2013

Students' Intentions to Use Wikis in Higher Education

Christian Kummer

Technische Universität Dresden, Dresden, Germany, christian.kummer@tu-dresden.de

Students' Intentions to Use Wikis in Higher Education

Christian Kummer

Technische Universität Dresden, Dresden, Germany
christian.kummer@tu-dresden.de

Abstract. Although wikis have gained considerable attention in higher education, students are often reluctant to use wikis in formal learning processes. Unlike company employees, students are not often rewarded for their participation in wiki-based assignments. Therefore, students seem to be opportunistic and decide to adopt wikis if they fit their current situation and preferences. This paper adapts the Decomposed Theory of Planned Behaviour to examine the situation in higher education classrooms. To better understand students' decision to use wikis, we introduced an intrinsic and extrinsic motivation construct. A survey was conducted with 133 first semester students to test the proposed model. The results provide support for the importance of an intrinsic and extrinsic motivation construct to explain influence on students' wiki use.

Keywords: technology acceptance, wiki, intrinsic motivation, extrinsic motivation, decomposed theory of planned behaviour

1   Introduction

The Web 2.0 has attracted considerable attention over the past few years. Social networking sites, blogs, wikis, podcasts, and more have changed the way that people search for, obtain, and share information. This change has had a substantial impact not only on our private lives but also on higher education [13]. Many educators have started to adapt and incorporate technology into their classrooms. Wikis especially have become popular with the development of the Web 2.0 and have gained reasonable attention in higher education. A wiki is a "freely expandable collection of interlinked web pages, a hypertext system for storing and modifying information – a database where each page is easily editable by any user" [25]. Wikis have been used to support collaborative learning [44], collaborative writing [24], and student engagement [28]. Although wikis are not a new phenomenon in higher education [19], there is still uncertainty about how to integrate wikis into classroom efficiently. As a consequence, instructors are struggling with students that are reluctant to use wikis [11], [14]. At the same time, there is a lack of empirically tested research [18], [27] about the students' perception of using wikis in formal learning processes within higher education.

   The goal of this paper is to address this research gap by exploring factors that influence students' decision to adopt wikis within formal learning processes in higher

education. Our research is distinctive for three reasons: first, we use the Decomposed Theory of Planned Behaviour (DTPB) [37] as a theoretical background for this study, which has not been previously tested in this context. Prior research only investigated students' intentions towards the whole software category, Web 2.0 [21], and is therefore limited. Students' decisions to adopt particular software depend on the context: e.g. the intention to voluntarily use social bookmarks in a classroom is different from the intention to write a graded assignment in a wiki. Second, we adapt the DTBP to suit the specific context of using wikis within formal learning processes in higher education. This is necessary because the motivation to use wikis is different from other contexts. Therefore, we included two constructs that represent the influence of intrinsic and extrinsic motivation on students' intention to use wikis. Based on literature, we integrate perceived enjoyment [22] and anticipated rewards [6]. In combination, these constructs allow us to understand the different motivations that are crucial for the adoption of a particular technology. Third, by modelling perceived usefulness as an influence on behavioural intention and by removing attitude, we take previously reported substitution effects from studies [38], [42] into account for the DTPB. The revised model was tested using a survey of first semester students in an introductory course on information systems. We then examined the proposed hypotheses using the partial least square approach to data analysis.

The paper is structured as follows: in the second section, we propose an adapted model of technology acceptance of wikis in higher education. Within the third section, we explain the methodology of our study. The results of the study are presented in the fourth chapter. The fifth chapter discusses the results and shows how instructors could benefit from these results. Finally, the next research steps are outlined.

2   Theoretical Model

The theoretical framework used in this study is based on the Decomposed Theory of Planned Behaviour [37]. The DTPB has its origin in the Theory of Planned Behaviour [2]. The TPB asserts that an individuals' usage behaviour is a direct function of perceived behavioural usefulness and behavioural intention that in turn is a function of attitude, subjective norm, and perceived behavioural control. The DTPB extends the TPB by adding further influence factors on attitude and perceived behavioural control, resulting in more explanatory power [37]. As this study did not test a particular wiki implementation, we omitted usage behaviour because it cannot be measured without using a wiki. Therefore, behavioural intention is used as the strongest predictor of actual use. For this reason, we favoured the DTPB over the Technology Acceptance Model (TAM) [12] because the DTPB allows a better prediction of the behavioural intention than the TAM [37]. The proposed model (see Figure 1) can be used to test influences on wiki adoption without relying on a specific wiki implementation.

