The Effect of Resistance to Change on Students' Acceptance in a Flipped Classroom Course

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Abstract: Digital technologies are increasingly used in higher education in so-called blended learning courses. A growing popular course concept is the Flipped Classroom (FC). In an FC, knowledge is acquired at home and deepened in the in-class time with the teacher. Compared to traditional teaching concepts, FC courses are considered particularly effective in terms of learning success. However, the transformation to FC-concepts is a big change for learners and students and often combines with a resistance to change. In this study we investigate the effect of resistance to change (inertia) on the acceptance of Flipped Classroom courses from the students' perspective. Teachers can use this knowledge to increase the attractiveness of FC.

1 INTRODUCTION

The use of digital technologies in university teaching enables new forms of teaching and learning. Teachers expect positive effects from so-called blended learning courses (Lehmann et al. 2015). One variant of blended learning is the Flipped Classroom (FC) (Bergmann and Sams 2012). In the FC courses, knowledge acquisition takes place at home. For this purpose, digital technologies such as learning videos or online quizzes are provided. The consolidation of knowledge then takes place in the classroom supervised by the teacher. Many studies prove the positive influence of FC, especially in the area of active, independent work and learning success (Abeysekera and Dawson 2015; Sun et al. 2018), (Voigt et al. 2020).

Despite its popularity, the FC concept is still relatively new. For the students, it represents a clear departure from the previous, lecturer-centered teaching-learning arrangement. The success of an FC depends largely on the acceptance of the stakeholders involved. First studies use modifications of the well-known Technology Accteptance Model according to Davis (Davis 1986) to measure the acceptance of the overall FC construct (Vogelsang and Hoppe 2018). In contrast to the original variant, which focuses on the use of a single technology, the entirety of the learning unit represents the technology object in this case. The TAM is suitable for measuring the attitude of the target group towards certain aspects (such as the quality of outcomes or the influence of social peers) in connection with the use of the learning concept. One aspect that has not yet been included in the investigations is the resistance of students to accept new concepts. This resistance is called inertia in science and is an important and at the same time difficult to grasp effect variable (Polites and Karahanna 2012). Inertia is often an initial reaction to changes. Only through the reduction of the resistance to change a real acceptance of new technology concepts such as the Flipped Classroom can take place. Therefore, it is to be assumed that inertia reduces acceptance. In this research, we want to close the research gap mentioned above. The present paper therefore aims to answer the following research question (RQ):

RQ: *What influence has the inertia on the acceptance of a Flipped Classroom from the students' perspective in our course?*

To answer the research question, we have developed a quantitative questionnaire, which is tested in an FC course in the Master of Business Informatics.

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In a first step, we conduct a reliability and a factor analysis to measure the suitability of the selected items and constructs. Subsequently, we conduct a regression analysis to show the interdependencies. The resulting model provides researchers with information about the connection between attitude-related acceptance decisions and the resistance of the target group, which is difficult to observe. Practical implications for lecturers and program coordinators can be derived from the model, which can lead to acceptance-promoting measures.

2 THEORETICAL FOUNDATIONS

Acceptance is used to measure the assent and agreement of an individual, e.g. with a technology. The best known model that deals with the explanation and measurement of technology acceptance is the Technology Acceptance Model according to Davis (Davis 1986).

The TAM is based on the Theory of Reasoned Action (Fishbein and Ajzen 1975). The essence of this theory is that a behavioural intention precedes the actual behaviour. Based on this assumption, human actions can be explained and predicted to a certain degree. The TAM assumes that the intention to use a system (*intention to use*) precedes the actual use. The *intention to use* (IU) is explained in the original acceptance model by two predictors (*perceived ease of use* and *perceived usefulness*). Especially its easy comprehensibility and high validity have contributed to its wide dissemination (Vogelsang et al. 2013).

A large branch of research is concerned with investigations on the validity of the TAM in different contexts such as the working world (Venkatesh et al. 2012) or the university (Park 2009). In the course of time numerous extensions of the TAM have been developed. Often external variables such as age or experience of the users are used (Venkatesh et al. 2003). In addition, the model is extended by factors from other models in order to increase the accuracy of the information. One such extension is the TAM2 (Venkatesh and Davis 2000). In this model the core dimensions are preceded by predictors from the area of cognitive-instrumental and social components.

