema et al., 2015; Fearnley & Amora, 2020] • PEOU [Fathema et al., 2015; Fearnley & Amora, 2020; Lavidas et al., 2022]	** (0.01)
	Innovativeness (INV) on PU [Waris & Hameed, 2022]	*** (0.001)

Category	External variable (proved predictor of cognitive response)	Significance level
System characteristics	System Quality (SQ) on PU & PEOU [Fathema et al., 2015; Fearnley & Amora, 2020]	*** (0.001)
	Technological Complexity (TC) on PEOU [Lavidas et al., 2022]	*** (0.001)
	User-Interface Design (UID) on PU & PEOU [Waris & Hameed, 2022]	*** (0.001)
External characteristics	Subjective Norms (SN) on PU [Lavidas et al., 2022]	*** (0.001)
	Image (I) on PU [ibid.]	* (0.05)
	Facilitating Conditions (FC) on PEOU [ibid.]	** (0.01)
	Job Relevance (JR) on PU & PEOU [Alharbi & Drew, 2014]	*** (0.001)

Compiled by the author

1.3. Proposed research model and hypotheses

As defined earlier, the proposed model will be based on the original TAM by [Davis, 1986]. Herein in addition to basic connections (user motivation part), it is necessary to choose a set of contextual external variables based on the analysis of existing studies on LMS adoption in other countries, as well as on some findings on LMS usage in Russia. Review of existing research has revealed that external variables to be included in similar models fall into 3 categories: user characteristics, system characteristics, and external characteristics. It might be reasonable to include one variable from each category in order to enjoy a rather comprehensive overview of possible externalities in this process of adoption.

For user characteristics, variable Innovativeness (INV) is chosen over Perceived Self-Efficacy (PSE) as more compliant with the goal of current research. [Midgley & Dowling, 1978] defined

innovativeness as an independent construct that is referred to as an individual's tendency to seek creativity and make innovation. [Hirschman, 1980] explains innovativeness as a personality trait that is reflected through novelty seeking. [Agarwal & Prasad, 1998] proposed the concept of innovativeness in the domain of information technology, and defined it as «the willingness of an individual to try out any new information technology».

Given that the study aims to identify predictors of LMS adoption and means of its stimulation with the view of helping directors of universities and LMS providers, it would be more reasonable to treat particularly Innovativeness as a potential predictor of cognitive response, since it is a personal trait that can be measured and evaluated [Hirschman, 1980]. For example, if Innovativeness is proven to be a robust predictor of cognitive response, it will indicate that directors should hire more innovative academicians in stimulating full-capacity usage of LMS on the organizational level, and LMS providers better focus on more innovative institutions with innovative staff in defining their target segments through predicting level of acceptance. Moreover, the research of Russian faculty indirectly points to presence of such a connection, given that more technology-immersed academicians were found to be more acceptive of an LMS [Скурихина, 2021]. So, the following is hypothesized based on evidence from [Waris & Hameed, 2022; Скурихина, 2021]:

- H1: innovativeness (INV) of a faculty member has significant positive effect on perceived usefulness (PU) of the current LMS

In terms of system characteristics, System Quality (SQ) was proved to be the most comprehensive variable, utilized more than others in this category. On top of that, [Скурихина, 2021] accounts resistance to LMS usage on the Russian market particularly to poor system quality (namely, insufficient workability). System quality in the Internet environment measures the desired characteristics (usability, availability, reliability, adaptability, and response time) of an e-commerce system (i.e., LMS) [DeLone & McLean, 2003]. One can notice that in investigated studies on LMS adoption [Fathema et al., 2015; Fearnley & Amora, 2020] system quality is measured in a scale proposed by [Liaw, 2008], where items reflect user's satisfaction with different aspects of a system (e.g., 'I am satisfied with LMS functionality'). However, in current study perceived system quality is measured the way it is originally intended to be – as sufficiency of desired system characteristics (e.g. 'Functionality of the current LMS is sufficient to my needs') – and not as satisfaction with them. So, the following hypotheses are based on evidence from [Fathema et al., 2015; Fearnley & Amora, 2020; Скурихина, 2021] – with regards to definition proposed by [DeLone & McLean, 2003]:

- H2a: perceived quality of the current LMS (SQ) has significant positive effect on perceived usefulness (PU) of the current LMS
- H2b: perceived quality of the current LMS (SQ) has significant positive effect on perceived ease of use (PEOU) of the current LMS

Finally, as for external characteristics, Facilitating Conditions (FC) variable was selected due to the fact that it has the highest potential to assist in answering the main research question and achieving study aim, as this particular variable is completely within the scope of organization's influence. Plus, Russian faculty members explained their unwillingness to use an LMS particularly by an absence of facilitating conditions [Скурихина, 2021]. Facilitating conditions are defined as the objective environmental factors that help achieve a task and are accepted by a wide audience [Thompson et al., 1991]. In all investigated studies on LMS adoption among faculty members, the variable of facilitating conditions is measured in a scale by [Teo, 2010], which focuses on availability of external help in a form of instructions or guidance (e.g., 'Specialized instruction concerning LMS use is available to me' [Waris & Hameed, 2022]). Finding out whether the presence of those facilitating conditions does stimulate adoption or not is focal in identifying proper means of stimulation within an organization, and this will help provide directors of universities and other policy-makers with relevant recommendations. So, the following is hypothesized based on evidence from [Lavidas et al., 2022; Скурихина, 2021]:

- H3: facilitating conditions (FQ) as assistance in using current LMS has significant positive effect on perceived ease of use (PEOU) of the current LMS

Additionally, **age** was incorporated among external variables as a controlling one. It is a common practice in research on technology acceptance to control for the effects of demographic aspects, especially age. Namely, [Hong et al., 2013] in their thorough literature review find age to be used as a control variable in 69 studies on information systems' acceptance (out of 253 investigated). Given that age is measured on a continuous scale in current research, it can be simply included among other regressors, as advised by [de Battisti & Siletti, 2019].

Other hypotheses stem from the original basic model of technology acceptance by [Davis, 1986]. Cognitive response includes perceived usefulness (PU) and perceived ease of use (PEOU). Perceived usefulness signifies that the performance of an individual enhances by using a specific system [Herrenkind et al., 2019]. Perceived ease of use can be referred as proper understanding regarding the use of a new technology [Özdemir, 2020]. This cognitive response is known to cause affective response in a form of attitude towards usage [Davis, 1986]. Attitude towards usage (ATU) is defined as «an individual's positive or negative feeling about performing the target

behavior (e.g., using a system)» [Ajzen & Fishbein, 1975, p. 216]. So, the following hypothesizes are taken directly from [Davis, 1986]:

- H4: perceived ease of use (PEOU) of the current LMS has significant positive effect on perceived usefulness (PU) of the current LMS
- H5: perceived ease of use (PEOU) of the current LMS has significant positive effect on attitude towards usage (ATU) of the current LMS
- H6: perceived usefulness (PU) of the current LMS has significant positive effect on attitude towards usage (ATU) of the current LMS

Lastly, affective response is known to define behavioral response in a form of actual usage [Davis, 1986]. This ultimate endogenous variable of actual usage tends to be measured quite ambiguously in existing studies on LMS adoption. For example, [Fathema et al., 2015] among others borrow the scale from [Malhotra & Galletta, 1999], where items address overall scale of usage (e.g., 'Overall to what extent do you use LMS?' [ibid.]). However, it seems crucial here to distinguish between usage intensiveness (frequency) and usage extensiveness (number of functions used), considering the mentioned problem of particularly non-extensive usage of LMS among faculty members [Jaschik & Lederman, 2014; Dahlstrom et al., 2014; Allen & Seaman, 2010; Скурихина, 2021]. So, the following is hypothesized based on evidence from [Davis, 1986]:

- H7a: attitude towards usage (ATU) of the current LMS has significant positive effect on intensiveness (frequency) of its actual usage (AUI)
- H7b: attitude towards usage (ATU) of the current LMS has significant positive effect on extensiveness (depth) of its actual usage (AUE)

Taking everything into consideration, there are 9 research hypotheses (paths to verify), which are presented in solid lines on the hypothesized structural equation model below (all paths presuppose significant positive effect of one variable on another):

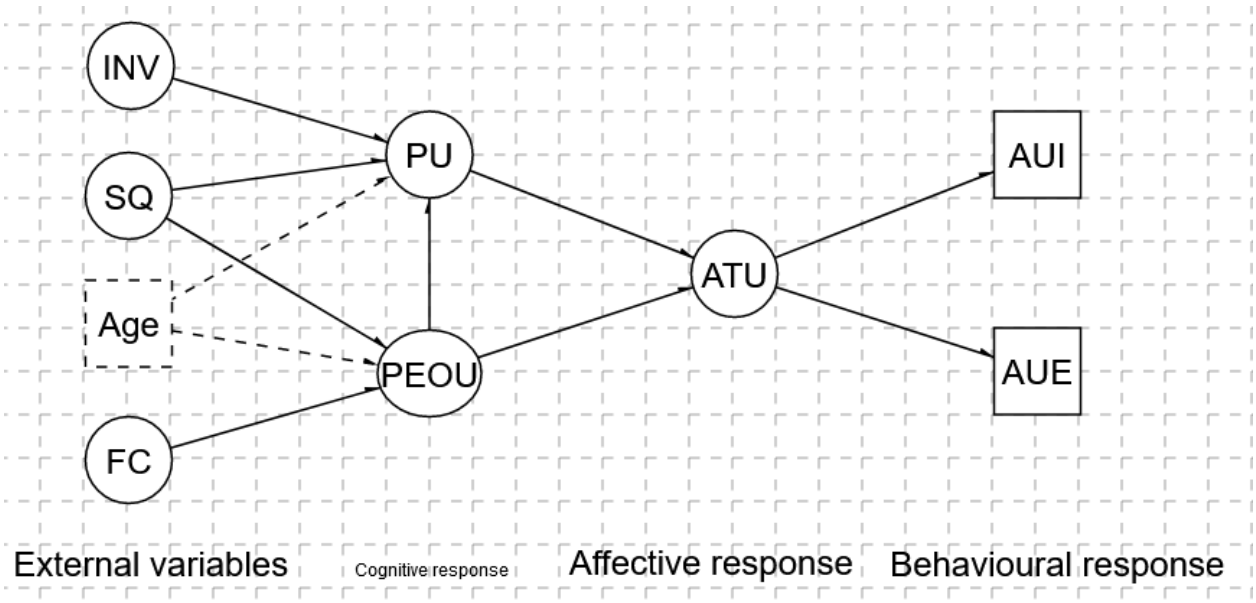

Figure 3. *Proposed research model for faculty acceptance of LMS in Russia*

CHAPTER 2. EMPIRICAL STUDY OF RUSSIAN FACULTY MEMBERS RELATIONS WITH LEARNING MANAGEMENT SYSTEMS

2.1. Research design

The tool to be used for modeling chain of effects between latent constructs is structural equation modeling (SEM), which is to be performed in SPSS AMOS. It is a quantitative method of data analysis that is based on regression analysis (structural model) and factor analysis (measurement model). Given the quantitative nature of the method, it correspondingly requires quantitative data to be collected from a survey in a form of questionnaire, which is known to be the most widespread method to collect primary data that is quantitative and self-reported (not observed).

Considering the topic and the aim of current study, population for this research is faculty members of Russian higher education institutions where a LMS is implemented. [Boomsma, 1982] suggests that the minimal sample size for conducting path analysis in structural equation modeling is 100 – hence it is the lower threshold in the number of participants for the current study.

The survey is conducted in a form of online questionnaire, distributed in collaboration with Russian Federal Educational and Methodical Association in Economics and Management. This partnership allows to recruit faculty members from various Russian regions via online communication tools. Hence non-random online intercept sampling is to be used as a method of data collection, resulting in convenience sampling being obtained. However, the diversity of the network in terms of geographical dispersity allows to suppose that the sample reflects the population to some sufficient extent, thanks to having access to academicians from various Russian regions and universities.

The original full questionnaire can be found in [Appendix 1]. Here is the description of its structure and meaning:

- Block 1: presence of LMS in the organization (filtering for the whole questionnaire)
- Block 2: current LMS experience (filtering) → statements on current system quality (SQ) and actual usage (AU) with self-reported usage frequency (AUI) & self-reported number of functions used (AUE) – if applicable
- Block 3: prior LMS experience (filtering) → statements on previous system quality (PSQ) – if applicable
- Block 4: statements on facilitating conditions (FC) and their peculiarities
- Block 5: statements on perceived usefulness (PU), perceived ease of use (PEOU) and attitude towards usage (ATU)

- Block 6: demographics and statements on innovativeness (INV)

2.2. Obtained sample

The sample of 422 respondents has been obtained, out of whom 403 were a part of stated population (faculty members of Russian higher education institutions with a LMS at the workplace). So, the size of eligible sample is 403.

Current sampling has managed to cover 42 Russian regions. In [Table 2] one can find more sample characteristics in terms of demographical distribution:

Table 2. Sample characteristics

Variable	Total	%
Gender		
Male	97	76
Female	306	24
Age (years)		
30 or less	35	9
31-40	94	24
41-50	133	33
51-60	86	21
61-70	45	11
71 or more	10	2
Academic position		
Assistant Professor	16	4
Senior Lecturer	59	15
Associate Professor	252	63
Professor	43	11
Other	33	8
Academic degree		
None	86	21
Candidate of Science	271	68
Doctor of Science	46	11
Teaching experience (years)		
10 or less	84	21
11-20	129	32
21-30	123	31
31-40	50	12
41 or more	17	4
Area of teaching		
Mathematical sciences	31	8
Natural and technical sciences	32	8
Social and humanitarian sciences	340	84

Compiled by the author

2.3. Measurement model

2.3.1. Verification of constructs

The summary of each scale's parameters will be presented at the end of the paragraph in [Table 3]. Now the process of each construct's verification will be described in detail with all SPSS and AMOS outputs presented in [Appendix 2], featuring highlights of all the relevant indices.

Construct of innovativeness (INV) consisted of 4 items, one of which (INV4) was formulated in a reverse manner. The scale was adopted from [Waris & Hameed, 2022], had sufficient face validity after reversing of INV4, and had acceptable reliability with Cronbach's Alpha equaling 0,772. However, the deletion of reversed item – INV4_REVERSED – would lead to substantial increase in Cronbach's Alpha, so it is necessary to pay closer attention to the performance of this statement in confirmatory factor analysis.