As a consequence, we removed perceived ease of use as an influence on perceived usefulness for three reasons. First, we did not test a particular wiki implementation. Although different wiki implementations have basis functionality in common, ease of

use is dependent on a particular wiki implementation. Second, today's students are comfortable with nearly every form of technology [30]. Perceived ease of use is moderated by experience. Therefore, perceived ease of use is not that important in forming behavioural intention if the users are already familiar with the technology [40], [43]. Third, a wiki is web-based application. Perceived ease of use did not appear as a significant determinant when access to a system is provided by a graphical front-end and a browser [1]. Therefore, we removed perceived ease of use in order to get a model that is as parsimonious as possible, but facilitates the understanding of students' decision to adopt wikis [3], [37].

In the following, we introduce an adapted DTPB that is used to study factors influencing students' behavioural intention to use wikis if they are provided within formal learning processes in higher education classrooms.
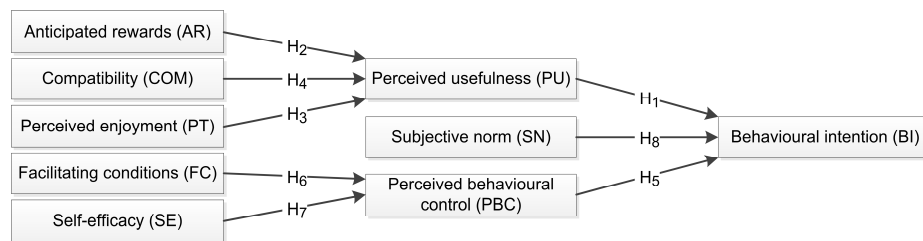

Fig. 1. Research model

2.1 Perceived Usefulness

In contrast to the DTPB, we replaced attitude with perceived usefulness because attitude is not always a reliable predictor of behavioural intention. Attitude is not significant if constructs related to performance and effort expectancies are included in the model [42]. Research results suggest that attitude can be substituted with perceived usefulness [38], [42].

Perceived usefulness (PU) is defined as the "prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" [12]. Previous studies have shown strong empirical support that perceived usefulness positively influences behavioural intention [37], [43]. In the context of wikis in formal learning processes, perceived usefulness is viewed as the degree to which students believe that using wikis will help them learn better. Hence, perceived usefulness is hypothesised to positively influence the behavioural intention.

Hypothesis 1: Perceived usefulness will positively influence students' intentions to use wikis.

The situation in higher education classrooms is different than the situation in small and medium-sized companies, for example. Unlike company employees, students are often not rewarded for their participation in wiki-based assignments if they are not mandatory [14]. Therefore, students seem to be opportunistic, and they will decide to adopt wikis in formal learning processes only if they fit their current situation and

preferences. Students choose an approach to learning by interpreting the "teaching context in the light of their own preconceptions and motivations" [5]. Although the DTPB already takes individual preconceptions (e.g. perceived usefulness) and context (e.g. facilitating conditions) into account, motivations to adopt a particular technology are disregarded. The motivation to use a particular technology depends on their application; e.g. a student's motivation when using wikis for a graded assignment is probably different from their motivation when commenting on a lecture via a social network service.

Taking this situation into account, we integrated anticipated rewards [6] and perceived enjoyment [22] as new constructs that explain students' extrinsic and intrinsic motivation. Extrinsic motivation refers to something that is done because it results in a nameable outcome, whereas intrinsic motivation refers to something that is done because it is "inherently interesting or enjoyable" [35].

Anticipated Rewards. Different studies have shown that students do not use wikis unless it is mandatory or if they are rewarded for their work [11], [14]. Hence, we argue that *anticipated* extrinsic *rewards* (AR) like graded assignments cause a higher degree of perceived usefulness of wikis [45]. Anticipated rewards are defined as the "degree to which one believes that one will receive extrinsic incentives" [6] for using wikis within formal learning processes. Therefore, anticipated rewards reflect the reward-based superior influence on students' intentions.

Hypothesis 2: Anticipated rewards will positively influence perceived usefulness.

Perceived Enjoyment. The variety of motives to contribute to Wikipedia shows [29] that people do not only participate if they are rewarded. Therefore, there are students who are intrinsically motivated to use wikis. In formal learning processes, these students enjoy using wikis because every participant can read their contributions. This gave them the "feeling of teaching other users and sharing knowledge" [33]. These students "enjoy the process and do not perceive it as being effortful compared to those who have less intrinsic motivation" [41]. Due to its facilitating effect, we included *perceived enjoyment* (PT) as an intrinsic motivator construct that positively influences perceived usefulness.