The TAM and its extensions are still valid today. It is also often used to explain the intended use of scenarios in which technology plays an important role. For example, acceptance studies are used to measure the acceptance of blended learning events (Abeysekera and Dawson 2015; Padilla-Meléndez et al. 2013). Here, the *intention of use* is not aimed at the use of the technology alone, but rather at the overall concept.

While the acceptance studies focus on the presence of positive reinforcing factors, there are of course also factors whose presence can weaken the *intention to use* the technology. The *inertia* or resistance to change is a difficult construct to grasp, as it is primarily expressed through strongly anchored attitudes. *Inertia* or resistance to change describes remaining in old habits even though better alternatives are available. *Inertia* research has its origin in consumer research, whereby *inertia* in this environment means remaining loyal to a brand instead of choosing new, different or even better alternatives (Murray and Häubl 2007). The investigation of the phenomenon takes place in different scenarios. For example, the influence of *inertia* on the use of IS (information systems) (Polites and Karahanna 2012) is investigated. *Inertia* is based on individual habits.

Inertia expresses itself by remaining with familiar structures and thus counteracts acceptance. However, the influence of *inertia* on user acceptance has not yet been investigated. In general, the negative aspects of changing a learning scenario are rarely discussed (Vogelsang et al. 2019).

3 RESEARCH MODEL AND SAMPLE

TAM2 (Venkatesh and Davis 2000) was chosen as the initial model for the investigation. Only a few modifications are necessary to adapt to the present FC scenario. First, all external variables were removed from the model. We assume a high homogeneity of the selected sample with respect to *experience*, *age* and *voluntariness*. As predictors, *output quality* (OQ) was chosen as the cognitive and *subjective norm* (SN) as the social component. *Output quality* measures the students' attitude towards improvements through the new concept and its advantages. The *subjective norm*, on the other hand, measures the influence of fellow students with regard to the new concept. The *image* used in TAM2 was excluded, since an *image* gain of the students via a course to be taken voluntarily is not considered relevant. Instead, the other cognitive components, *job relevance* and *result demonstrability*, were adapted to the university context and replaced by the construct of *expected effort* used in the Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003). It can be

assumed that students compare exactly the effort of the course with the expected results. Therefore, it is assumed that this construct is more applicable than the presentation of the success, which only becomes visible as the exam result at the end of the course.

Thus, we use a model that examines the influence of *perceived ease of use* (EoU) and *perceived usefulness* (PU) on the *intention to use* (UI), as well as the effect of EoU on PU. Predictors of PU are, according to the theoretical basis, the *output quality* (OQ), the *subjective norm* (SN) and the *expected effort* (EE). The influence of the *inertia* (RC) on the *intention of use* and the *perceived usefulness* should also be tested. In addition, we want to test whether these predictors EE, OQ and SN have an effect on the inertia. In our questionnaire, the individual factors are each measured with three to four items. Figure 1 shows all influences to be tested in our research model.

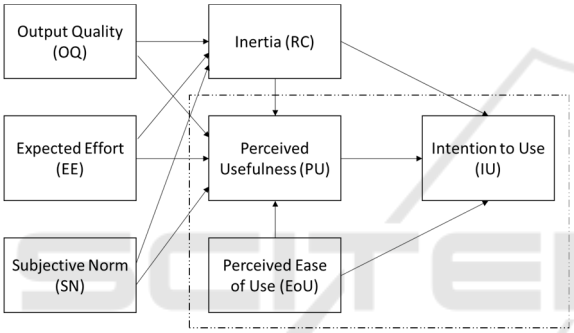

Figure 1: Research Model.

The following hypotheses can be derived from this research model: Hypotheses **H01 a)** to **H01 c)** address the connections from the original TAM model.

H01a) *In our FC course, the perceived usefulness affects the intention of use.*

H01b) *The perceived ease of use has an effect on the intention of use in our FC course.*

H01c) *The perceived ease of use affects the perceived usefulness in our FC course.*

H02 a) to **H02 c)** test the effects of TAM2.