Proceeding with this composition of the construct to confirmatory factor analysis (CFA), the construct did not prove to be robust enough. It had p-value for CMIN/df index > 0,05 (0,09), suggesting that there is no statistically significant difference between empirical and implied theoretical data, but still insufficient goodness of fit with CMIN/df ratio > 2 (2,413). GFI (which is analogous to R^2) > 0,9 (0,994), indicating acceptable explanatory power of items within the construct. TLI and CFI indices both > 0,9 (0,988 and 0,996, respectively), and RMSEA < 0,08 (0,059) with p-value for RMSEA > 0,05 (0,316), meaning that goodness of fit is unlikely to be enhanced further. The construct had sufficient composite reliability with CFR > 0,7 (0,81) and decent average variance explained (AVE) > 0,5 (0,55). However, problems occurred with convergent validity, due to mentioned problematic item INV4_REVERSED having unacceptably low standardized regression weight (0,295 < 0,5), even though it is considered significant with p-value for t-statistics < 0,05. Still the construct does not load heavily enough on the item, raising concerns with its unidimensionality and lowering overall goodness of fit. Hence the item INV4_REVERSED was excluded. After its exclusion the construct consisted of 3 items only, so running CFA for this latent variable was impossible. Ultimately, it is judged possible to proceed with this reduced composition of the construct of innovativeness (INV), and have a closer look at it further in simultaneous CFA.

Construct of system quality (SQ) consisted of 5 items. The scale was self-developed based on the definition proposed by [DeLone & McLean, 2003]. It had sufficient face validity and good reliability with Cronbach's Alpha equal 0,882.

Confirmatory factor analysis revealed some flaws in the construct, with insufficient overall goodness of fit (CMIN/df > 2) and p-value for CMIN/df < 0,05 indicating significant discrepancy between empirical and implied theoretical data. As long as p-close for RMSEA < 0,05, the goodness of fit can still be enhanced. In doing so certain covariances between errors were admitted in the specification (MI > 8), which resulted in better but still not perfect outcomes. Goodness of fit was enhanced but remained questionable (CMIN/df > 2), but no further amendments can be made given that RMSEA < 0,08 and p-close for RMSEA > 0,05. Convergent validity is present with all regression weights being significant, composite reliability is good with CFR = 0,88 and average variance explained is acceptable with AVE = 0,61. So, it is judged possible to proceed with this composition of the construct of system quality (SQ) and keep an eye on it at simultaneous CFA.

Construct of facilitating conditions (FC) consisted of 3 items. It was adopted from [Lavidas et al., 2022] with minor adjustments. It had sufficient face validity and satisfactory reliability with Cronbach's Alpha equaling 0,87. As long as it included only 3 statements, running CFA for this latent variable was impossible. Hence it is judged possible to proceed with this initial composition of the construct of facilitating conditions, and have a closer look at it further in simultaneous CFA.

Construct of perceived usefulness (PU) consisted of 4 items. It was adopted from [Venkatesh & Davis, 2000]. It had sufficient face validity and excellent reliability with Cronbach's Alpha equaling 0,955.

Confirmatory factor analysis revealed some flaws in the construct, with insufficient overall goodness of fit (CMIN/df > 2) and p-value for CMIN/df < 0,05 indicating significant discrepancy between empirical and implied theoretical data. As long as p-close for RMSEA < 0,05, the goodness of fit can still be enhanced. In doing so certain covariances between errors were admitted in the specification, which resulted in excellent goodness of fit being obtained: CMIN/df < 2, p-value for CMIN/df > 0,05, and no further amendments can be made given that RMSEA < 0,08 and p-close for RMSEA > 0,05. Convergent validity is present with all regression weights being significant, composite reliability is excellent with CFR = 0,96 and average variance explained is good with AVE = 0,85. So, it is judged possible to proceed with this composition of the construct of perceived usefulness (PU).

Construct of perceived ease of use (PEOU) consisted of 4 items. It was adopted from [Venkatesh & Davis, 2000]. It had sufficient face validity and excellent reliability with Cronbach's Alpha equaling 0,928. Confirmatory factor analysis also revealed no flaws in the construct, with sufficient overall goodness of fit (p-value for CMIN/df > 0,05), convergent validity (all regression

weights are significant), composite reliability (CFR = 0,93) and average variance explained (AVE = 0,77). So, it is judged possible to proceed with this initial composition of the construct of ease of use (PEOU).

Lastly, construct of attitude towards usage (ATU) consisted of 4 items. It was adopted from [Fathema et al., 2015]. It had sufficient face validity and excellent reliability with Cronbach's Alpha equaling 0,95.

Confirmatory factor analysis revealed some flaws in the construct, with insufficient overall goodness of fit (CMIN/df > 2) and p-value for CMIN/df < 0,05 indicating significant discrepancy between empirical and implied theoretical data. As long as p-close for RMSEA < 0,05, the goodness of fit can still be enhanced. In doing so certain covariances between errors were admitted in the specification, which resulted in excellent goodness of fit being obtained: CMIN/df < 2, p-value for CMIN/df > 0,05, and no further amendments can be made given that RMSEA < 0,08 and p-close for RMSEA > 0,05. Convergent validity is present with all regression weights being significant, composite reliability is excellent with CFR = 0,95 and average variance explained is good with AVE = 0,84. So, it is judged possible to proceed with this composition of the construct of attitude towards usage (ATU).

Summary on the model constructs (measured on a scale from 1 to 5) is presented in [Table 3].

Table 3. Constructs overview

Construct	Source	Number of items left	Cronbach's Alpha	CFR	AVE
Innovativeness (INV)	[Waris & Hameed, 2022]	3 (out of 4)	0,867	-	-
System quality (SQ)	Self-developed based on [DeLone & McLean, 2003]	5 (out of 5)	0,882	0,88	0,61
Facilitating conditions (FC)	[Lavidas et al., 2022]	3 (out of 3)	0,87	-	-
Perceived usefulness (PU)	[Venkatesh & Davis, 2000]	4 (out of 4)	0,955	0,96	0,85

Construct	Source	Number of items left	Cronbach's Alpha	CFR	AVE
Perceived ease of use (PEOU)	[Venkatesh & Davis, 2000]	4 (out of 4)	0,928	0,93	0,77
Attitude towards usage (ATU)	[Fathema et al., 2015]	4 (out of 4)	0,95	0,95	0,84

Compiled by the author

2.3.2. Simultaneous CFA

Measurement model in its initial composition did not show good results with p-value for CMIN/df < 0,05 (0,00), CMIN/df > 2 (2,49) and GFI < 0,9 (0,89), pointing at poor goodness of fit and statistically significant discrepancy between theoretical and empirical data. More on the initial measurement model can be found in [Appendix 2].

In search for model refinement, the following steps were undertaken:

1. All substantial covariances between errors within the same constructs were admitted (MI > 8)
2. Items SQ4 and SQ5 within the construct of system quality were excluded as ones having only marginally acceptable standardized regression weight (less than 0,65) and an error with more than 3 substantial suggested covariances (MI > 8) with errors and items from other constructs.
3. Item PEOU1 within the construct of perceived ease of use was excluded as one with an error that has alarmingly immense suggested covariance with the construct itself (MI = 33).

Measurement model in its final composition turned out to be of sufficient quality: even though some discrepancies between theoretical and empirical data still persist with p-value for CMIN/df < 0,05, overall it is of sufficient goodness of fit with CMIN/df < 2, has high explanatory power with GRI > 0,9, and requires no further improvements with p-close for RMSEA > 0,05. It is significantly better compared to the model in its initial composition: the final measurement model had 65 less degrees of freedom (163 vs. 228), while enjoying CMIN that is smaller by 300 (268 vs. 568), which is way more than 85 that would make them equal with a significance level of 0,05 (according to chi-square distribution tables). More on the final measurement model can be found in [Appendix 2].

Summary on simultaneous CFA is presented in the table below:

Table 4. Measurement models overview

CFA model	CMIN	df	CMIN/df	p-value	GFI	CFI	RMSEA (pclose)
Initial model	568	228	2.49	0.00	0.89	0.94	0.06 (0.00)
Final model	268	163	1.65	0.00	0.96	0.99	0.04 (0.98)

Compiled by the author

Descriptive statistics on the constructs of final measurement model (in their final composition) and proof of discriminant validity ($r^2$12<AVE1, <AVE2) is presented in [Table 5] below:

Table 5. Descriptives, correlations and AVE for final model constructs[1]

Construct	Mean	Standard deviation	1	2	3	4	5	6
1. Innovativeness	3.62	1.06	0.71					
2. System quality	3.75	1.01	0.03	0.71				
3. Facilitating conditions	3.83	1.04	0.06	0.22	0.70			
4. Perceived usefulness	3.54	1.17	0.13	0.24	0.26	0.80		
5. Perceived ease of use	3.50	1.06	0.04	0.27	0.25	0.27	0.78	
6. Attitude towards usage	3.66	1.13	0.09	0.37	0.35	0.68	0.46	0.84

Compiled by the author

[1] Below the diagonal – squared correlations between the constructs. Diagonal – AVEs

2.4. Structural model

The initial structural model can be found in [Appendix 2]. It holds two aspects of actual usage as separate dependent variables – actual usage intensiveness (observed variable measured as usage frequency - on a scale from 0 to 5) and actual usage extensiveness (observed variable measured as number of functions used - on a scale from 0 to 9). The model has some flaws in its quality with CMIN/df > 2 (2,35) and p-value for CMIN/df < 0,05 (0,00). Moreover, p-close for RMSEA < 0,05 (0,02) signifies that there is still room for substantial refinements.

In search for refinements, one can notice immense suggested covariance between errors of observed dependent variables – AUI and AUE (MI = 84). In addition to that, they are both influenced pretty evenly by their regressor (ATU). This leads to thinking that in fact those variables fall into 1-dimensional latent variable of actual usage, which must be reflected in model specification.

Ultimately, final structural model (with AUI and AUE as items of actual usage) turns out to be good enough to be interpreted. Even though p-value for CMIN/df < 0,05 signifies that some discrepancies still persist, overall it is of decent fit with CMIN/df < 2 (1,91), GFI > 0,9 (0,92), RMSEA < 0,08 (0,048) and p-close for RMSEA > 0,05 (0,7), meaning that no drastic refinements are needed. Moreover, newly introduced latent response variable of actual usage (AU) seems to perform well: it is of high convergent validity thanks to both items having statistically significant regression weights with standardized estimates > 0,5; it has decent composite reliability with CFR > 0,7 (0,72) and decent average variance explained with AVE > 0,5 (0,57). More on the quality of final structural model can be found in [Appendix 2].

Results of paths analysis are presented in [Table 6] below:

Table 6. Results of hypotheses tests

Paths	Std. coefficient	Sig.
Innovativeness (INV) – perceived usefulness (PU)	0.276	*** (0.00)
System quality (SQ) – perceived usefulness (PU)	0.222	*** (0.00)
System quality (SQ) – perceived ease of use (PEOU)	0.417	*** (0.00)
Facilitating conditions (FQ) – perceived ease of use (PEOU)	0.352	*** (0.00)

Paths	Std. coefficient	Sig.
Perceived ease of use (PEOU) – perceived usefulness (PU)	0.439	*** (0.00)
Perceived usefulness (PU) – attitude towards usage (ATU)	0.683	*** (0.00)
Perceived ease of use (PEOU) – attitude towards usage (ATU)	0.339	*** (0.00)
Attitude towards usage (ATU) – actual usage (AU)	0.552	*** (0.00)
Squared multiple correlation		
Actual usage (AU)	31%	

Compiled by the author

The final empirical model is presented below, with paths in green signifying significant positive effect of one variable on another (on the significance level of 0.001):

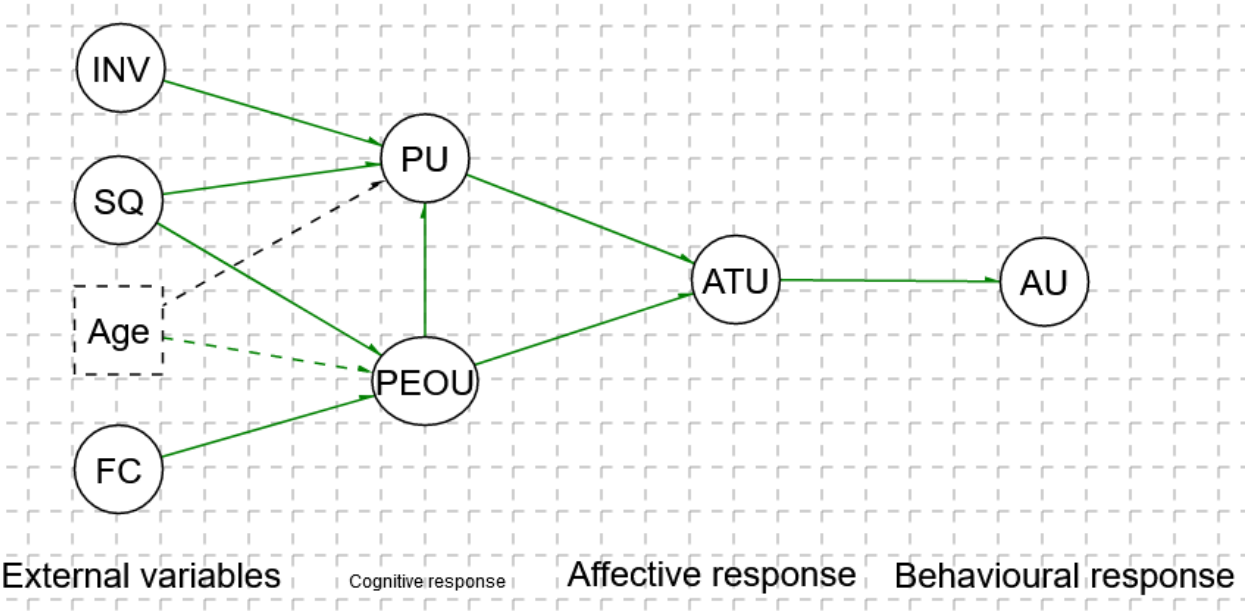

Figure 4. *Final empirical model for LMS acceptance among Russian faculty*

2.5. Expanding on obtained results: additional tests

Among statistically significant predictors of an LMS usage, two factors can be directly manipulated by stakeholders of current research: **system quality**, which is within the influence of LMS providers, and **facilitating conditions**, which are within the influence of universities' directors. Thus, keeping in mind the aim of this study, additional tests should be run in order to specify recommendations for those parties, willing to stimulate full-capacity usage of an LMS.