Hypothesis 3: Perceived enjoyment will positively influence perceived usefulness.

Compatibility. Conformant to the DTPB, we included the *compatibility* (COM) of an information system in the theoretical model. Compatibility is generally regarded as the degree to which an information system is congruous with the potential user's existing values, previous experiences, and current needs [37]. In this study, we used Chen's definition of educational compatibility as the degree to which a wiki "complies with the overall learning expectancy of students, including the current learning situation, the learning style, and the preference of conducting learning activities" [8]. Hence, it is expected that an increasing compatibility of the learning style and learning situation with wikis will positively influence the perceived usefulness of wikis in formal learning processes.

Hypothesis 4: Compatibility will positively influence perceived usefulness.

2.2 Perceived Behavioural Control

Individuals do not have complete control over their behaviour in some circumstances. *Perceived behavioural control* (PBC) reflects the level of control individuals feel they have over their own behaviour. It is an important determinant of intention because individuals' behavioural intention is strongly influenced by their perception of the ability to perform it [2], [37]. Regarding students' use of wikis in formal learning processes, perceived behavioural control reflects the students' feeling about their confidence in using wikis and the availability of resources needed to use them.

Hypothesis 5: Perceived behavioural control over wikis will positively influence students' intentions to use wikis.

Facilitating Conditions. The first component influencing perceived behavioural control describes the necessary resources to engage in a behaviour [2], [37]. These *facilitating conditions* (FC) influence the behavioural intentions and the actual use of the technology. In our context, missing resources such as time and technology hinder the use of wikis for formal learning processes.

Hypothesis 6: The availability of facilitating conditions will positively influence perceived behavioural control.

Self-efficacy. *Self-efficacy* (SE) beliefs can influence individuals' behavioural intentions and therefore their actions. This describes an individual's confidence in the ability to perform a behaviour [2], [4]. In the context of wikis in formal learning processes, self-efficacy defines the students' perception of their abilities to use a wiki in higher education classrooms.

Hypothesis 7: Self-efficacy will positively influence perceived behavioural control.

2.3 Subjective Norm

Subjective norm (SN) is defined as the degree to which an "individual perceives that most people who are important to him think he should or should not use the system" [43]. With regard to wikis in formal learning processes, the students' perception of the use of wikis can be influenced by persons important to them. In contrast to the DTPB, we have not distinguished between peer and superior influence because previous studies showed no significant influence of superior influence on students' intentions and perceptions [32], [36].

Hypothesis 8: Subjective norm will positively influence students' intentions to use wikis.

3   Method

To test the model, a survey was conducted to investigate students' intentions to use wikis in higher education classrooms. The survey consisted of a questionnaire developed from material discussed and tested previously [6], [8], [22-23], [37], [39], [43]; see Table 1 for a list of the items. Because this study did not focus on a particular wiki implementation, the students were told to imagine a learning scenario where they collaboratively contribute information to a wiki with their fellow students. The items were slightly modified to suit the context and translated into German. We gave the German items to a peer for back-translation into English to check whether they result in items similar to the originals. Afterwards, wording and translation changes were included in the questionnaire. Each construct was measured using a five-point Likert scale, ranging from "strongly disagree" to "strongly agree".

The study was conducted January 2012 among first semester students enrolled in an introductory course in information systems at a large German university. Participation in the survey was completely voluntary. 425 questionnaires were handed out at the beginning of the lecture and were collected afterwards. 245 questionnaires were returned, at least partly filled out. 133 data records remained after discarding incomplete questionnaires. The participants included 76 males (57.1%) and 57 females (42.9%). Most of the participants were between 18 and 23 years of age (n = 124; 93.2%), and the remaining students (n = 9; 6.8%) were under 29 years of age. The participants were students of economics with a focus on business administration (n = 89; 66.9%), business informatics (n = 20; 15%), engineering management (n = 23; 17.3%), or business economics and education (n = 1; 0.8%).

The collected data was analysed using the partial least squares (PLS) path modelling to assess scales validity and test the hypotheses. This was done using SmartPLS software [34]. PLS is a component-based structural equation modelling technique that has minimal demands on measurements scales, sample size, and residual distributions [9]. We choose PLS because of its minimal requirements regarding sample size and prediction capability [17]. However, the "10 times rule" is fulfilled, specifying the minimum sample size as "10 times the largest number of predictors for any dependent variable in the model" [17]. As the "10 times rule" is only a minimum requirement, we calculated the statistical power according to Cohen using G*Power [10], [15]. The number of cases is sufficient to detect relationships of a medium effect size with a power of 95% (n = 119). This statistical power is regarded as sufficient because the hypotheses were previously tested in other contexts. It is therefore likely that small effect sizes were discovered.