H02a) *The subjective norm affects the perceived usefulness in our FC course.*

H02b) *The expected effort affects the perceived usefulness in our FC course.*

H02c) *The result quality has an effect on the perceived usefulness in our FC course.*

Hypotheses **H03a)** to **H04c)**, on the other hand, address the inertia in FC:

H03a) *Inertia affects the perceived usefulness in our FC course.*

H03b) *In our FC course, inertia affects the intention of use.*

H04a) *In our FC course, the results quality has an effect on the inertia.*

H04b) The *expected effort has an effect on the inertia in our FC course.*

H04c) *The subjective norm has an effect on the inertia in our FC course.*

For the purpose of data collection, a written, voluntary and anonymous survey of students was conducted in the winter semester 2017/18 at the last session of the course "Project Management", which is designed as a Flipped Classroom. Within this course, students will be provided with audio-supported slides as video clips during the online time. Based on this, activating methods such as case study work and literature discussions will be carried out during the attendance time to deepen the students' knowledge.

A total of 40 students took part in the survey. Among the participants, 62% were male and 26% female. 95% of all participants took part in the lectures in the classroom, 82.5% in the guest lecture and 70% used the group work. The most frequent reason given for non-participation was the overlap with other courses, with 7.5% of participants. 5% had parallel work placements or jobs and 2% of the students stated that they did not participate in at least one of the classroom sessions due to the increased workload.

The survey contains 23 quantitative questions, which were assigned to the seven different factors.

The data evaluation consists of two steps: In the first part, the survey is verified for statistical quality criteria, in particular reliability and validity. For this purpose, the reliability analysis and the factor analysis are carried out and the theoretical framework is adapted to the results. In the second step, the significant correlations are examined by means of regression analyses to test the influences shown in the above research model. A total of four regression models are used with the dependent variables: *intention to use*, *perceived usefulness*, *perceived ease of use* and *inertia*.

4 MODEL VERIFICATION

The first step of the analysis aims at the composition of the questionnaire. First, the factors are verified and adjusted by means of reliability analysis. In the course of the reliability analysis, two items are removed that were originally assigned to the factor *perceived usefulness*. Cronbacs Alpha is thus 0.770. Table 1 shows the Cronbachs alpha and the item scale correlation for all items after removing the two items.

Table 1: Cronbachs Alpha.

Factor	Item	Cronbachs Alpha, if Item is left out	Item Scale Correlation
Intention to use (IU)	IU1	0.736	0.280
	IU2	0.746	0.100
	IU3	0.741	0.180
Inertia (RC)	RC1	0.737	0.275
	RC2	0.713	0.540
	RC3	0.769	0.439
	RC4	0.703	0.678
Items Perceived usefulness (PU)	PU1	0.734	0.292
	PU3	0.742	0.195
Items Ease of Use (EoU)	EoU1	0.720	0.481
	EoU2	0.721	0.489
	EoU3	0.730	0.364
Output Quality (OQ)	OQ1	0.726	0.423
	OQ2	0.738	0.229
	EE1	0.749	0.020
Expected Effort (EE)	EE2	0.748	0.127
	EE3	0.741	0.232
	RC5	0.728	0.366
	PU2	0.740	0.228
Subjective Norm (SN)	SN1	0.715	0.619
	SN2	0.728	0.419
	SN3	0.727	0.407

The designations of the items refer to the final order after factor analysis.

For further analysis, all items were coded uniformly. For example, item RC3 was coded negatively and PU2 and PU3 positively. Furthermore, factor analysis was used to confirm the seven factors IU, PU, EoU, OQ, EE, SN and RC, which are each measured with 3 to 5 items. Figure 2 shows all new item-classifications.