Namely, it is necessary to find out which particular aspects of system quality and which particular facilitating conditions would lead to this desired intensive and extensive usage of systems in question.

System quality

In order to find out which particular aspects of system quality contribute mostly to full-capacity usage of an LMS, correlation analysis was undertaken, juxtaposing 5 items of SQ construct with variables of usage intensiveness (AUI) and extensiveness (AUE). Given that all variables are measured on conditionally-interval scale and the amount of sample allows to assume normality of distribution, Pearson correlation coefficient is used to assess strength of relation. Results of correlation analysis are presented in [Table 7] below:

Table 7. Correlations between aspects of system quality and aspects of actual usage

Aspect of system quality	Pearson correlation with usage intensiveness (AUI)	Significance	Pearson correlation with usage extensiveness (AUE)	Significance
Functionality (SQ1)	0.26	*** (0.000)	0.19	*** (0.000)
Interface (SQ2)	0.29	*** (0.000)	0.17	*** (0.001)
Design (SQ3)	0.21	*** (0.000)	0.10	- (0.059)
Workability (SQ4)	0.14	** (0.007)	0.08	- (0.139)
Effectiveness in tracking students' performance (SQ5)	0.21	*** (0.000)	0.14	** (0.005)

Compiled by the author

Facilitating conditions

In order to find out which particular aspects of facilitating conditions contribute mostly to full-capacity usage of an LMS, correlation analysis was undertaken. It aimed to juxtapose binary variables of facilitating conditions, which were measured additionally and reflected absence or presence of a particular facilitating measure, with variables of usage intensiveness (AUI) and extensiveness (AUE). Given that the aim is to measure strength of interrelation between binary and conditionally-interval variables, Point-Biserial Pearson Correlation Coefficient is analyzed. The results can be found in [Table 8] below:

Table 8. Correlations between particular facilitating conditions and aspects of actual usage

Facilitating condition	**Point biserial correlation with usage intensiveness (AUI)**	**Significance**	**Point biserial correlation with usage extensiveness (AUE)**	**Significance**
Indirect facilitation (assistance)				
Workshop on LMS usage	0.08	- (0.097)	0.12	* (0.018)
Online course on LMS usage	0.08	- (0.133)	0.16	*** (0.001)
Methodical guidelines on LMS usage	0.12	* (0.014)	0.20	*** (0.000)
Internal faculty experts on LMS usage	0.15	** (0.003)	0.17	*** (0.001)

Facilitating condition	Point biserial correlation with usage intensiveness (AUI)	Significance	Point biserial correlation with usage extensiveness (AUE)	Significance
Multimedia instructions on LMS usage	0.15	** (0.002)	0.13	** (0.008)
Direct facilitation (stimulation)				
Financial benefits for usage	0.03	- (0.609)	0.10	- (0.055)
Mandatory usage organization-wide	0.14	** (0.004)	0.19	*** (0.000)
Sanctions for non-usage	0.21	*** (0.000)	0.14	** (0.006)

Compiled by the author

2.6. Theoretical and practical implications

From the **theoretical perspective**, current research contributes to the existing knowledge base through proposing the first empirically-proven model of LMS adoption among faculty members in Russia. This is yet another proof of the applicability of TAM [Davis, 1986] – now the model has shown itself as a robust base for modeling technology acceptance in another new context (on learning management systems in Russia), as this research model, which is evidently based on TAM, has turned out to be of decent quality and has had all the basic paths (from cognitive to behavioral response) confirmed significant. Hence one can conclude that, in general, user

motivation part in technology acceptance is likely to stay the same even in turbulent contexts, where major forced switches from one technology to another take place (like in Russia now).

Another notable revelation is that response variable of actual usage is indeed a unidimensional construct, even when measured indirectly in its aspects (intensiveness and extensiveness), and not on a Likert scale. Intensiveness (as frequency) and extensiveness (as number of utilized functions) of LMS usage in Russia go hand by hand, obviously falling into a single construct of actual usage. In other words, those professors who use an LMS frequently tend to use it extensively as well, taking advantage of its numerous functions.

The last but not the least theoretical implication is that personal innovativeness does positively affect cognitive response towards an LMS (its perceived usefulness). Even though these relationships have already been proved empirically in previous studies on LMS adoption in other countries [Waris & Hameed, 2022], current study is the first to prove this influence with controlling for the effect of age, which seems mandatory as innovativeness tends to correlate with age [Packalen & Bhattacharya, 2019; Green et al., 1986]. Consequently, now it is known that, compared to a less innovative user, a person who is open to new ideas will be more benevolent in evaluating usefulness of a technology (LMS), even when the age is the same. Other findings on the predictive power of remaining external variables (system quality, facilitating conditions) can not be considered as revelations, but may point out at the similarity between Russian and foreign LMS markets, as long as the results are in line with outcomes of American, Philippine and Pakistani colleagues [Fathema et al., 2015; Fearnley & Amora, 2020; Warris & Hameed, 2022].

From the **practical perspective**, a set of targeted recommendations for two main research stakeholders – directors of universities and LMS providers – has been elaborated based on obtained findings.

I. Recommendations for university management team:

1. To prioritize system quality over facilitating conditions

Even though both factors were found to be significant antecedents of cognitive response towards an LMS, increasing its perceived ease of use and ultimately its actual usage, system quality enjoys slightly stronger influence (standardized regression weight 0.42 vs 0.35). Hence in situations of budget constraints, it is advised that universities choose high-quality (and most likely expensive) LMS over comprehensive system of facilitating conditions. In order to ensure that a potential new system is perceived to be of high quality, it might be a good idea to arrange pilot testing among target users (faculty), with subsequent measurement of main quality parameters, which were found

to eventually constitute the construct of system quality (sufficiency of functionality, convenience of interface and pleasance of design). This way, system quality will be a facilitating condition itself.

2. To focus on simple and reactive assistance on LMS usage as means of indirect facilitation

Analyzing correlation between means of indirect facilitation to use an LMS and its actual usage (intensiveness and extensiveness), one can notice that the best results are shown by the types of assistance that can be taken advantage of easily and quickly: methodical guidelines, multimedia instructions and internal faculty experts. In comparison, such means of LMS usage facilitation as workshops and online courses, while obviously requiring more financial and time resources from the management, were found to be ineffective in stimulating usage intensiveness (frequency), and only merely effective in promoting usage extensiveness (increasing the scope of functionality used by a faculty). This phenomenon might be due to the fact that professors tend to use reactive approach in dealing with educational technologies, so they tend to seek quick answers for their arisen questions, rather than anticipating those questions in advance. Another possible explanation might be in excessive time-consumption of means like workshops and online courses, which leads to staff simply neglecting them due to lack of time, thus making no use of those instruments. Consequently, arranging any kind of demanding activities dedicated to LMS usage seems inefficient.

3. To neglect positive motivation as a direct mean of LMS usage facilitation

Considering direct means of LMS usage facilitation, positive motivation in a form of financial stimuli turned out to be ineffective in promoting those systems, not correlating significantly neither with usage intensiveness nor with usage extensiveness. Compulsion (requirement to use an LMS, sanctions in case of non-usage), on the other hand, was indeed associated with full-capacity usage of LMS. The reason behind it might be that those compulsions serve as the first push towards intensive and extensive usage, forcing faculty to dedicate time to an LMS, which results in its usefulness being uncovered and taken advantage of lately. In general, once again the costliest tool turned out to be ineffective, and thus clearly inefficient, which is why it should be neglected.

II. <u>Recommendations for LMS providers</u>:

1. To focus on innovative institutions with a developed system of facilitating conditions (strategic marketing level)

Even though system quality was found to be the most robust antecedent of cognitive response and further usage of an LMS, other parameters, which are not controlled by LMS providers (facilitating

conditions at a client organization, personal innovativeness of end-users), also play a vital role in the process of adoption. Hence even the most brilliant system will not be accepted widely without mentioned favorable conditions, and the contracts are unlikely to be prolonged, resulting in seemingly low LTV (life-time value) of those rigid and unsupportive organizations. So, CAC (customer acquisition costs) in this segment have to be rather low in order to make these relationships profitable (LTV > CAC). Consequently, in strategic marketing it might be wise to focus on institutions with obligatory usage of an LMS (proven to be the best stimulator of full-capacity usage amongst direct means), internal experts at each department (proven to be one of the best stimulators of full-capacity usage amongst indirect means), and rather innovative faculty at most (probably in business schools or technical institutions, but further research is needed here). Also, it is recommended to provide client organizations with usage guidelines and multimedia instructions as it does help in adoption.

2. To prioritize system's functionality, interface and effectiveness in tracking students' progress in product development (operational marketing level)

System quality as a whole turned out to be a robust regressor of cognitive response and further full-capacity usage. However, not all of its aspects were found to be equally important. Namely, while aesthetically pleasing LMS design and high workability do contribute to increased usage intensiveness (frequency), they do not influence depth of usage. It is indeed logical that a person is willing to return to a pleasing and workable system more often, but it does not make it easier to adopt new functions (as user-friendly interface does, for example). Hence in order to ensure successful adoption of an LMS among end-users, when working on a product as a marketing mix element it is necessary to focus on its functionality, interface friendliness and effectiveness in tracking students' performance. It must be noted that what matters is users' perception, and not objective expression of those aspects. Consequently, it might a good idea to launch pilot testing of a new (or refined) system among target users, with measuring subsequently perception of those 3 focal parameters of system quality.

3. To emphasize diverse functionality, user-friendly interface and aesthetically pleasing design in promoting an LMS to end-users (operational marketing level)

When looking closely at what eventually constitutes the construct of system quality, one could spot that the only items left are functionality, interface and design. Thus, a positive cognitive response (both perceived usefulness and perceived ease of use) emerges as a result of those particular parameters being highly appraised. If an LMS provider sticks to pull communicative strategy in promotion, focusing some of its marketing efforts on end-users (faculty members), it is

recommended to emphasize mentioned aspects in promotional campaigns, aiming to elicit positive cognitive response and successful implementation further on.

2.7. Limitations and further research directions

One of the main limitations of current research (as well as of the majority of similar ones) is in the measurement of response variable (actual usage). Herein data on LMS usage is self-reported by a respondent, whereas in fact it can be observed objectively via factual data. It seemingly constitutes a major limitation inasmuch as this way of measurement might cause low-reliable results due to social desirability bias. Even though the survey is anonymous, respondents may feel tense in reporting little usage, which is evidently condemned by authorities. Consequently, further studies should aim at collecting factual data on usage: for that it will be necessary to download data on user behavior and analyze it user-wide, eliciting information on frequency of sessions and their content.

Another limitation is connected with the fact that this study has failed to engage a substantial number of teachers from colleges and corporate universities, thus the findings cannot be generalized on all population of professors. For example, students in corporate universities might be more mature and demanding, which may result in students' influence being a regressor of actual usage in those settings. Consequently, further studies should strive to recruit more respondents from colleges and corporate universities.

Lastly, being constrained by the limitations of the data analysis method (PLS-SEM), which does not tolerate missing values and thus any optional variables, this study did not consider peculiarities of prior experience in using LMS, whereas certain number of professors have had it (partly due to the fostered switches from foreign to local systems, mentioned in the beginning). This lapse constitutes a limitation because [Feather, 1966] founded that the successfulness of prior experience defines expectations regarding future success, so it is reasonable to hypothesize that this construct of prior experience – measured as its successfulness – can be another robust predictor of cognitive response in the model (external variable). Consequently, further research on LMS adoption – especially in turbulent contexts, such as Russian, with major forced replacements – should find ways to include the variable of prior experience successfulness in the model and test its effects.

CONCLUSION

Current study was devoted to adoption of learning management systems among faculty members in Russia, and aimed to find out how to predict and stimulate full-capacity usage of those systems, with the view of providing managerial recommendations to directors of universities and LMS suppliers.

In chapter 1 a theoretical base was developed. First, a notion of learning management systems as an educational technology was introduced, with emphasizing of the problem of its non-extensive usage among faculty members. Then technology acceptance model (TAM) was chosen as a base to model the process of adoption of the technology in question, given its high applicability in similar studies. The specification of this base model required coming up with the set of contextual external variables, which are contingent upon region and particular technology. As long as no one has applied this model for LMS in Russia, similar studies in other countries were reviewed in search of relevant external variables. Ultimately, personal innovativeness, perceived system quality and facilitating conditions (plus gender as a commonly used control variable) were chosen as ones giving the most comprehensive overview on possible externalities and having the most promising perspectives in achieving research tasks (namely, to formulate practical recommendations for research stakeholders). Additionally, the response variable of actual usage was attempted to be treated multidimensionally (as usage intensiveness and usage extensiveness separately), given the stated problem of specifically non-extensive usage. Other relationships were taken directly from the base TAM model, and this constituted the proposed research model.

In chapter 2 empirical study was presented. Methodology presupposed applying PLS-SEM (partial least squares structural equation modeling) as the main method of data analysis (quantitative), given the subject of the study (process of adoption, which is a chain of effects with latent constructs). Partnership with Federal Educational and Methodical Association allowed to obtain a sample of 403 representatives of formulated population (faculty members of Russian higher education institutions with an LMS at the workplace), which exceeds the minimum threshold of 100 for SEM studies. After a set of refinements, all constructs proved to be reliable and valid, with measurement model enjoying decent goodness of fit. This allowed us to proceed with the structural model, where the response variables (AUI and AUE) obviously fell into a single construct of actual usage, which helped increase the quality of the model and get results that are reliable enough to be interpreted. Like this, path analysis resulted in all research hypotheses being accepted on the significance level of 0.001. Additional correlation tests were run to specify the obtained results – namely, it was revealed that among system quality parameters the most important ones are

functionality, interface and effectiveness in tracking students' performance (correlate significantly with both usage intensiveness and extensiveness), and among facilitating conditions the most robust (by the same criterion) are guidelines and multimedia instructions on LMS usage, along with internal LMS experts in each faculty, whereas financial stimuli turned out to be ineffective.

