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HOW CULTURAL VALUES INFLUENCE THE APPROPRIATION OF TECHNOLOGY-MEDIATED LEARNING

Research

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Abstract

Information technology (IT) is an important enabler of innovative learning scenarios. Today, numerous IT-enabled learning scenarios – often referred to as technology-mediated learning (TML) – such as massive open online courses, are applied worldwide across different cultures. However, little insights are available regarding the appropriation of TML and how culture influences the appropriation process. Based on adaptive structuration theory and espoused cultural values, we develop and evaluate a theoretical model capturing the cultural effects in the context of TML appropriation. By means of structural equation modeling and a partial least squares approach, we research the moderating role of espoused cultural values and its influence on TML appropriation. The results show that faithfulness, comfort with technology, and collaborative learning appropriation significantly affect learning success as appropriation outcome. Moreover, the results indicate that espoused cultural values influence the appropriation of TML. The present paper thus theoretically contributes to the scientific discussion concerning TML appropriation and the impact of culture on the deployment of IT while also making a practical contribution by deriving implications for TML application across different cultures.

Keywords: Appropriation, Technology-Mediated Learning, Espoused Cultural Values, Adaptive Structuration Theory.

1 Introduction

Organizational training is one of the most prevalent and pervasive methods to engage the productivity of individuals (Gupta and Bostrom, 2013; Arthur *et al.*, 2003). In this context, technology influences the majority of current learning scenarios in organizations. Usually, this concept is referred to as technology-mediated learning (TML). TML is considered important because it improves learning outcomes, facilitates cost advantages, fosters the sharing of expertise in a global setting, and provides learning opportunities for disadvantaged locations (Webster and Hackley, 1997; López-Pérez *et al.*, 2011). These potentials are particularly evident considering developing and newly industrialized countries with a huge demand for organizational training (Docebo, 2014).

In this context, research suggests that individual differences are important influencers of learning outcomes (Gupta *et al.*, 2010b). Self-paced TML and the ability to customize TML according to individual demands emphasize the need to understand individual differences in TML (Gupta *et al.*, 2010b). Research highlights that the application of TML for training purposes in a global context is often hindered by cultural issues (Gerbic, 2005; Hornik and Tupchiy, 2006). On the one hand, differences in learning styles and teaching concepts such as self-regulated and collaborative learning differ heavily across cultures (Fischer and Kopp, 2007; Joy and Kolb, 2009). On the other hand, there are major cross-cultural differences in technology use (Leidner and Kayworth, 2006; Kummer *et al.*, 2012; Kap-

pos and Rivard, 2008). Culture, hereby defined as shared values of a group of individuals (Straub *et al.*, 2002), is considered to be a critical variable when explaining an individual's user interaction in sociotechnical systems (Leidner and Kayworth, 2006) and is in consequence of importance for TML. In this context, previous research has shown that TML that is not adjusted according to cultural preferences leads to unsatisfying learning outcomes (Ernst *et al.*, 2016). Therefore, it is necessary to derive generalizable results on how culture influences TML and how to design TML according to the cultural background of its users (Ernst *et al.*, 2015). To investigate such user-specific TML interactions, research suggests the role of TML appropriation for the learning process and learning outcomes (Gupta and Bostrom, 2009, 2013). However, up until now, research on TML has not investigated the impact of cross-cultural differences on the appropriation of TML.

As a response to the demand for research on the role of culture as a key contextual factor for the TML appropriation process, the main goal of this paper is to develop and evaluate a theoretical model that investigates the impact of culture on the relationships between antecedents that have been shown to be of importance for the appropriation of TML and TML outcomes, both on an individual level of analysis. We therefore seek to answer our underlying research questions (RQ): (1) How does TML appropriation influence TML outcomes? and (2) How do cultural values influence the appropriation process of TML? For this purpose, we build on the concept of espoused national cultural values (Srite and Karahanna, 2006), which enables us to derive generalizable findings on how culture influences TML (Soares *et al.*, 2007). For the model development, we draw on adaptive structuration theory (AST) (DeSanctis and Poole, 1994) as a meta-theoretical concept for TML and its appropriation process (Bostrom *et al.*, 2009). In consequence, we provide a theory of explanation and prediction with our work (Gregor, 2006; Weber, 2012) and contribute to practice by offering design implications for the deployment of TML in different cultures.