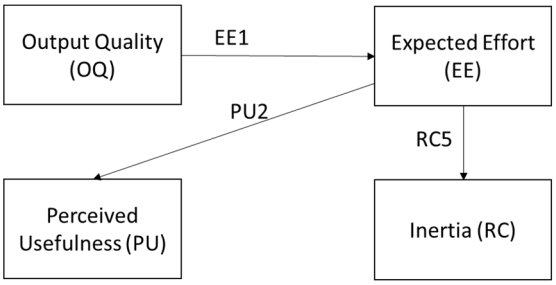

Figure 2: Factor Analysis.

As shown in Table 2, the *intention to use* is measured by the willingness to reapply such a learning concept in our FC course.

Table 2: Items Intention to Use.

Items: Intention to Use (IU)	Formulation
IU1	I would choose to attend such a learning concept again.
IU2	I would like to see more learning concepts of this kind.
IU3	I would also take other courses with such learning concepts.

The perceived usefulness, on the other hand, is characterized by an expected improvement in one's own exam preparation and an expected increased learning success due to the Flipped Classroom. The final items are shown in table 3. During factor analysis, PU2 was reassigned to the perceived usefulness.

Table 3: Items Perceived Usefulness.

Items: Perceived Usefulness (PU)	Formulation
PU1	My learning success is increased by such a learning concept.
PU2	I have the feeling that such a learning concept negatively influences my learning success.
PU3	I feel badly prepared for the exam because of the learning concept.

The items of the factor perceived ease of use is shown in table 4 and asked whether the various elements of online time were easy for students to use. There were no changes during factor analysis for EoU.

Table 4: Items Ease of Use.

Items: Ease of Use (EoU)	Formulation
EoU1	I find it easy to use the video tutorials.
EoU2	I consider the videos to be simple to handle
EoU3	I find it easy to work with the videos the way I want to.

After factor analysis, the expected effort is measured by the perceived appropriateness of the cost-benefit ratio, a perceived increase in the workload due to the use of the Flipped Classroom, as well as by the workload compared to other learning concepts that are not designed as FC courses as shown in table 5.

Table 5: Items Expected Efford.

Items: Expected Effort (EE)	Formulation
EE1	The amount of work and the result of the learning concept are appropriate.
EE2	If all lectures were designed in this way, the study effort would be too high for me.
EE3	I believe that such a learning concept increases my study workload.

The factor subjective norm, on the other hand, is shown in table 6 measured by the attitude of the fellow students towards the Flipped Classroom as well as by the general image of such a learning concept.

Table 6: Items Subjective Norm.

Items: Subjective Norm (SN)	Formulation
SN1	Most of my fellow students think that it is good to participate in such a learning concept.
SN2	My fellow students support the participation in such a learning concept.
SN3	My friends like the learning concept.

Table 7 shows the items of OQ. Since EE1 was ordered from OQ to EE in the course of the factor analysis, OQ is only measured with two items.

Table 7: Items Qutput Quality.

Items: Output Quality (OQ)	Formulation
OQ1	I believe that the learning concept improves the teaching in general during studies.
OQ2	I am aware of the advantages of the learning concept in general.

The *inertia* is shown in Table 8 and is characterized by the perceived stress and by remaining in the status quo. Item RC5, which was originally assigned to the effort expectation, was added.

Table 8: Items Inertia.

Items Inertia (RC)	Formulation
RC1	I prefer the familiar to new structures.
RC2	When I hear that innovations are pending, I feel stressed.
RC3	I am open to innovation.
RC4	I rely on established concepts.
RC5	The thought of the new learning concept has stressed me.

These newly sorted factors form the basis for further analysis.

5 REGRESSION ANALYSIS

In the second part of the statistical analysis, the regression models are assessed to reveal significant influences. Based on the previously formulated hypotheses, a total of three models could be estimated with the dependent variables: *Perceived usefulness*, *intention to use* and *inertia*. All factors that have an effect on the ten percent or lower significance level in at least one of the two regressions are presented. The parameters, significance levels and T-values of all regression models are shown in Table 9 - 11.

The *perceived usefulness* is shown in table 9. It determined to be five percent significant in our FC course and can be explained by $PU = 3.588\,C + 0.220\,EoU + 0.253\,EE - 0.318\,RC$.

Table 9: Regression model for PU.