These findings contributed to theory via proposing the first empirically verified model of LMS adoption among faculty members in Russia, proving unidimensionality of actual usage with a different measurement approach, and finding positive effect of personal innovativeness on perceived usefulness of a system with controlling for age. Also, a set of practical recommendations were developed based on those results. Like that, directors of universities were advised to prioritize LMS quality over facilitating conditions, focus on simple and reactive assistance in LMS usage and neglect positive motivation to use an LMS. Providers of LMS are recommended to focus on innovative organizations with a developed system of facilitating conditions; prioritize system's functionality, interface and effectiveness in tracking students' progress in developing a system; emphasize diverse functionality, user-friendly interface and aesthetically pleasing design in promoting a system to end-users. Main limitations, which define suggested research directions, are connected with self-reported and thus unreliable measurement of the response variable, failure to cover professors in colleges and corporate universities, and inability to address previous LMS experience in model specification.

Taking everything into consideration, it can be concluded that the research aim was attained, and all of the tasks accomplished, so the work is of decent usefulness for academicians and practitioners related to technology acceptance (and learning management systems in particular).

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APPENDICES

Appendix 1. Questionnaire

Опыт освоения систем дистанционного обучения (СДО / LMS) преподавателями российских вузов

Добрый день!

Спасибо, что нашли время принять участие в нашем исследовании, посвященном опыту использования СДО - систем дистанционного обучения (также известных как learning management systems, LMS). Проект реализуется студентом программы магистратуры Master in Management Высшей школы менеджмента СПбГУ Эриком Крюковым совместно с Центром преподавательского мастерства в бизнес-образовании ВШМ СПбГУ.

Данный опрос является анонимным, его результаты будут использованы только в исследовательских целях и в агрегированном виде. Приблизительное время прохождения составит 6 минут.

Результаты исследования будут доступны всем участникам, заполнившим опрос и оставившим контактные данные.

st063303@student.spbu.ru (not shared) Switch accounts

Next Page 1 of 9 Clear form

Система дистанционного обучения (СДО, англ. LMS)

Система дистанционного обучения (СДО - англ. Learning Management System, LMS) - это Интернет-платформа, на которой преподаватель может взаимодействовать со студентами (размещать материалы, делать объявления, проводить тестирования, принимать и оценивать письменные работы).

Распространенными примерами СДО являются Blackboard, Brightspace, Moodle, Canvas, iSpring, StartExam и другие. Также СДО может быть самописной, т.е. созданной вузом самостоятельно.

Около 99% вузов имеют СДО, а значит, почти наверняка в Вашей организации она тоже имеется в том или ином виде.

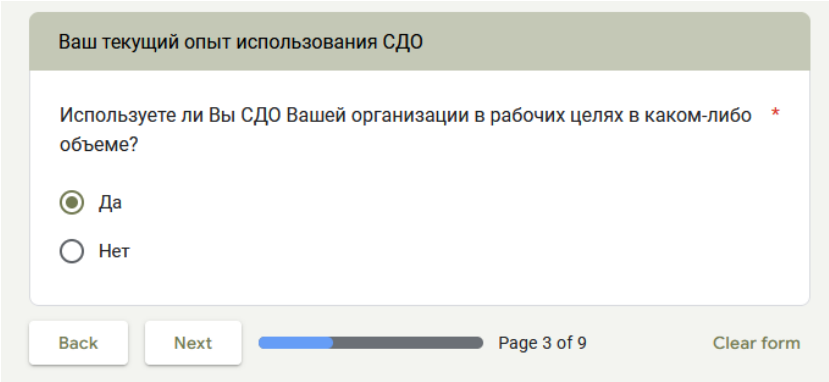
Есть ли в Вашей образовательной организации система дистанционного обучения (СДО, англ. LMS)? *

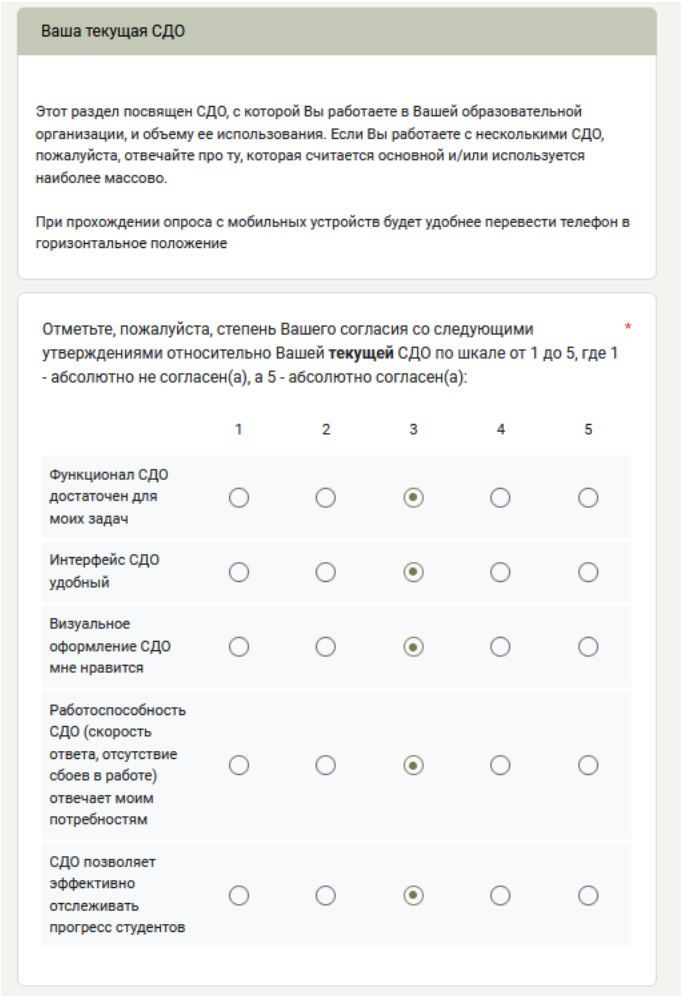
- (•) Да
- ( ) Нет
- ( ) Затрудняюсь ответить

Является ли использование СДО обязательным в Вашей организации? *

- (•) Да
- ( ) Нет
- ( ) Не знаю

Back Next Page 2 of 9 Clear form


Ваш текущий опыт использования СДО
Используете ли Вы СДО Вашей организации в рабочих целях в каком-либо объеме? *
Да
Нет
Back
Next
Page 3 of 9
Clear form


Ваша текущая СДО
Этот раздел посвящен СДО, с которой Вы работаете в Вашей образовательной организации, и объему ее использования. Если Вы работаете с несколькими СДО, пожалуйста, отвечайте про ту, которая считается основной и/или используется наиболее массово.
При прохождении опроса с мобильных устройств будет удобнее перевести телефон в горизонтальное положение
Отметьте, пожалуйста, степень Вашего согласия со следующими утверждениями относительно Вашей текущей СДО по шкале от 1 до 5, где 1 - абсолютно не согласен(а), а 5 - абсолютно согласен(а): *
1
2
3
4
5
Функционал СДО достаточен для моих задач
Интерфейс СДО удобный
Визуальное оформление СДО мне нравится
Работоспособность СДО (скорость ответа, отсутствие сбоев в работе) отвечает моим потребностям
СДО позволяет эффективно отслеживать прогресс студентов

Укажите, пожалуйста, как часто Вы используете Вашу СДО (в среднем в течение семестра): *

- ○ Ежедневно
- ◉ Раз в 2-3 дня
- ○ Раз в неделю
- ○ Раз в 2-4 недели
- ○ Реже чем раз в месяц (эпизодически)
- ○ Other:

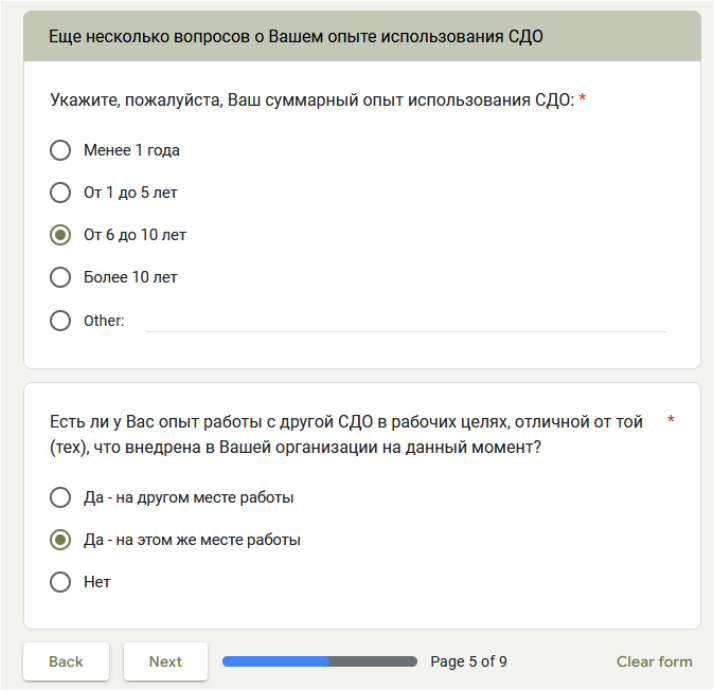
Отметьте, пожалуйста, какие функции Вашей СДО Вы использовали хотя бы единожды: *

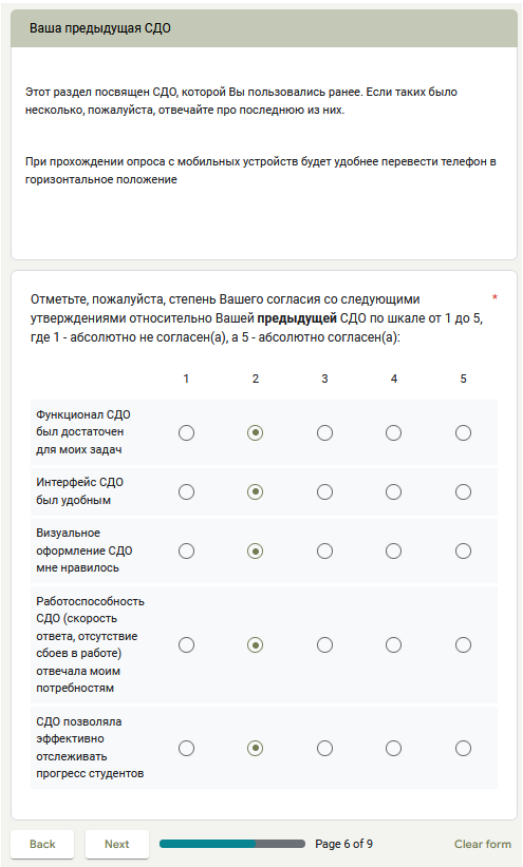
- ☑ Публикация материалов (лекционные слайды, информация о курсе и т.д.)
- ☐ Односторонняя коммуникация со студентами (размещение объявлений, отправка уведомлений на электронную почту и т.д.)
- ☐ Двусторонняя коммуникация со студентами (создание форумов для коммуникации студентов между собой или с преподавателем)
- ☐ Сбор письменных работ (создание назначения для загрузки файла с работой)
- ☐ Оценка письменных работ (размещение оценки или иной обратной связи на загруженную работу)
- ☐ Проведение тестов (проведение экзаменов или других тестирований на платформе СДО)
- ☐ Внесение оценок в систему вручную (не на загруженную работу или тест)
- ☐ Анализ результатов студентов (ознакомление с агрегированными результатами тестирований, выявление отстающих студентов и т.д.)
- ☐ Работа с данными учебной аналитики, встроенным в СДО (анализ дэшбордов по активности и успеваемости студентов, статистика работы с учебными материалами и активности на платформе и т.п.)
- ☐ Other:

Оцените, пожалуйста, относительную степень использования Вами текущей СДО за разные промежутки времени по шкале от 1 до 4, где 1 - использовал(а) мало и редко, а 4 - использовал(а) активно и регулярно *

	1	2	3	4
За все время	○	◉	○	○
За последний месяц	○	○	◉	○
За последнюю неделю	○	○	◉	○

Back Next Page 4 of 9 Clear form


Еще несколько вопросов о Вашем опыте использования СДО
Укажите, пожалуйста, Ваш суммарный опыт использования СДО: *
Менее 1 года
От 1 до 5 лет
От 6 до 10 лет
Более 10 лет
Other:
Есть ли у Вас опыт работы с другой СДО в рабочих целях, отличной от той (тех), что внедрена в Вашей организации на данный момент? *
Да - на другом месте работы
Да - на этом же месте работы
Нет
Back
Next
Page 5 of 9
Clear form


Ваша предыдущая СДО
Этот раздел посвящен СДО, которой Вы пользовались ранее. Если таких было несколько, пожалуйста, отвечайте про последнюю из них.
При прохождении опроса с мобильных устройств будет удобнее перевести телефон в горизонтальное положение
Отметьте, пожалуйста, степень Вашего согласия со следующими утверждениями относительно Вашей предыдущей СДО по шкале от 1 до 5, где 1 - абсолютно не согласен(а), а 5 - абсолютно согласен(а): *
1
2
3
4
5
Функционал СДО был достаточен для моих задач
Интерфейс СДО был удобным
Визуальное оформление СДО мне нравилось
Работоспособность СДО (скорость ответа, отсутствие сбоев в работе) отвечала моим потребностям
СДО позволяла эффективно отслеживать прогресс студентов
Back
Next
Page 6 of 9
Clear form

Поддержка организации в использовании текущей СДО

В этом разделе мы зададим Вам несколько вопросов о том, как выстроена поддержка использования СДО в Вашей образовательной организации. Если в Вашей организации их несколько, пожалуйста, отвечайте о той СДО, которая считается основной и/или используется наиболее массово.