Table 1. Summary of items and factor loadings

Construct	Item		Loading
Anticipated rewards [6]	AR1	I will receive a better grade in return for my participation in wikis.	.93
	AR2	I will receive a chance for a better grading in return for my participation in wikis.	.94
Behavioural intention [43]	BI1	Assuming I had access to wikis, I intend to use them.	.94
	BI2	Given that I had access to wikis, I predict that I would use them.	.97
	BI3	I plan to use wikis in my studies if they are provided.	.97
Compatibility [8]	COM1	Using wikis is compatible with all aspects of my learning.	.90
	COM2	Using wikis is completely compatible with my current learning situation.	.93
	COM3	I think using wikis fits well with the way I like to conduct learning activities.	.93
	COM4	Using wikis fits into my learning style.	.89
Facilitating conditions [39]	FC1	When I need help to use wikis, guidance is available to me.	.92
	FC2	When I need help to use wikis, specialized instruction is available to help me.	.89
	FC3	When I need help to use wikis, a specific person is available to provide assistance.	.91
Perceived behavioural control [37]	PBC1	I would be able to use wikis.	.93
	PBC2	Using wikis is entirely within my control.	.91
	PBC3	I have the resources and the knowledge and the ability to make use of wikis.	.94
Perceived enjoyment [22]	PT1	While participating in wikis, I experienced pleasure.	.91
	PT2	The process of participating in wikis is enjoyable.	.86
	PT3	I have fun using wikis.	.88
Perceived usefulness [43]	PU1	Using wikis improves my learning efficiency/performance.	.88
	PU2	Using wikis in increases my productivity.	.89
	PU3	Using wikis enhances my effectiveness.	.93
	PU4	I find the system to be useful in my tasks.	.82
Self-efficacy [23]	SE1	I have confidence in my ability to provide knowledge that other students consider valuable.	.92
	SE2	I have the expertise needed to provide valuable knowledge for other students.	.94
	SE3	Most fellow students think that the knowledge I transfer is valuable to them.	.86
Subjective norm [43]	SN1	People who are important to me think that I should participate in wikis.	.96
	SN2	People who influence my behaviour encourage me to participate in wikis.	.96

4   Results

PLS path models are interpreted in two-steps process, encompassing (1) the assessment of the reliability and the validity of the measurement model, and afterwards, (2) the evaluation of the structural model that explains hypothesized causal paths.

4.1   Measurement Model

Each construct was measured using reflective indicators. To evaluate the reliability and validity of the measurement model, we assessed the convergent validity and the discriminant validity of the scale items.

Convergent validity was assessed using three criteria: internal consistency, indicator reliability, and average variance extracted (AVE). To ensure internal consistency, Cronbach's alpha α_C and internal composite reliability ρ_c should be greater than .70 [9]; both thresholds were exceeded for all constructs, see Table 2 for ρ_c. Table 1 lists the constructs, the related items, and the factor loadings. Indicator reliability can be assumed because each indicator loads high (> .80) on the related construct [9]. Finally, every AVE exceeded the suggested threshold of .50 [9].

Table 2. Descriptive statistics, correlation of constructs, composite reliability ρ_c, and AVE

	M	SD	ρ_c	Inter-construct correlations								
				AR	BI	COM	FC	PBC	PT	PU	SE	SN
AR	2.46	1.16	.93	.87 (.93)								
BI	3.36	1.18	.97	.22	.92 (.96)							
COM	3.17	1.04	.95	.37	.72	.83 (.91)						
FC	2.77	1.04	.94	.45	.43	.56	.83 (.91)					
PBC	3.47	1.15	.95	.27	.67	.74	.51	.86 (.93)				
PT	2.55	1.04	.92	.37	.36	.51	.53	.41	.78 (.89)			
PU	3.14	1.00	.93	.52	.70	.80	.59	.68	.66	.78 (.88)		
SE	2.68	1.06	.93	.50	.39	.47	.49	.52	.57	.56	.82 (.91)	
SN	2.40	1.15	.96	.46	.29	.48	.50	.34	.53	.51	.44	.92 (.96)
Note: Diagonal elements are the average variance extracted (AVE) and, in parenthesis, the square root of the AVE.												

Discriminant validity is achieved if the conceptually different constructs exhibit sufficient difference. Therefore, the factor loading of each indicator is expected to be greater than all of its cross loadings [9], and the AVE of a construct should be higher than the constructs' highest squared correlation with any other construct [16], as shown in Table 2. Both criteria satisfactorily fulfilled the requirements, demonstrating discriminant validity.