Factor	Perceived Usefulness (PU)* $R^2 = 0.259 \;\; F = 4.073$		
	$\propto$	Coef.	T
Constant	p < 0.01	3.588	3.744
Perceived Ease of Use (EoU)	p < 0.10	0.220	1.824
Output Quality (OQ)	p > 0,10	-	-
Expected Effort (EE)	p < 0.10	0.253	1.940
Subjective Norm (SN)	p > 0,10	-	-
Inertia (RC)	p < 0.05	-0.318	-2.278

Significance of the regression model: ** p < 0.01 * p < 0.05

As shown in table 9, it is positively influenced by the *perceived ease of use* and the *expected effort*, and negatively influenced by the *inertia*. The strongest influence on PU is the *inertia*. The *subjective norm* and the *output quality*, on the other hand, have no significant influence on the *perceived usefulness* in our FC course.

Moreover, the regression model shown in table 10 is used to determine the *intention to use* and applies to the one-percent significance level. It has the largest R^2 of all estimated models and can be determined by $IU = 3.737\,C + 0.398\,PU + 0.302\,EoU - 0.384\,RC$.

Table 10: Regression model for IU.

Factor	Intention to Use (IU)** $R^2 = 0.376, \;\; F = 7.218$		
	$\propto$	Coef.	T
Constant	p < 0.01	3.737	4.092
Perceived Usefulness (PU)	p < 0.05	0.398	2.566
Perceived Ease of Use (EoU)	p < 0.05	0.302	2.470
Inertia (RC)	p < 0.01	-0.384	-2.841

Significance of the regression model: ** p < 0.01 * p < 0.05

The strongest influence on the IU is the *perceived usefulness*, which positively influences IU in addition to the *perceived ease of use*. On the other hand, the presence of *inertia* reduces the *intention to use*.

Finally, a regression model could also be estimated for *inertia* as a target variable for the five percent significance level. This allows it to be determined by: $RC = 2.190\,C - 0.344\,OQ$ and is only negatively influenced by the *output quality*.

Table 11: Regression model for RC.

Factor	Inertia (RC)* $R^2 = 0.100, \;\; F = 4.209$		
	$\propto$	Coef.	T
Constant	p < 0.05	2.190	2.518
Output Quality (OQ)	p < 0.05	-0.344	-2.052

Significance of the regression model: ** p < 0.01 * p < 0.05

No significant influence on the inertia could be demonstrated for the quality of the result and the *subjective norm*. Overall, our model is able to explain 37% of the effects on the intention of use.

6 HYPOTHESIS TESTING

First of all, it becomes apparent that all relationships contained in the original TAM model can also be observed in our FC. Hence, the *perceived usefulness* has a positive effect on the *intention to use*. The hypothesis **H01a)** can be confirmed. The *perceived ease of use* also has an influence on the *perceived usefulness* and the *intention to use*: the higher EoU is, the higher is IU and PU in our FC course. Thus, hypotheses **H01b)** and **H01c)** are both supported.

However, the relations we suspect from hypotheses **H02a)** to **H02c)** cannot be completely confirmed. Only the *expected effort* affects the *perceived usefulness* as predicted, but not the *output quality* and the *subjective norm*. The higher the *expected effort* is, the higher is the *perceived usefulness*. As shown in Table 5, EE is to be interpreted as a fair cost-benefit ratio and as an effort perceived as appropriate for the course. In our Flipped Classroom, however, the *subjective norm* has no influence on PU. Thus, the hypotheses **H02a)** and **H02c)** are rejected, while **H02b)** can be confirmed.

The *inertia* also has an effect on both the *perceived usefulness* and the *intention to use*. Hence, a high general resistance to change leads to a lower *intention to use* the teaching concept, the hypotheses **H03a)** and **H03b)** are both supported. The *inertia* can in turn be explained by the *output quality*: A higher *output quality* reduces the *inertia*. Hypothesis **H04b)** can be confirmed. Thus, the higher the generally known advantages and the importance of the teaching concept for the study, the lower the resistance to change. While the *output quality* in the FC model without inertia would has no influence on the *perceived usefulness* and the *intention of use* in our course, in the acceptance model shown above it has an indirect effect on IU and PU via the *inertia*.