Отметьте, пожалуйста, степень Вашего согласия со следующими утверждениями относительно организационной поддержки в использовании текущей СДО по шкале от 1 до 5, где 1 - абсолютно не согласен(а), а 5 - абсолютно согласен(а): *

	1	2	3	4	5
При необходимости я могу оперативно получить помощь в работе с СДО	○	○	◉	○	○
Для разрешения сложностей, связанных с СДО, я могу обратиться к группе внутренних экспертов	○	○	◉	○	○
Мне предоставлено достаточно инструкций по работе с СДО	○	○	◉	○	○

Что из перечисленного есть в Вашей образовательной организации? *

- [x] Практикум по работе в СДО
- [ ] Онлайн-курс по работе в СДО
- [ ] Подробные методические указания по работе в СДО
- [ ] Внутренние эксперты по работе в СДО на каждом факультете
- [ ] Инструкции по работе в СДО в мультимедиа формате
- [ ] Ничего из перечисленного
- [ ] Other:

Какие формы стимулирования использования СДО предусмотрены в Вашей организации? *

- [x] Финансовые (премирование / доплата / ...)
- [ ] Организационные (требования к организации учебного процесса)
- [ ] Санкции при неиспользовании СДО
- [ ] Ничего из перечисленного
- [ ] Other:

Back Next Page 7 of 9 Clear form

Ваше отношение к текущей СДО

Если Вы не используете текущую основную СДО Вашей организации - отвечайте, пожалуйста, исходя из Вашего представления о ней

Отметьте, пожалуйста, степень Вашего согласия со следующими утверждениями относительно полезности **текущей** СДО по шкале от 1 до 5, где 1 - абсолютно не согласен(а), а 5 - абсолютно согласен(а): *

	1	2	3	4	5
Использование этой СДО улучшает (может улучшить) мои результаты как преподавателя	○	○	◉	○	○
Использование этой СДО увеличивает (может увеличить) мою продуктивность	○	○	◉	○	○
Использование этой СДО повышает (может повысить) мою эффективность как преподавателя	○	○	◉	○	○
Эта СДО полезна в моей работе	○	○	◉	○	○

Отметьте, пожалуйста, степень Вашего согласия со следующими утверждениями относительно легкости использования **текущей** СДО по шкале от 1 до 5, где 1 - абсолютно не согласен(а), а 5 - абсолютно согласен(а): *

	1	2	3	4	5
Мое взаимодействие с СДО прозрачно и понятно	○	○	◉	○	○
Взаимодействие с СДО не требует когнитивных усилий	○	○	◉	○	○
Использовать СДО легко	○	○	◉	○	○
Добиться от СДО желаемых действий легко	○	○	◉	○	○

Отметьте, пожалуйста, степень Вашего согласия со следующими утверждениями относительно Вашего отношения к использованию текущей СДО по шкале от 1 до 5, где 1 - абсолютно не согласен(а), а 5 - абсолютно согласен(а): *

	1	2	3	4	5
Текущую СДО стоит использовать	○	○	◉	○	○
Мне нравится использовать эту СДО	○	○	◉	○	○
Я считаю крайне желательным использование этой СДО в академических целях	○	○	◉	○	○
В целом мое отношение к использованию текущей СДО положительное	○	○	◉	○	○

Back Next Page 8 of 9 Clear form

В заключение несколько вопросов о Вас

Укажите, пожалуйста, Ваш пол: *

- ○ Мужской
- ○ Женский

Укажите, пожалуйста, Ваш возраст (кол-во полных лет): *

Your answer

Отметьте, пожалуйста, степень Вашего согласия со следующими утверждениями относительно себя по шкале от 1 до 5, где 1 - абсолютно не согласен(а), а 5 - абсолютно согласен(а): *

	1	2	3	4	5
В моем круге общения я обычно первым(-ой) пробую новые информационные технологии	○	○	○	○	○
Мне нравится экспериментировать с новыми информационными технологиями	○	○	○	○	○
В целом я не чураюсь пробовать новые информационные технологии	○	○	○	○	○
Обычно я с осторожностью отношусь к новым идеям	○	○	○	○	○

Укажите, пожалуйста, Вашу должность на текущем месте работе: *

- ◯ Аспирант или лаборант
- ◯ Ассистент
- ◯ Старший преподаватель
- ◯ Доцент
- ◯ Профессор
- ◯ Other: _____

Укажите, пожалуйста, Вашу ученую степень: *

- ◯ Отсутствует
- ◯ Кандидат наук
- ◯ Доктор наук
- ◯ PhD (получена за рубежом)
- ◯ Other:

Укажите, пожалуйста, Ваш педагогический стаж (кол-во полных лет): *

Your answer

Укажите, пожалуйста, Вашу основную специализацию в преподавании на текущем месте работы: *

- ◯ Математические науки (математика и т.д.)
- ◯ Естественные и технические науки (биология, химия, физика и т.д.)
- ◯ Социально-гуманитарные науки (история, экономика, психология и т.д.)

Укажите, пожалуйста, тип Вашей образовательной организации: *

- ◯ Высшее учебное заведение (университет, институт, академия, ...)
- ◯ Профессиональная образовательная организация (колледж, техникум, ...)
- ◯ Организация корпоративного обучения (корпоративный университет, корпоративный учебный центр и т.п.)
- ◯ Other: _____

Укажите, пожалуйста, в каком субъекте РФ находится Ваше учебное заведение: *

Your answer

Укажите, пожалуйста, название Вашего учебного заведения (текущее место работы):

Your answer

Укажите Ваш электронный адрес, если Вы хотели бы получить результаты исследования (результаты будут разосланы в июне-июле этого года)

Your answer

Back Submit Page 9 of 9 Clear form

Appendix 2. SPSS and AMOS outputs

Innovativeness (INV)

Reliability Statistics

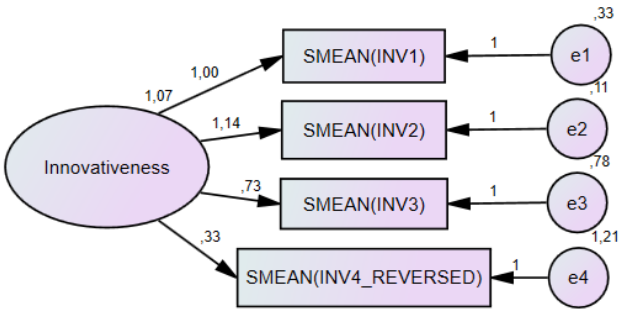
Cronbach's Alpha	N of Items
,772	4

Item Statistics

	Mean	Std. Deviation	N
INV1	3,4268	1,18300	403
INV2	3,5732	1,22839	403
INV3	3,8660	1,16410	403
INV4_REVERSED	3,5980	1,15133	403

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
INV1	11,0372	7,200	,736	,627
INV2	10,8908	6,690	,798	,585
INV3	10,5980	8,141	,568	,720
INV4_REVERSED	10,8660	10,096	,252	,867



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	8	4,825	2	,090	2,413
Saturated model	10	,000	0		
Independence model	4	739,103	6	,000	123,184

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,026	,994	,969	,199
Saturated model	,000	1,000		
Independence model	,568	,556	,260	,334

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,993	,980	,996	,988	,996
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,059	,000	,129	,316
Independence model	,551	,518	,585	,000

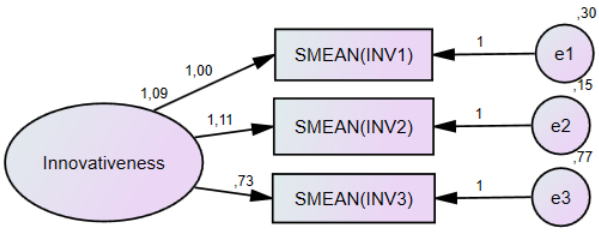
Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
INV1_1	<---	Innovativeness	1,000				
INV2_1	<---	Innovativeness	1,144	,053	21,759	***	
INV3_1	<---	Innovativeness	,733	,049	14,955	***	
INV4_REVERSED_1	<---	Innovativeness	,329	,055	5,929	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
INV1_1	<---	Innovativeness	,874
INV2_1	<---	Innovativeness	,963
INV3_1	<---	Innovativeness	,651
INV4_REVERSED_1	<---	Innovativeness	,295

Factor 1			
	Lamda	Lamda-squared	Error variance
Item 1	0,874	0,76	0,24
Item 2	0,963	0,93	0,07
Item 3	0,651	0,42	0,58
Item 4	0,295	0,09	0,91
Item 5			
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	2,78	2,20	1,80
SummeQ	7,75	4,85	3,23
Composite factor reliability		**0,81**	
AVE		**0,55**	



System quality (SQ)

Reliability Statistics

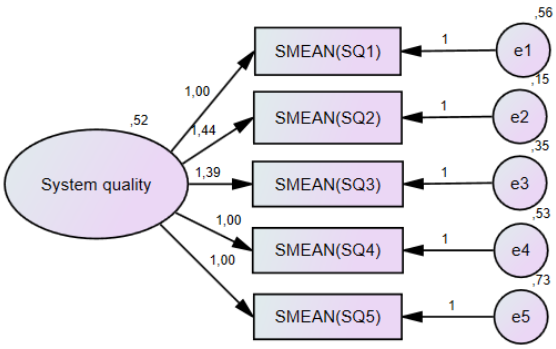
Cronbach's Alpha	N of Items
,882	5

Item Statistics

	Mean	Std. Deviation	N
SQ1	4,02	1,068	384
SQ2	3,65	1,142	384
SQ3	3,57	1,192	384
SQ4	3,59	1,051	384
SQ5	3,55	1,151	384

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SQ1	14,35	14,778	,664	,868
SQ2	14,72	13,173	,832	,828
SQ3	14,80	13,380	,753	,848
SQ4	14,79	14,649	,698	,861
SQ5	14,82	14,418	,644	,874



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	10	47,333	5	,000	9,467
Saturated model	15	,000	0		
Independence model	5	1138,689	10	,000	113,869

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,049	,953	,859	,318
Saturated model	,000	1,000		
Independence model	,594	,406	,109	,271

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,958	,917	,963	,925	,962
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,145	,109	,184	,000
Independence model	,530	,504	,556	,000

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
SQ1_1 <--- SQ	1,000				
SQ2_1 <--- SQ	1,442	,086	16,863	***	
SQ3_1 <--- SQ	1,385	,087	15,984	***	
SQ4_1 <--- SQ	,995	,075	13,218	***	
SQ5_1 <--- SQ	1,002	,082	12,205	***	

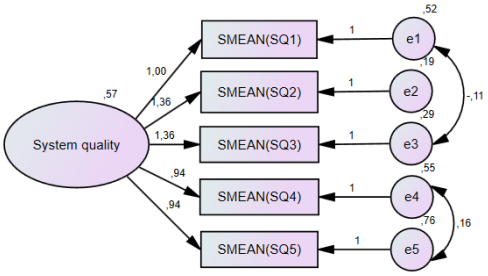
Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
SQ1_1 <--- SQ	,694
SQ2_1 <--- SQ	,936
SQ3_1 <--- SQ	,862
SQ4_1 <--- SQ	,702
SQ5_1 <--- SQ	,646

Factor 1			
	Lamda	Lamda-squared	Error variance
Item 1	0,694	0,48	0,52
Item 2	0,936	0,88	0,12
Item 3	0,862	0,74	0,26
Item 4	0,702	0,49	0,51
Item 5	0,646	0,42	0,58
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	3,84	3,01	1,99
SummeQ	14,75	9,07	3,96
Composite factor reliability		**0,88**	
AVE		**0,60**	

Covariances: (Group number 1 - Default model)

	M.I.	Par Change
e4 <--> e5	23,633	,161
e3 <--> e5	5,683	-,069
e2 <--> e4	8,484	-,060
e2 <--> e3	5,403	,038
e1 <--> e5	7,023	,090
e1 <--> e3	9,474	-,078



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	12	10,241	3	,017	3,414
Saturated model	15	,000	0		
Independence model	5	1138,689	10	,000	113,869

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,025	,990	,951	,198
Saturated model	,000	1,000		
Independence model	,594	,406	,109	,271

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,991	,970	,994	,979	,994
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,077	,029	,132	,150
Independence model	,530	,504	,556	,000

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
SQ1_1 <--- SQ	1,000				
SQ2_1 <--- SQ	1,362	,082	16,574	***	
SQ3_1 <--- SQ	1,364	,088	15,450	***	
SQ4_1 <--- SQ	,941	,071	13,211	***	
SQ5_1 <--- SQ	,937	,078	12,028	***	

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
SQ1_1 <--- SQ	,723
SQ2_1 <--- SQ	,922
SQ3_1 <--- SQ	,884
SQ4_1 <--- SQ	,692
SQ5_1 <--- SQ	,629

Factor 1

	Lamda	Lamda-squared	Error variance
Item 1	0,723	0,52	0,48
Item 2	0,922	0,85	0,15
Item 3	0,884	0,78	0,22
Item 4	0,692	0,48	0,52
Item 5	0,629	0,40	0,60
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	3,85	3,03	1,97
SummeQ	14,82	9,17	3,89
Composite factor reliability		**0,88**	
AVE		**0,61**	

Facilitating conditions (FC)

Reliability Statistics

Cronbach's Alpha	N of Items
,865	3

Item Statistics

	Mean	Std. Deviation	N
FC1	3,82	1,127	403
FC2	3,87	1,200	403
FC3	3,79	1,179	403

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
FC1	7,66	4,539	,808	,754
FC2	7,62	4,292	,796	,761
FC3	7,69	4,956	,637	,906

Perceived usefulness (PU)

Reliability Statistics

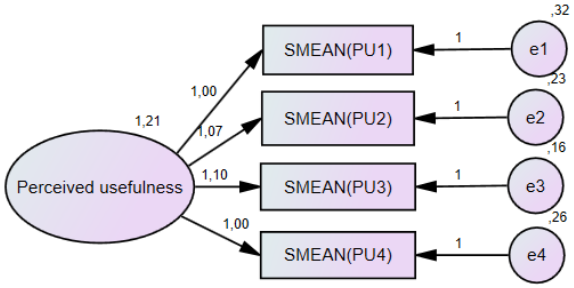
Cronbach's Alpha	N of Items
,955	4

Item Statistics

	Mean	Std. Deviation	N
PU1	3,47	1,240	403
PU2	3,50	1,272	403
PU3	3,47	1,274	403
PU4	3,71	1,211	403