The results of the model evaluation demonstrated that satisfactory reliability, convergent validity, and discriminant validity were achieved. Therefore, all scales in this study sufficiently measured the related constructs.

Finally, we addressed concerns regarding common method bias by using a statistical approach suggested by Podsakoff et al. and by following a method proposed by Liang et al. [26], [31]. The average of indicator variance caused by substantive constructs (0.85) was substantially greater than the method-based variance (0.01). Additionally, most of the method factor loadings were insignificant. Common method bias is thus not a serious concern of this study.

4.2   Structural Model

The hypotheses were tested with SmartPLS [34]. We used the bootstrapping method to determine the significance of the paths among the constructs. As recommended, we used the number of valid observations (n = 133) as the number of bootstrap cases, 5,000 bootstrap samples, and selected the individual sign changes option [20]. Therefore, we derived significance for item loadings and path coefficients β by using the t-statistic.
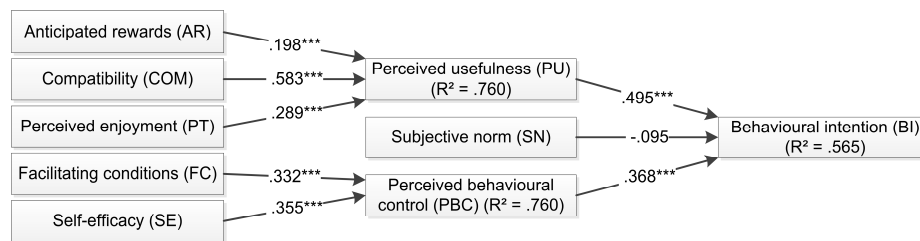

Fig. 2. PLS path analysis model (*** p < .001)

The R^2 values of the endogenous constructs indicate the percentage of variance explained by the model and therefore give information about the explanatory power of the structural model. According to the thresholds denoted by [9], the R^2 of behavioural intention (R^2 = .565) and perceived behavioural control (R^2 = .352) is moderate, though perceived usefulness (R^2 = .760) had a substantial level [9]. All structural paths were found to be significant except one. The R^2 values of the endogenous variables and the significance of the modelled paths are depicted in Figure 2. Additionally, we calculated the effect size f^2, which can be explored to see the impact of an exogenous variable on an endogenous variable. The impact at the structural model can be considered a small (f^2 = .02), medium (f^2 = .15), or large (f^2 = .35) effect [9]; for effect sizes of the paths see Table 3. The predictive capabilities of the proposed model were tested using cross-validated redundancy measure Q^2. Each Q^2 value was greater than zero; therefore, the model can be seen to have predictive relevance [9].

As expected, perceived usefulness had a significant and positive influence on the behavioural intention to use a wiki in formal learning processes. The effect size on the intention was medium (f^2 = .202). Therefore, hypothesis H_1 (β = .495; p < .001) was supported. The proposed positive influence of anticipated rewards on perceived usefulness (H_2, β = .198; p < .001) was significant, the effect was on a good small level (f^2 = .114), and therefore the hypothesis was supported. The proposed positive influ-

ence of perceived enjoyment on perceived usefulness (H$_3$, β = .289; p < .001) was significant and had a medium effect (f² = .195). Thus, hypothesis H$_3$ was supported. The positive influence of compatibility on perceived usefulness (H$_4$, β = .583; p < .001) was supported significantly. Hence, a high compatibility with the students' learning situation increases the perceived usefulness. The effect size had a large effect (f² = .497) as well as the highest influence on perceived usefulness.

Table 3. Path coefficients β, t-statistic, and effect size f²

Hypotheses		*β*	*t-statistic*	*f²*
H$_1$	PU → BI	.495***	5.586	.202
H$_2$	AR → PU	.198***	3.393	.114
H$_3$	PT → PU	.289***	5.006	.195
H$_4$	COM → PU	.583***	10.406	.497
H$_5$	PBC → BI	.368***	4.072	.166
H$_6$	FC → PBC	.332***	4.162	.114
H$_7$	SE → PBC	.355***	4.223	.128
H$_8$	SN → BI	-.095	1.606	
Note: * p < .05 ** p < .01 *** p < .001.				