Hypotheses **H04a)** and **H04c)**, on the other hand, must be rejected, since there was no significant influence of the *expected effort* and the *subjective norm* on the *inertia*. Thus, the *subjective norm* has no effect in our FC course as a whole.

7 IMPLICATIONS

From the regression models determined in Chapter 5, an acceptance model of our Flipped Classroom course can be derived, which describes the influences of the students' *intention to use* a new teaching concept such as FC. The acceptance model is shown in Figure 3.

In the teaching context, our model means that students are not dependent on the opinions of their fellow students when deciding to take part in an FC.

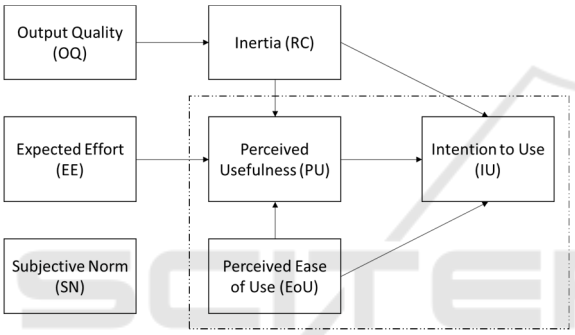

Figure 3: Acceptance Model.

More important are *expected effort* and the expected *output quality*. The general, positive assumptions about the concept reduce resistance and negative feelings towards the change. For teachers and program coordinators it is therefore important that the advantages of an FC can be communicated and promoted. These measures lead to an increased *intention to use* the concept by students through the predictors of *perceived usefulness* and *ease of use*. As described in Chapter 4, this *perceived usefulness* refers to the individual advantages for exam preparation and the expected learning success. Such an increase in learning success in FC has already been observed in previous studies using activating methods and improved feedback (Giannakos et al. 2014). In order to increase the *perceived ease of use*, which influences the *perceived usefulness* and thus also the *intention to use*, the university could produce explanatory videos that make it easier for students to use digital media.

8 CONCLUSION

In the acceptance model of our FC course, we have shown that the students' *intention to use* the new technologies in education can be predicted by the *perceived usefulness* and *perceived ease of use*. Social components, on the other hand, have no influence - in addition to the results of TAM2. Davis already shows that the influence of the *subjective norm* decreases over time (Venkatesh and Davis 2000). Since our examined sample is a master course, an identical effect seems logical. Thus, the opinion of other students does not influence the decision to attend such a teaching concept. Cognitive components are the main focus of this model to explain the use of FC. In our FC course, the *output quality* plays a special role, since it can reduce the influence of the *inertia*. A positive ratio of effort to benefit also promotes acceptance. This shows that students are quite willing to achieve a lot if the effort leads to a positive result.

Especially in times of the Corona Pandemic, where many digital teaching materials have been created, the future integration of a Flipped Classroom is particularly useful. Because in such blended learning concepts, the newly created digital media can continue to be used profitably, when face-to-face teaching is possible again. Both at this point in time and at times when exclusive online teaching is integrated, student acceptance is of central importance for the success of studies. With our model, we therefore aim to contribute towards understanding resistance to change in order to facilitate the integration of such teaching concepts today and in future.

The limitations of our acceptance model are initially to be found in the small sample of 40 students. Furthermore, the results are case-related and apply to the Flipped Classroom concept presented above. FCs can be designed differently, which could have an influence on the statistical results and must be considered in the interpretation. Furthermore, the low R^2 value of the regression model for RC suggests that there are other factors affecting the *inertia* that we have not considered. Therefore, there is no claim to completeness of the model. Future research could on the one hand verify whether our acceptance model can be confirmed in other Flipped Classrooms with different conditions and especially with and with a larger number of participants and on the other hand supplement missing influencing factors of the resistance to chan. In addition, it could be examined whether the influence of the subjective norm depends on how far the students have progressed in their

studies, and also whether the *subjective norm* is also absent in earlier courses, for example in the Bachelor's degree. We, therefore, call for further research analysing the connection between TAM and digital course concepts.

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