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PU1	10,67	12,807	,867	,949
PU2	10,65	12,399	,895	,940
PU3	10,67	12,242	,917	,934
PU4	10,43	12,873	,886	,943



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	8	13,510	2	,001	6,755
Saturated model	10	,000	0		
Independence model	4	1766,557	6	,000	294,426

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,014	,985	,923	,197
Saturated model	,000	1,000		
Independence model	1,018	,319	-,135	,191

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,992	,977	,993	,980	,993
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,120	,065	,184	,021
Independence model	,854	,821	,888	,000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PU1_1	<---	PU	1,000				
PU2_1	<---	PU	1,069	,036	29,612	***	
PU3_1	<---	PU	1,096	,035	31,405	***	
PU4_1	<---	PU	,995	,036	28,012	***	

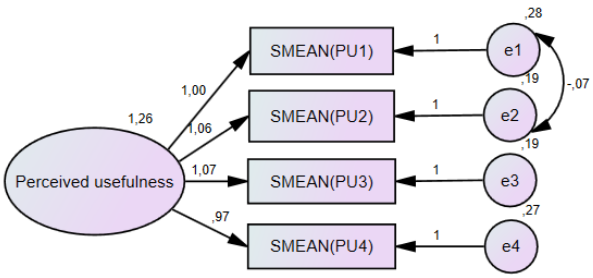
Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
PU1_1	<---	PU	,889
PU2_1	<---	PU	,927
PU3_1	<---	PU	,949
PU4_1	<---	PU	,907

Factor 1			
	Lamda	Lamda-squared	Error variance
Item 1	0,889	0,79	0,21
Item 2	0,927	0,86	0,14
Item 3	0,949	0,90	0,10
Item 4	0,907	0,82	0,18
Item 5			
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	3,67	3,37	0,63
SummeQ	13,48	11,38	0,39
Composite factor reliability		**0,96**	
AVE		**0,84**	

Covariances: (Group number 1 - Default model)

			M.I.	Par Change
e3	<-->	e4	4,906	-,030
e1	<-->	e2	7,661	-,045



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	9	,300	1	,584	,300
Saturated model	10	,000	0		
Independence model	4	1766,557	6	,000	294,426

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,002	1,000	,996	,100
Saturated model	,000	1,000		
Independence model	1,018	,319	-,135	,191

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	1,000	,999	1,000	1,002	1,000
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,000	,000	,108	,736
Independence model	,854	,821	,888	,000

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
PU1_1 <--- PU	1,000				
PU2_1 <--- PU	1,065	,037	28,423	***	
PU3_1 <--- PU	1,066	,034	31,432	***	
PU4_1 <--- PU	,974	,034	28,503	***	

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
PU1_1 <--- PU	,906
PU2_1 <--- PU	,940
PU3_1 <--- PU	,940
PU4_1 <--- PU	,903

Factor 1			
	Lamda	Lamda-squared	Error variance
Item 1	0,906	0,82	0,18
Item 2	0,94	0,88	0,12
Item 3	0,94	0,88	0,12
Item 4	0,903	0,82	0,18
Item 5			
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	3,69	3,40	0,60
SummeQ	13,61	11,58	0,36
Composite factor reliability		**0,96**	
AVE		**0,85**	

Perceived ease of use (PEOU)

Reliability Statistics

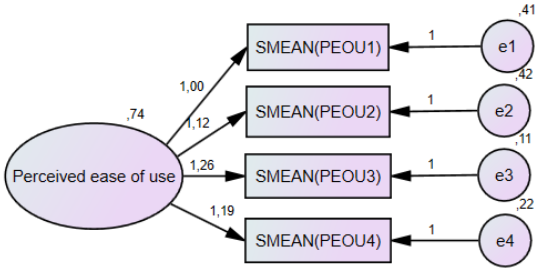
Cronbach's Alpha	N of Items
,928	4

Item Statistics

	Mean	Std. Deviation	N
PEOU1	3,89	1,077	403
PEOU2	3,47	1,164	403
PEOU3	3,56	1,132	403
PEOU4	3,46	1,129	403

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PEOU1	10,49	10,181	,777	,924
PEOU2	10,91	9,589	,796	,919
PEOU3	10,82	9,218	,899	,884
PEOU4	10,91	9,438	,860	,897



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	8	3,553	2	,169	1,776
Saturated model	10	,000	0		
Independence model	4	1365,118	6	,000	227,520

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,009	,996	,979	,199
Saturated model	,000	1,000		
Independence model	,751	,362	-,063	,217

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,997	,992	,999	,997	,999
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,044	,000	,117	,445
Independence model	,751	,717	,784	,000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PEOU1_1	<---	PEOU	1,000				
PEOU2_1	<---	PEOU	1,118	,058	19,302	***	
PEOU3_1	<---	PEOU	1,256	,053	23,544	***	
PEOU4_1	<---	PEOU	1,190	,054	22,097	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
PEOU1_1	<---	PEOU	,801
PEOU2_1	<---	PEOU	,829
PEOU3_1	<---	PEOU	,957
PEOU4_1	<---	PEOU	,909

Factor 1			
	Lamda	Lamda-squared	Error variance
Item 1	0,801	0,64	0,36
Item 2	0,829	0,69	0,31
Item 3	0,957	0,92	0,08
Item 4	0,909	0,83	0,17
Item 5			
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	3,50	3,07	0,93
SummeQ	12,22	9,43	0,86
Composite factor reliability		**0,93**	
AVE		**0,77**	

Attitude towards usage (ATU)

Reliability Statistics

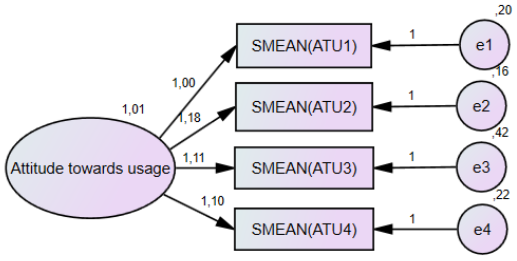
Cronbach's Alpha	N of Items
,950	4

Item Statistics

	Mean	Std. Deviation	N
ATU1	3,85	1,103	403
ATU2	3,55	1,258	403
ATU3	3,47	1,295	403
ATU4	3,76	1,205	403

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ATU1	10,78	12,538	,878	,936
ATU2	11,08	11,306	,913	,923
ATU3	11,16	11,529	,842	,947
ATU4	10,88	11,776	,893	,930



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	8	11,540	2	,003	5,770
Saturated model	10	,000	0		
Independence model	4	1691,405	6	,000	281,901

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,014	,987	,934	,197
Saturated model	,000	1,000		
Independence model	,948	,326	-,124	,195

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,993	,980	,994	,983	,994
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,109	,054	,173	,040
Independence model	,836	,803	,870	,000

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
ATU1_1 <--- ATU	1,000				
ATU2_1 <--- ATU	1,182	,035	33,864	***	
ATU3_1 <--- ATU	1,113	,042	26,573	***	
ATU4_1 <--- ATU	1,100	,035	31,197	***	

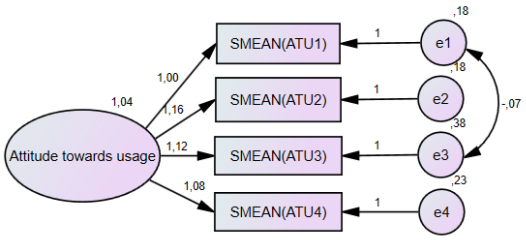
Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
ATU1_1 <--- ATU	,913
ATU2_1 <--- ATU	,947
ATU3_1 <--- ATU	,866
ATU4_1 <--- ATU	,920

Factor 1			
	Lamda	Lamda-squared	Error variance
Item 1	0,913	0,83	0,17
Item 2	0,947	0,90	0,10
Item 3	0,866	0,75	0,25
Item 4	0,92	0,85	0,15
Item 5			
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	3,65	3,33	0,67
SummeQ	13,29	11,07	0,45
Composite factor reliability		**0,95**	
AVE		**0,83**	

Covariances: (Group number 1 - Default model)

	M.I.	Par Change
e1 <--> e3	7,877	-,048



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	9	,111	1	,739	,111
Saturated model	10	,000	0		
Independence model	4	1691,405	6	,000	281,901

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,001	1,000	,999	,100
Saturated model	,000	1,000		
Independence model	,948	,326	-,124	,195

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	1,000	1,000	1,001	1,003	1,000
Saturated model	1,000		1,000		1,000

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,000	,000	,092	,839
Independence model	,836	,803	,870	,000

Regression Weights: (Group number 1 - Default model)

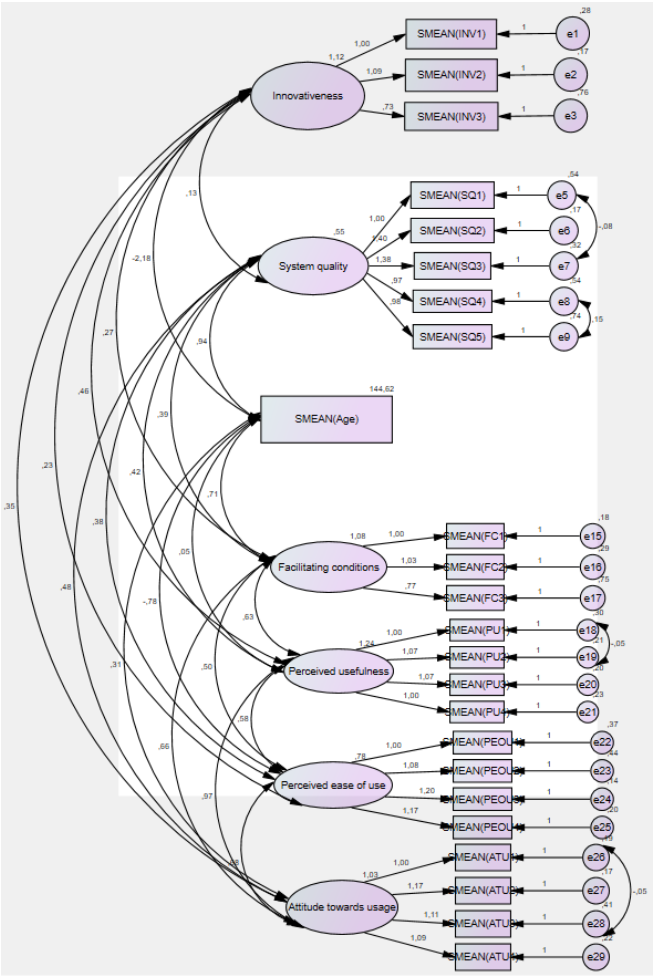
	Estimate	S.E.	C.R.	P	Label
ATU1_1 <--- ATU	1,000				
ATU2_1 <--- ATU	1,160	,034	33,967	***	
ATU3_1 <--- ATU	1,118	,044	25,443	***	
ATU4_1 <--- ATU	1,084	,034	31,620	***	

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
ATU1_1 <--- ATU	,924
ATU2_1 <--- ATU	,941
ATU3_1 <--- ATU	,880
ATU4_1 <--- ATU	,917

Factor 1			
	Lamda	Lamda-squared	Error variance
Item 1	0,924	0,85	0,15
Item 2	0,941	0,89	0,11
Item 3	0,88	0,77	0,23
Item 4	0,917	0,84	0,16
Item 5			
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	3,66	3,35	0,65
SummeQ	13,41	11,25	0,42
Composite factor reliability		**0,95**	
AVE		**0,84**	

Initial measurement model



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	72	568,113	228	,000	2,492
Saturated model	300	,000	0		
Independence model	24	9132,206	276	,000	33,088

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,127	,895	,861	,680
Saturated model	,000	1,000		
Independence model	,689	,165	,092	,152

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,938	,925	,962	,954	,962
Saturated model	1,000		1,000		1,000

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,061	,055	,067	,002
Independence model	,283	,278	,288	,000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
INV1_1	<---	Innovativeness	1,000				
INV2_1	<---	Innovativeness	1,092	,048	22,948	***	
INV3_1	<---	Innovativeness	,725	,048	15,203	***	
SQ1_1	<---	SQ	1,000				
SQ2_1	<---	SQ	1,403	,083	16,961	***	
SQ3_1	<---	SQ	1,375	,089	15,371	***	
SQ4_1	<---	SQ	,965	,073	13,236	***	
SQ5_1	<---	SQ	,976	,080	12,247	***	
FC1_1	<---	FQ	1,000				
FC2_1	<---	FQ	1,031	,043	24,211	***	
FC3_1	<---	FQ	,767	,048	15,922	***	
PU1_1	<---	PU	1,000				
PU2_1	<---	PU	1,066	,037	28,436	***	
PU3_1	<---	PU	1,071	,034	31,133	***	
PU4_1	<---	PU	,997	,034	29,488	***	
PEOU1_1	<---	PEOU	1,000				
PEOU2_1	<---	PEOU	1,076	,054	19,795	***	
PEOU3_1	<---	PEOU	1,204	,049	24,737	***	
PEOU4_1	<---	PEOU	1,167	,049	23,674	***	
ATU1_1	<---	ATU	1,000				
ATU2_1	<---	ATU	1,172	,033	35,159	***	
ATU3_1	<---	ATU	1,110	,044	25,514	***	
ATU4_1	<---	ATU	1,093	,034	32,245	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
INV1_1	<---	Innovativeness	,895
INV2_1	<---	Innovativeness	,940
INV3_1	<---	Innovativeness	,659
SQ1_1	<---	SQ	,709
SQ2_1	<---	SQ	,930
SQ3_1	<---	SQ	,874
SQ4_1	<---	SQ	,695