Consistent with the DTPB, hypotheses H$_5$, H$_6$, and H$_7$ were supported. The influence of perceived behavioural control on behavioural intention is positive, significant (H$_5$, β = .368; p < .001), and had a medium effect (f² = .166) on behavioural intention. The hypothesised positive influence of facilitating conditions on perceived behavioural control was significant (H$_6$, β = .332; p < .001). However, the effect size was only small (f² = .114). Finally, the proposed positive influence of self-efficacy on perceived behavioural control was also significant (H$_7$, β = .355; p < .001), but has only a small effect (f² = .128). Unexpectedly, subjective norm had no significant influence on behavioural intention. Hence, hypothesis H$_8$ was not supported.

To ensure that no significant paths have been left out of the model, we compared it to the saturated model. A saturated model connects all exogenous variables with the endogenous variable, whereas the theoretical model only includes the hypothesised paths. Both models were compared with each other in order to verify "(1) that the significant paths in the theoretical model also remain significant in the saturated model, and (2) that adding the paths via the saturated model does not significantly increase the f²" [17]. We compared the adjusted R² of the proposed theoretical model (adjusted R² = .555) with the saturated one (adjusted R² = .606). All relationships stayed significant, and the effect size of the additional paths was small (f² = .129). Therefore, it is unlikely that any significant path has been left out in the theoretical model.

5   Discussion

In this study, we adapted the DTPB to explore the factors that influence students' decision to adopt wikis within formal learning processes in higher education. Consistent with previous research, perceived usefulness (e.g. [12]) and perceived behavioural control (e.g. [37]) had significant influence on behavioural intention. In conjunction with subjective norm, perceived usefulness and perceived behavioural control explain 56% of the variability of behavioural intention. In contrast to previous studies (e.g. [43]), subjective norm had no significant influence on behavioural intention. This finding is counterintuitive as students are spending a lot of time together while studying. Accordingly, it seems reasonable to expect them to influence each other's attitude towards technology for learning. However, the argument may not be relevant for first semester students, as there may not have formed personal relationships and learning habits yet. The lack of mutual influence could explain why subjective norm had no influence on students' behavioural intention. Accordingly, instructors' influence on first semesters should also be limited.

By integrating anticipated rewards and perceived enjoyment as constructs that represent intrinsic and extrinsic motivation, the proposed model considers the specific situation in higher education classrooms. The results show that both constructs were antecedents of perceived usefulness. In conjunction with compatibility, anticipated rewards and perceived enjoyment explain 76% of the variability of perceived usefulness. As hypothesised, anticipated rewards and perceived enjoyment had a positive influence on perceived usefulness. Therefore, students perceive wiki assignments as more useful if they are rewarded (e.g. with grades) or if they enjoy working with wikis. Compatibility had a large and significant effect on perceived usefulness. This is consistent with findings by Chen [8], who shows that educational compatibility is more important than the perceptions regarding technology usage. Therefore, the larger the compatibility with the learning situation, the larger is the perceived usefulness.

Consistent with the DTPB [37], facilitating conditions and self-efficacy both had a small, significant influence on perceived behavioural control.

5.1   Practical Implications

The underlying question of this study is what can we do as instructors to explain our students' lack of motivation? What can we do to engage our students and encourage them to use wikis? In the following, we outline some implications of the results.

Anticipated rewards, perceived enjoyment, and compatibility were strong determinants of perceived usefulness. The large influence of compatibility calls attention to students' learning preferences and learning style. Instructors have to think carefully about how wikis can support students' learning styles rather than changing them. While someone's learning style does not change in a short time, instructors can accommodate students with a course assignment that fits their learning situation. Students use wikis if they fit their goals, whether they are intrinsically or extrinsically

motivated. But in either case, a wiki assignment must fit the learning situation of the student. Therefore, wikis should be an integral part of the course assignment rather than just an additional duty. Thereby, it is more likely that students will engage with a wiki if the course assignment necessitates it. As a consequence, instructors should ask themselves if a wiki is beneficial for a certain task assignment – and opt for an alternative if the task does not benefit from using a wiki.

While instructors cannot change their students' learning style, they can abet wiki adoption by targeting students' motivation. One precondition for the students to use wikis in class is that wiki assignments are integrated into the course in a reasonable and rewarding way. Otherwise, students will abstain from using the wiki [11], [14]. Through mandatory and assessed wiki work, extrinsic rewards can be set easily. Alternatively, instructors can try to motivate students by conferring certificates after taking part in a wiki-based course, instead of forcing them into wiki use by rewarding them with a grade [7].