The remainder of this paper is structured as follows: First, we provide a brief overview of the theoretical background considering AST and TML appropriation, as well as cultural theory. Next, we describe the development of our theoretical model. The fourth section presents the research method to evaluate the model before we report our results in the fifth section. In section 6, we discuss implications of our results. In section 7, we highlight possible limitations of our study and call for future research activities before the paper closes with a conclusion.

2 Theoretical Background

2.1 Adaptive Structuration Theory

To examine TML, we draw on the theoretical basis of AST that allows to investigate the relationship between technology and social structures, for example how group decision support systems are used in organizations (DeSanctis and Poole, 1994). AST, developed by DeSanctis and Poole (1994) based on Gidden's structuration theory (Giddens, 1984), is a meta-theory (Bostrom *et al.*, 2009) describing the social existence of a group beyond their information processing activities (Chin *et al.*, 1997). According to them, the social aspect of group work determines the adoption of technology that supports their own working processes. Therefore, the social aspect further influences the information process and interaction features within the internal group work and hence also their group output. By this means, the appropriation of technology structures the group process and is therefore produced and reproduced in social action (Comi *et al.*, 2013), thus being especially important for TML that enables for example collaborative learning of peers.

These thoughts are based on two premises (Gupta and Bostrom, 2009). The first one relates to the influence of structures embedded in a specific context and is defined as rules, resources, and capabilities in a given context (DeSanctis and Poole, 1994). Applying this in a TML context, we consider the learning methods and structures that are, for example, reflected by the deployment of information

technology (IT) such as a learning management system (LMS). The second premise focuses on the user of an IT artifact, for example how a learner interacts with the provided structures. Within this interaction, participants learn and adapt the learning methods and structures (Gupta and Bostrom, 2009). This appropriation process is in itself a complex phenomenon and includes cognitive processes and interactions relating to the already introduced learning methods, support in the learning process, and other elements of the learning scenario influencing learning success. The latter represents "the goal assessment or measures for determining the accomplishment of learning goals" (Gupta and Bostrom, 2009, p. 713) and is the key outcome measure of TML (Janson *et al.*, 2014b). Considering the role of individuals in social interactions with information systems, research has highlighted that individual differences are also affecting the appropriation process; therefore, they significantly affect the outcomes of IT use (Gupta and Bostrom, 2009). In our paper, we focus on the impact of cultural differences and therefore introduce the concept of espoused national cultural values in the next section to study the impact of cultural differences on the TML appropriation process.

2.2 Espoused National Cultural Values

Culture itself is a complex construct related to different reference layers (Kummer *et al.*, 2012) and is therefore still under investigation (Leidner and Kayworth, 2006). In the past, information systems (IS) research predominantly concentrated on national and organizational culture as the two main layers of reference. Both emerged as separate research streams and focused on values that discriminate one group from another (Leidner and Kayworth, 2006). National culture is used to differentiate attitudes and behavioral differences between people from different countries (Shore and Venkatachalam, 1996). Contrary, organizational cultural research examines the cultural values exhibited by members of a specific organization (Hofstede *et al.*, 2010). Considering the phenomenon of a globalized world and the need to understand national cultural differences, this paper focuses on national cultural values.

However, we do not disregard the impact of the different reference layers that shape an individual's behavior. While culture is still a macro-level phenomenon, it often lacks precision explaining an individual's behavior (Srite and Karahanna, 2006). Most definitions therefore rely on the assumption that the membership of an individual to a specific cultural group, for example the national culture, defines their espoused values (Straub *et al.*, 2002). Reviews in IS research (e.g., Ford *et al.*, 2003; Kummer *et al.*, 2012; Leidner and Kayworth, 2006) showed that research is dominated by the use of indirect value-based approaches in order to understand the interaction of culture and IT. Such an approach uses secondary data to ascribe certain characteristics to cultural groupings without taking the individual into account (Soares *et al.*, 2007). Nonetheless, individuals are shaped by various cultural influences that may include organizations, religions, or specific subcultures. This implies that individuals vary in the degree to which they espouse certain values and do not only espouse values that are dictated by a single cultural group (Straub *et al.*, 2002). This research practice has encountered skepticism in IS research (Leidner and Kayworth, 2006; Leidner, 2010; Kummer *et al.*, 2012). One key issue of this approach is the evolving nature of national culture (Ali and Brooks, 2008; Gaspay *et al.*, 2009; Ford *et al.*, 2003; McCoy *et al.*, 2005; Gallivan and Srite, 2005; Myers and Tan, 2002). This is particularly evident in national cultures that are not easily generalizable, such as the Chinese culture, which is coined by different subcultures (Martinsons and Ma, 2009).