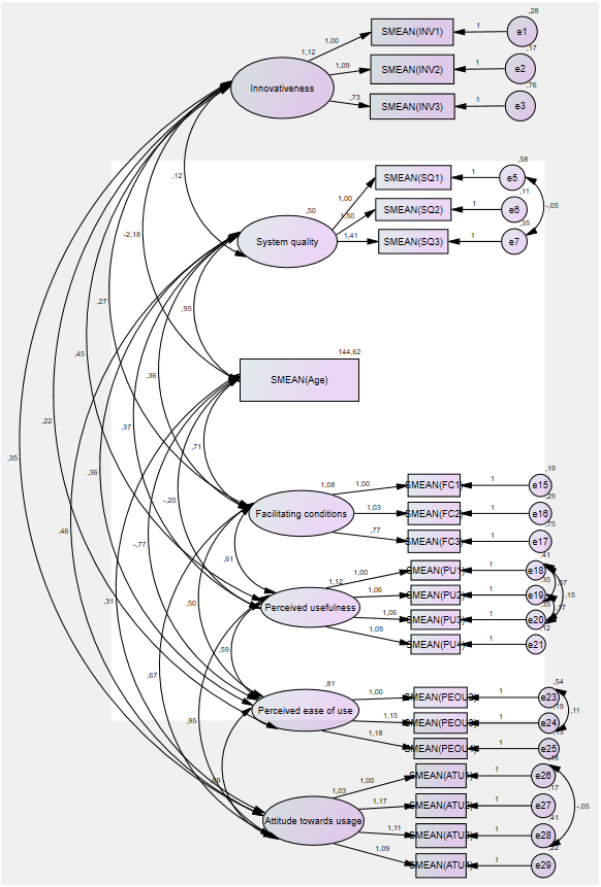
			Estimate
SQ5_1	<---	SQ	,642
FC1_1	<---	FQ	,924
FC2_1	<---	FQ	,895
FC3_1	<---	FQ	,678
PU1_1	<---	PU	,899
PU2_1	<---	PU	,934
PU3_1	<---	PU	,937
PU4_1	<---	PU	,918
PEOU1_1	<---	PEOU	,824
PEOU2_1	<---	PEOU	,820
PEOU3_1	<---	PEOU	,943
PEOU4_1	<---	PEOU	,917
ATU1_1	<---	ATU	,920
ATU2_1	<---	ATU	,945
ATU3_1	<---	ATU	,870
ATU4_1	<---	ATU	,920

Covariances: (Group number 1 - Default model)

			M.I.	Par Change
e29	<-->	PU	7,351	,043
e29	<-->	Innovativeness	8,468	-,076
e28	<-->	FQ	4,052	-,059
e28	<-->	Innovativeness	8,473	,100
e27	<-->	FQ	4,254	-,042
e27	<-->	SQ	4,536	,030
e26	<-->	PEOU	7,811	,040
e26	<-->	PU	12,989	-,054
e26	<-->	FQ	5,219	,047
e24	<-->	PEOU	6,123	,034
e24	<-->	FQ	8,643	-,061
e23	<-->	ATU	4,276	-,033
e23	<-->	PEOU	10,350	,067
e23	<-->	e24	10,480	,053
e22	<-->	ATU	15,046	,057
e22	<-->	PEOU	38,120	-,118
e22	<-->	FQ	7,510	,075
e22	<-->	e26	6,430	,040
e22	<-->	e24	6,039	-,037
e21	<-->	ATU	25,934	,061
e21	<-->	PU	31,638	-,091
e21	<-->	e29	11,124	,046
e21	<-->	e26	10,508	,042
e21	<-->	e25	4,549	-,030
e21	<-->	e22	10,301	,055

			M.I.	Par Change
e20	<-->	ATU	8,848	-,034
e20	<-->	PU	8,027	,044
e20	<-->	e26	20,116	-,056
e20	<-->	e22	12,046	-,057
e19	<-->	e20	6,238	,032
e17	<-->	PEOU	7,939	,075
e9	<-->	PU	9,131	,079
e9	<-->	FQ	5,457	,084
e9	<-->	SQ	7,247	-,066
e9	<-->	e29	10,008	,069
e9	<-->	e27	12,980	-,073
e9	<-->	e20	4,130	,044
e9	<-->	e15	5,129	,056
e8	<-->	Age_1	4,628	-,909
e8	<-->	FQ	5,448	,073
e8	<-->	e25	13,237	,070
e8	<-->	e24	8,025	-,050
e8	<-->	e18	6,912	-,058
e8	<-->	e15	4,587	,046
e7	<-->	e19	4,024	,035
e7	<-->	e9	6,105	-,068
e6	<-->	e27	8,819	,039
e6	<-->	e23	5,062	-,043
e5	<-->	Age_1	4,526	-,949
e5	<-->	e23	8,149	,077
e2	<-->	e18	13,519	-,070
e2	<-->	e5	7,081	-,064
e1	<-->	e18	8,494	,056

Final measurement model



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	68	268,155	163	,000	1,645
Saturated model	231	,000	0		
Independence model	21	8028,947	210	,000	38,233

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,114	,940	,915	,663
Saturated model	,000	1,000		
Independence model	,718	,184	,102	,167

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,967	,957	,987	,983	,987
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,040	,031	,048	,975
Independence model	,304	,299	,310	,000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
INV1_1	<---	Innovativeness	1,000				
INV2_1	<---	Innovativeness	1,092	,048	22,963	***	
INV3_1	<---	Innovativeness	,726	,048	15,208	***	
SQ1_1	<---	SQ	1,000				
SQ2_1	<---	SQ	1,496	,099	15,062	***	
SQ3_1	<---	SQ	1,408	,093	15,065	***	
FC1_1	<---	FQ	1,000				
FC2_1	<---	FQ	1,032	,043	24,152	***	
FC3_1	<---	FQ	,767	,048	15,917	***	
PU1_1	<---	PU	1,000				
PU2_1	<---	PU	1,061	,039	27,023	***	
PU3_1	<---	PU	1,060	,035	30,685	***	
PU4_1	<---	PU	1,093	,040	27,254	***	
PEOU2_1	<---	PEOU	1,000				
PEOU3_1	<---	PEOU	1,155	,047	24,482	***	
PEOU4_1	<---	PEOU	1,184	,060	19,712	***	
ATU1_1	<---	ATU	1,000				
ATU2_1	<---	ATU	1,168	,033	35,087	***	
ATU3_1	<---	ATU	1,108	,043	25,524	***	
ATU4_1	<---	ATU	1,094	,034	32,592	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
INV1_1	<---	Innovativeness	,894
INV2_1	<---	Innovativeness	,941
INV3_1	<---	Innovativeness	,659
SQ1_1	<---	SQ	,682
SQ2_1	<---	SQ	,955
SQ3_1	<---	SQ	,861
FC1_1	<---	FQ	,924
FC2_1	<---	FQ	,895
FC3_1	<---	FQ	,678
PU1_1	<---	PU	,856
PU2_1	<---	PU	,886
PU3_1	<---	PU	,884
PU4_1	<---	PU	,959
PEOU2_1	<---	PEOU	,776

			Estimate
PEOU3_1	<---	PEOU	,921
PEOU4_1	<---	PEOU	,947
ATU1_1	<---	ATU	,921
ATU2_1	<---	ATU	,943
ATU3_1	<---	ATU	,869
ATU4_1	<---	ATU	,922

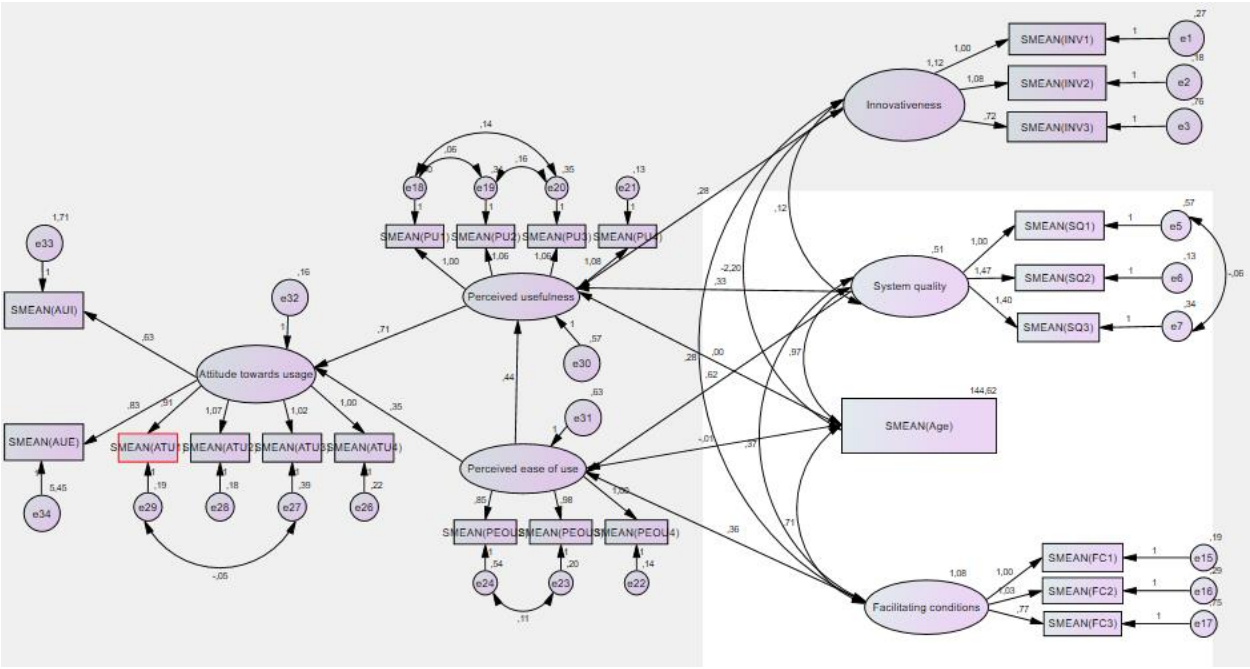
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
INV_MEAN	403	1,00	5,00	3,6220	1,05916
SQ_MEAN	384	1,00	5,00	3,7457	1,00527
FC_MEAN	403	1,00	5,00	3,8271	1,03752
PU_MEAN	403	1,00	5,00	3,5354	1,17359
PEOU_MEAN	403	1,00	5,00	3,4963	1,06358
ATU_MEAN	403	1,00	5,00	3,6588	1,13497
Valid N (listwise)	384				

Correlations

		INV_MEAN	SQ_MEAN	FC_MEAN	PU_MEAN	PEOU_MEAN	ATU_MEAN
INV_MEAN	Pearson Correlation	1	,160	,253	,357	,200	,308
	Sig. (2-tailed)		,002	,000	,000	,000	,000
	N	403	384	403	403	403	403
SQ_MEAN	Pearson Correlation	,160	1	,469	,485	,524	,611
	Sig. (2-tailed)	,002		,000	,000	,000	,000
	N	384	384	384	384	384	384
FC_MEAN	Pearson Correlation	,253	,469	1	,508	,503	,591
	Sig. (2-tailed)	,000	,000		,000	,000	,000
	N	403	384	403	403	403	403
PU_MEAN	Pearson Correlation	,357	,485	,508	1	,523	,829
	Sig. (2-tailed)	,000	,000	,000		,000	,000
	N	403	384	403	403	403	403
PEOU_MEAN	Pearson Correlation	,200	,524	,503	,523	1	,676
	Sig. (2-tailed)	,000	,000	,000	,000		,000
	N	403	384	403	403	403	403
ATU_MEAN	Pearson Correlation	,308	,611	,591	,829	,676	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	
	N	403	384	403	403	403	403

Initial structural model



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	66	493,844	210	,000	2,352
Saturated model	276	,000	0		
Independence model	23	8336,503	253	,000	32,951

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,176	,900	,869	,685
Saturated model	,000	1,000		
Independence model	,722	,186	,112	,170

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,941	,929	,965	,958	,965
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,058	,051	,065	,024
Independence model	,282	,277	,287	,000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PEOU	<---	FC	,360	,052	6,951	***	
PEOU	<---	SQ	,619	,081	7,630	***	
PEOU	<---	Age	-,012	,004	-3,251	,001	
PU	<---	INV	,276	,043	6,464	***	
PU	<---	SQ	,328	,079	4,157	***	
PU	<---	PEOU	,437	,053	8,194	***	
PU	<---	Age	,004	,004	1,223	,221	
ATU	<---	PU	,713	,041	17,488	***	
ATU	<---	PEOU	,350	,034	10,303	***	
INV1_1	<---	INV	1,000				
INV2_1	<---	INV	1,084	,047	23,066	***	
INV3_1	<---	INV	,725	,048	15,245	***	
SQ1_1	<---	SQ	1,000				
SQ2_1	<---	SQ	1,471	,098	14,956	***	
SQ3_1	<---	SQ	1,405	,093	15,087	***	
FC1_1	<---	FC	1,000				
FC2_1	<---	FC	1,032	,044	23,679	***	
PU1_1	<---	PU	1,000				
PU2_1	<---	PU	1,061	,039	26,917	***	
PU3_1	<---	PU	1,057	,035	30,533	***	
PU4_1	<---	PU	1,083	,040	27,172	***	
PEOU4_1	<---	PEOU	1,000				
PEOU3_1	<---	PEOU	,979	,034	29,097	***	
PEOU2_1	<---	PEOU	,848	,042	20,006	***	
ATU4_1	<---	ATU	1,000				
ATU3_1	<---	ATU	1,020	,037	27,775	***	
ATU2_1	<---	ATU	1,066	,030	35,054	***	
ATU1_1	<---	ATU	,911	,029	31,914	***	
AUI	<---	ATU	,633	,062	10,267	***	
AUE	<---	ATU	,832	,109	7,642	***	
FC3_1	<---	FC	,769	,048	15,883	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
PEOU	<---	FC	,352
PEOU	<---	SQ	,417
PEOU	<---	Age	-,132
PU	<---	INV	,276
PU	<---	SQ	,222
PU	<---	PEOU	,439
PU	<---	Age	,049
ATU	<---	PU	,685