Ideally, students are motivated extrinsically and intrinsically. Perceived enjoyment refers to one's intrinsic motivation. As perceived enjoyment had a significant influence on perceived usefulness, students seem to like the idea of working together within a wiki. This is consistent with previous qualitative research about the use of wikis in higher education. Students like the feeling of teaching others and sharing their knowledge [33]. And although intrinsic motivation cannot be built by instructors, they can design task assignments that stimulate intrinsic motivation. For example, working for a greater audience can motivate students: like writing a textbook together that will be publish as an open educational resource.

Independent of students' source of motivation, instructors should consider students' learning preferences and learning styles by seamlessly integrating wikis into the course. Thereby, instructors would not only lower barriers of adoption and invite students' participation and engagement in the wiki, but would also provide facilitating conditions. As facilitating conditions and self-efficacy had a significant influence on perceived behavioural control, accompanying wiki training and continuous support to lower technology barriers is recommended.

5.2   Limitations and Further Research Directions

From a research perspective, the study results indicate the suitability of the proposed model to explain the influences on the use of wikis in formal learning processes within higher education by students. However, this study has some limitations.

First, we did not have the opportunity to collect data from a random sample of students. A convenience sample was used to test the model (first semester students in an introductory course in information systems). In order to generalize the findings, this study should be replicated with students from different study courses and semesters.

Second, the explanatory power of this model regarding the influence of subjective norm on behavioural intention has to be further examined. Although subjective norm has been proven as a reliable influence in various acceptance models [37], [43], this was not the case in this study. Perhaps this is due to the fact that the subjective norm was measured with only two reflective indicators and without distinguishing between

different influence groups (e.g. peer influence, superior influence). An alternative explanation is that peers do have little influence on students' intentions and superior influence was substituted by anticipated rewards. Therefore, more qualitative and quantitative research is necessary to explore further social influences on technology adoption in the context of higher education.

Third, we refrained from including wiki characteristics in the model, but provided contextual information as a preamble to the questionnaire. While some will see this as a limitation, it facilitates the comparison of different educational technologies by shifting technology-specific characteristics into the background and focusing on the adoption of a form of technology in a particular setting. Further research should therefore investigate whether the proposed model yields different results with other Web 2.0 applications (e.g. social networking services, weblogs).

6   Conclusion

The results of this study provide a foundation for future research about factors that influence student use of wikis in higher education. We show that intrinsic and extrinsic motivation plays an important role in students' decision to participate and engage in wiki assignments. Based on these findings, researchers should examine methods to foster support for student use of wikis, as well as for other Web 2.0 applications. This would enable instructors to better address students' needs and preferences.

References

1. Agarwal, R., Prasad, J.: The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. Decision Sciences 28 (3), 557–582 (1997)
2. Ajzen, I.: The theory of planned behavior. Organizational Behavior and Human Decision Processes 50 (2), 179–211 (1991)
3. Bagozzi, R.P.: The self-regulation of attitudes, intentions, and behavior. Social Psychology Quarterly 55 (2), 178–204 (1992)
4. Bandura, A.: Self-efficacy mechanism in human agency. American Psychologist 37 (2), 122–147 (1982)
5. Biggs, J.: Approaches to the enhancement of tertiary teaching. Higher Education Research & Development 8 (1), 7–25 (1989)
6. Bock, G.-W. et al.: Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. MIS Quarterly 29 (1), 87–111 (2005)
7. Bonk, C.J. et al.: The tensions of transformation in three cross-institutional wikibook projects. Internet and Higher Education 12 (3-4), 126–135 (2009)

8. Chen, J.-L.: The effects of education compatibility and technological expectancy on e-learning acceptance. Computers & Education 57 (2), 1501–1511 (2011)

9. Chin, W.W.: The partial least squares approach to structural equation modeling. In: Marcoulides, G.A. (ed.): Modern methods for business research. Lawrence Erlbaum, Mahwah, NJ (1998)

10. Cohen, J.: Statistical power analysis for the behavioral sciences. Lawrence Erlbaum Associates, Hillsdale (1988)

11. Cole, M.: Using wiki technology to support student engagement: Lessons from the trenches. Computers & Education 52 (1), 141–146 (2009)

12. Davis, F. et al.: User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. Management Science 35 (8), 982–1003 (1989)

13. Downes, S.: E-Learning 2.0, http://elearnmag.acm.org/featured.cfm?aid=1104968

14. Ebner, M. et al.: Utilizing wiki-systems in higher education classes: A chance for universal access?. Universal Access in the Information Society 7 (4), 199–207 (2008)

15. Faul, F. et al.: Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. Behavior Research Methods 41 (4), 1149–1160 (2009)

16. Fornell, C., Larcker, D.F.: Structural equation models with unobservable variables and measurement error: Algebra and statistics. Journal of Marketing Research 18 (3), 382–388 (1981)

17. Gefen, D., Rigdon, E.E.: An update and extension to SEM guidelines for administrative and social science research. MIS Quarterly 35 (2), iii–xiv (2011)

18. Guo, Z., Stevens, K.J.: Factors influencing perceived usefulness of wikis for group collaborative learning by first year students. Australasian Journal of Educational Technology 27 (2), 221–242 (2011)

19. Guzdial, M. et al.: Beyond adoption to invention: Teacher-created collaborative activities in higher education. Journal of the Learning Sciences 10 (3), 265–279 (2001)

20. Hair, J.F. et al.: An assessment of the use of partial least squares structural equation modeling in marketing research. Journal of the Academy of Marketing Science 40 (3), 414-433 (2011)

21. Hartshorne, R., Ajjan, H.: Examining student decisions to adopt Web 2.0 technologies: Theory and empirical tests. Journal of Computing in Higher Education 21 (3), 183–198 (2009)

22. Hsu, C.-L., Lin, J.C.-C.: Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. Information & Management 45 (1), 65–74 (2008)

23. Kang, M. et al.: Identifying different antecedents for closed vs open knowledge transfer. Journal of Information Science 36 (5), 585–602 (2010)

24. Kessler, G.: Student-initiated attention to form in wiki-based collaborative writing. Language Learning & Technology 13 (1), 79–95 (2009)

25. Leuf, B., Cunningham, W.: The Wiki Way: Quick collaboration on the web. Addison-Wesley, Upper Saddle River, NJ (2001)

26. Liang, H. et al.: Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. MIS Quarterly 31 (1), 59–87 (2007)

27. Liu, X.: Empirical testing of a theoretical extension of the technology acceptance model: An exploratory study of educational Wikis. Commun. Education 59 (1), 52–69 (2010)

28. Neumann, D.L., Hood, M.: The effects of using a wiki on student engagement and learning of report writing skills in a university statistics course. Australasian Journal of Educational Technology 25 (3), 382–398 (2009)

29. Nov, O.: What motivates Wikipedians? Communications of the ACM. 50 (11), 60–64 (2007)
30. Pence, H.E.: Preparing for the real web generation. Journal of Educational Technology Systems 35 (3), 347–356 (2007)
31. Podsakoff, P.M. et al.: Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology 88 (5), 879–903 (2003)
32. van Raaij, E.M., Schepers, J.J.L.: The acceptance and use of a virtual learning environment in China. Comput. Educ. 50 (3), 838–852 (2008)
33. Ravid, G. et al.: Wikibooks in higher education: Empowerment through online distributed collaboration. Comput. Hum. Behav. 24 (5), 1913–1928 (2008)
34. Ringle, C.M. et al.: SmartPLS 2.0 (beta), http://www.smartpls.de (2005)
35. Ryan, R.M., Deci, E.L.: Intrinsic and extrinsic motivations: Classic definitions and new directions. Contemporary Educational Psychology 25 (1), 54–67 (2000)
36. Sun, P.-C. et al.: What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. Computers & Education 50 (4), 1183–1202 (2008)
37. Taylor, S., Todd, P.A.: Understanding information technology usage: A test of competing models. Information Systems Research 6 (2), 144–176 (1995)
38. Teo, T.: Is there an attitude problem? Reconsidering the role of attitude in the TAM. British Journal of Educational Technology 40 (6), 1139–1141 (2009)
39. Teo, T.: Modeling the determinants of pre-service teachers' perceived usefulness of e-learning. Campus-Wide Information Systems 28 (2), 124–140 (2011)
40. Venkatesh, V.: Determinants of perceived ease of use: Integrating perceived behavioral control, computer anxiety and enjoyment into the technology acceptance model. Information Systems Research 11 (4), 342–365 (2000)
41. Venkatesh, V. et al.: User acceptance enablers in individual decision making about technology: Toward an integrated model. Decision Sciences 33 (2), 297–316 (2002)
42. Venkatesh, V. et al.: User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly 27 (3), 425–478 (2003)
43. Venkatesh, V., Bala, H.: Technology Acceptance Model 3 and a Research Agenda on Interventions. Decision Sciences 39 (2), 273–315 (2008)
44. Wheeler, S. et al.: The good, the bad and the wiki: Evaluating student-generated content for collaborative learning. British Journal of Educational Technology 39 (6), 987–995 (2008)
45. Witney, D., Smallbone, T.: Wiki work: Can using wikis enhance student collaboration for group assignment tasks?. Innovations in Education and Teaching International 48 (1), 101–110 (2011)