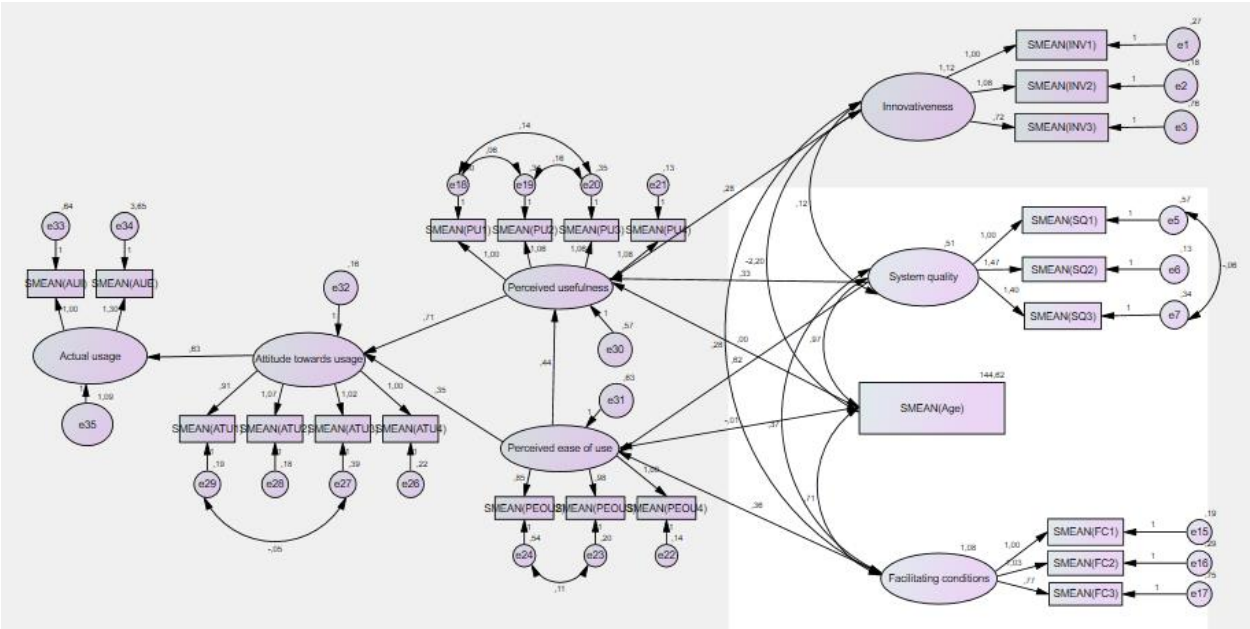
			Estimate
ATU	<---	PEOU	,337
INV1_1	<---	INV	,897
INV2_1	<---	INV	,937
INV3_1	<---	INV	,661
SQ1_1	<---	SQ	,689
SQ2_1	<---	SQ	,948
SQ3_1	<---	SQ	,867
FC1_1	<---	FC	,923
FC2_1	<---	FC	,895
PU1_1	<---	PU	,859
PU2_1	<---	PU	,888
PU3_1	<---	PU	,884
PU4_1	<---	PU	,953
PEOU4_1	<---	PEOU	,943
PEOU3_1	<---	PEOU	,921
PEOU2_1	<---	PEOU	,776
ATU4_1	<---	ATU	,921
ATU3_1	<---	ATU	,874
ATU2_1	<---	ATU	,941
ATU1_1	<---	ATU	,917
AUI	<---	ATU	,471
AUE	<---	ATU	,366
FC3_1	<---	FC	,679

Covariances: (Group number 1 - Default model)

			M.I.	Par Change
e30	<-->	FC	20,907	,176
e30	<-->	SQ	4,410	-,056
e32	<-->	SQ	8,521	,048
e32	<-->	e31	12,224	-,075
e17	<-->	e31	13,765	,142
e34	<-->	SQ	4,335	-,160
e34	<-->	INV	7,653	,339
e34	<-->	e32	5,667	-,140
e33	<-->	INV	8,949	,206
e33	<-->	e34	84,533	1,410
e29	<-->	FC	7,338	,063
e29	<-->	e30	16,089	-,080
e28	<-->	SQ	12,903	,058
e28	<-->	e34	5,864	-,138
e27	<-->	INV	8,082	,101
e26	<-->	FC	6,171	,061
e26	<-->	INV	8,206	-,078
e26	<-->	e31	4,734	-,048

			M.I.	Par Change
e26	<-->	e30	11,192	,070
e24	<-->	e30	8,293	-,081
e23	<-->	FC	7,094	-,061
e23	<-->	e33	5,799	,076
e21	<-->	Age	5,630	-,703
e21	<-->	SQ	6,851	-,043
e21	<-->	e34	12,620	,210
e21	<-->	e33	5,609	,078
e21	<-->	e28	9,436	-,038
e21	<-->	e26	6,842	,034
e20	<-->	e29	13,578	-,046
e19	<-->	e34	4,444	-,132
e19	<-->	e23	4,019	-,026
e16	<-->	e26	5,016	,038
e15	<-->	e30	6,425	,061
e7	<-->	e34	5,246	-,176
e7	<-->	e19	4,043	,035
e6	<-->	e32	5,140	,032
e6	<-->	e28	6,968	,036
e6	<-->	e24	5,817	-,046
e6	<-->	e21	5,583	-,033
e5	<-->	Age	4,225	-,946
e5	<-->	e28	5,339	-,044
e5	<-->	e24	8,721	,081
e2	<-->	FC	4,122	-,061
e2	<-->	e20	5,147	,036
e2	<-->	e18	13,190	-,069
e2	<-->	e5	7,626	-,068
e1	<-->	e18	8,595	,055

Final structural model



CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	67	399,537	209	,000	1,912
Saturated model	276	,000	0		
Independence model	23	8336,503	253	,000	32,951

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	,155	,919	,894	,696
Saturated model	,000	1,000		
Independence model	,722	,186	,112	,170

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	,952	,942	,977	,971	,976
Saturated model	1,000		1,000		1,000
Independence model	,000	,000	,000	,000	,000

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	,048	,041	,055	,703
Independence model	,282	,277	,287	,000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PEOU	<---	FC	,360	,052	6,952	***	
PEOU	<---	SQ	,619	,081	7,632	***	
PEOU	<---	Age	-,012	,004	-3,249	,001	
PU	<---	INV	,276	,043	6,459	***	
PU	<---	SQ	,328	,079	4,159	***	
PU	<---	PEOU	,437	,053	8,191	***	
PU	<---	Age	,004	,004	1,225	,220	
ATU	<---	PU	,711	,041	17,422	***	
ATU	<---	PEOU	,352	,034	10,332	***	
AU	<---	ATU	,625	,062	10,115	***	
INV1_1	<---	INV	1,000				
INV2_1	<---	INV	1,084	,047	23,065	***	
INV3_1	<---	INV	,725	,048	15,245	***	
SQ1_1	<---	SQ	1,000				
SQ2_1	<---	SQ	1,471	,098	14,957	***	
SQ3_1	<---	SQ	1,405	,093	15,087	***	
FC1_1	<---	FC	1,000				
FC2_1	<---	FC	1,032	,044	23,679	***	
PU1_1	<---	PU	1,000				
PU2_1	<---	PU	1,061	,039	26,919	***	
PU3_1	<---	PU	1,057	,035	30,533	***	
PU4_1	<---	PU	1,082	,040	27,146	***	
PEOU4_1	<---	PEOU	1,000				
PEOU3_1	<---	PEOU	,979	,034	29,102	***	
PEOU2_1	<---	PEOU	,848	,042	20,011	***	
ATU4_1	<---	ATU	1,000				
ATU3_1	<---	ATU	1,019	,037	27,752	***	
ATU2_1	<---	ATU	1,067	,030	35,168	***	
ATU1_1	<---	ATU	,911	,028	32,013	***	
FC3_1	<---	FC	,769	,048	15,884	***	
AUI_1	<---	AU	1,000				
AUE_1	<---	AU	1,300	,160	8,135	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
PEOU	<---	FC	,352
PEOU	<---	SQ	,417
PEOU	<---	Age	-,132
PU	<---	INV	,276
PU	<---	SQ	,222
PU	<---	PEOU	,439
PU	<---	Age	,049
ATU	<---	PU	,683
ATU	<---	PEOU	,339

			Estimate
AU	<---	ATU	,552
INV1_1	<---	INV	,897
INV2_1	<---	INV	,937
INV3_1	<---	INV	,661
SQ1_1	<---	SQ	,689
SQ2_1	<---	SQ	,948
SQ3_1	<---	SQ	,867
FC1_1	<---	FC	,923
FC2_1	<---	FC	,895
PU1_1	<---	PU	,859
PU2_1	<---	PU	,888
PU3_1	<---	PU	,884
PU4_1	<---	PU	,953
PEOU4_1	<---	PEOU	,943
PEOU3_1	<---	PEOU	,920
PEOU2_1	<---	PEOU	,776
ATU4_1	<---	ATU	,921
ATU3_1	<---	ATU	,873
ATU2_1	<---	ATU	,942
ATU1_1	<---	ATU	,917
FC3_1	<---	FC	,679
AUI_1	<---	AU	,843
AUE_1	<---	AU	,648

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
PEOU	,442
PU	,490
ATU	,865
AU	,305
AUE_1	,420
AUI_1	,711
FC3_1	,461
ATU1_1	,841
ATU2_1	,887
ATU3_1	,762
ATU4_1	,849
PEOU2_1	,602
PEOU3_1	,847
PEOU4_1	,890
PU4_1	,908
PU3_1	,782
PU2_1	,789
PU1_1	,738

	Estimate
FC2_1	,801
FC1_1	,852
SQ3_1	,751
SQ2_1	,898
SQ1_1	,474
INV3_1	,436
INV2_1	,878
INV1_1	,805

Actual usage (AU):

Factor 1			
	Lamda	Lamda-squared	Error variance
Item 1	0,843	0,71	0,29
Item 2	0,648	0,42	0,58
Item 3			
Item 4			
Item 5			
Item 6			
Item 7			
Item 8			
item 9			
Item 10			
SummeQ	1,49	1,13	0,87
SummeQ	2,22	1,28	0,76
Composite factor reliability		**0,72**	
AVE		**0,57**	

Additional tests

Correlations

		SQ1	SQ2	SQ3	SQ4	SQ5	AUI	AUE
SQ1	Pearson Correlation	1	,654**	,550**	,528**	,517**	,260**	,189**
	Sig. (2-tailed)		,000	,000	,000	,000	,000	,000
	N	384	384	384	384	384	384	384
SQ2	Pearson Correlation	,654**	1	,821**	,632**	,588**	,286**	,167**
	Sig. (2-tailed)	,000		,000	,000	,000	,000	,001
	N	384	384	384	384	384	384	384
SQ3	Pearson Correlation	,550**	,821**	1	,605**	,516**	,209**	,096
	Sig. (2-tailed)	,000	,000		,000	,000	,000	,059
	N	384	384	384	384	384	384	384
SQ4	Pearson Correlation	,528**	,632**	,605**	1	,577**	,138**	,076
	Sig. (2-tailed)	,000	,000	,000		,000	,007	,139
	N	384	384	384	384	384	384	384
SQ5	Pearson Correlation	,517**	,588**	,516**	,577**	1	,211**	,142**
	Sig. (2-tailed)	,000	,000	,000	,000		,000	,005
	N	384	384	384	384	384	384	384
AUI	Pearson Correlation	,260**	,286**	,209**	,138**	,211**	1	,547**
	Sig. (2-tailed)	,000	,000	,000	,007	,000		,000
	N	384	384	384	384	384	403	403
AUE	Pearson Correlation	,189**	,167**	,096	,076	,142**	,547**	1
	Sig. (2-tailed)	,000	,001	,059	,139	,005	,000	
	N	384	384	384	384	384	403	403

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		FC_Assistance_1	FC_Assistance_2	FC_Assistance_3	FC_Assistance_4	FC_Assistance_5	FC_Measures_1	FC_Measures_2	FC_Measures_3	AUI	AUE
FC_Assistance_1	Pearson Correlation	1	,226**	,217**	,105*	,137**	,050	,127*	,046	,083	,118*
	Sig. (2-tailed)		,000	,000	,035	,006	,319	,010	,361	,097	,018
	N	403	403	403	403	403	403	403	403	403	403
FC_Assistance_2	Pearson Correlation	,226**	1	,186**	-,034	,127*	,151**	,091	-,016	,075	,159**
	Sig. (2-tailed)	,000		,000	,495	,010	,002	,068	,750	,133	,001
	N	403	403	403	403	403	403	403	403	403	403
FC_Assistance_3	Pearson Correlation	,217**	,186**	1	,099*	,172**	,093	,106*	,149**	,122*	,201**
	Sig. (2-tailed)	,000	,000		,048	,001	,061	,034	,003	,014	,000
	N	403	403	403	403	403	403	403	403	403	403
FC_Assistance_4	Pearson Correlation	,105*	-,034	,099*	1	-,016	,041	,145**	,008	,149**	,168**
	Sig. (2-tailed)	,035	,495	,048		,741	,409	,004	,877	,003	,001
	N	403	403	403	403	403	403	403	403	403	403
FC_Assistance_5	Pearson Correlation	,137**	,127*	,172**	-,016	1	,103*	,099*	,065	,153**	,133**
	Sig. (2-tailed)	,006	,010	,001	,741		,038	,046	,193	,002	,008
	N	403	403	403	403	403	403	403	403	403	403
FC_Measures_1	Pearson Correlation	,050	,151**	,093	,041	,103*	1	-,005	,067	,026	,095
	Sig. (2-tailed)	,319	,002	,061	,409	,038		,912	,177	,609	,055
	N	403	403	403	403	403	403	403	403	403	403
FC_Measures_2	Pearson Correlation	,127*	,091	,106*	,145**	,099*	-,005	1	,079	,144**	,187**
	Sig. (2-tailed)	,010	,068	,034	,004	,046	,912		,114	,004	,000
	N	403	403	403	403	403	403	403	403	403	403
FC_Measures_3	Pearson Correlation	,046	-,016	,149**	,008	,065	,067	,079	1	,210**	,137**
	Sig. (2-tailed)	,361	,750	,003	,877	,193	,177	,114		,000	,006
	N	403	403	403	403	403	403	403	403	403	403
AUI	Pearson Correlation	,083	,075	,122*	,149**	,153**	,026	,144**	,210**	1	,547**
	Sig. (2-tailed)	,097	,133	,014	,003	,002	,609	,004	,000		,000
	N	403	403	403	403	403	403	403	403	403	403
AUE	Pearson Correlation	,118*	,159**	,201**	,168**	,133**	,095	,187**	,137**	,547**	1
	Sig. (2-tailed)	,018	,001	,000	,001	,008	,055	,000	,006	,000	
	N	403	403	403	403	403	403	403	403	403	403

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).