Therefore, we introduce the concept of espoused national cultural values, treating culture as multiple variables capturing individual differences (Udo and Bagchi, 2011; Srite and Karahanna, 2006; Gallivan and Srite, 2005; Straub *et al.*, 2002). Contrary to research that investigated how the macro-phenomenon of national culture impacts individual behavior (e.g., Kim *et al.*, 2011), the concept builds on the assumption that the nature of espoused values depends on the membership of individuals to a cultural group (Srite and Karahanna, 2006). Besides the membership to cultural groups, the values as well as the behavior of an individual are also shaped by professional, organizational, ethnic, religious, and certain other social groups. Hence, an individual can determine their own espoused cultural values. In general, the degree to which an individual embraces the values of their national culture de-

fines the espoused national cultural values (Srite and Karahanna, 2006). This also implies that culture is defined by an individual (Straub *et al.*, 2002) and then aggregated into the collective, taking into account that individuals espouse their national cultural values independently and different from each other, implying that the effect of national culture is not uniform across all individuals in a specific country (Srite and Karahanna, 2006). By relying on this concept, we intend to address the call for investigating individual differences in TML appropriation (Gupta *et al.*, 2010b; Gupta *et al.*, 2010a).

How many as well as which values exactly should be considered when researching espoused national cultural values is still under discussion (Leidner and Kayworth, 2006). In general and in IS research in specific, the contributions of anthropologist Hofstede (1980) are often used to explain cultural differences (Ford *et al.*, 2003; Leidner and Kayworth, 2006). For this purpose, he originally derived four dimensions of culture in a corporate setting at IBM: uncertainty avoidance, collectivism/individualism, power distance, and masculinity/femininity. Later, long-term orientation and indulgence/restraint were added in order to reflect cultural values that are, for example, exhibited by members of the Chinese population (Hofstede *et al.*, 2010). For the more mature theory base, we draw on the original set of four values and refer to each value as part of the participants' espoused national cultural values. Table 1 provides brief definitions of the used value dimensions, before section three proceeds with the model development.

Espoused National Cultural Value	**Definition**
Uncertainty Avoidance	Degree of risk accepted by the individual, which can be gleaned by the emphasis on rule obedience, ritual behavior, and labor mobility.
Collectivism/Individualism	Degree to which the individual emphasizes own needs as opposed to the group needs and prefers to act as an individual rather than as a group member.
Power Distance	Degree to which large differentials of power and inequality are accepted as normal by the individual.
Masculinity/Femininity	Degree to which gender inequalities are espoused by an individual.

Table 1. Espoused National Cultural Values (Definitions based on Srite and Karahanna (2006); Yoo et al. (2011); Hofstede et al. (2010)).

3 Model Development

Following the AST-based approach, in this section, we derive a theoretical model to investigate the impact of TML appropriation as well as the impact of espoused national cultural values on the appropriation process. We adopt the AST-based framework of Gupta and Bostrom (2009) that recognizes the appropriation process of TML methods and structures. AST posits that specific structures, for example an LMS in TML, consist of a spirit that is reflected by the "general goals and attitudes the technology aims to promote" (Poole and DeSanctis, 1989), as well as structural features that implement the spirit promoted by the provided structures (Gopal *et al.*, 1992). In TML, the spirit is formed by the learning goals and the specific epistemological perspective. It guides the design and implementation of the learning method that is appropriated in the learning/use process by the learners.

During this appropriation process, faithfulness as a social aspect (DeSanctis and Poole, 1994) regarding the use of technology can be observed, since certain perceptions about the role and utility of the technology are created. Regarding the appropriation process, faithfulness is defined as the extent to which the provided structural potentials are used in a manner that is consistent with the underlying spirit of the TML (Chin *et al.*, 1997; DeSanctis and Poole, 1994; Gopal *et al.*, 1992). Referring to TML, a faithful appropriation occurs when the learning methods and structures are appropriated in consistence with the overall learning goals and epistemological perspective, which represent the underlying spirit of the TML, and in turn influence learning outcomes positively (Gupta and Bostrom, 2009). An example is the use of a forum in an LMS to discuss learning materials within a constructivist learning scenario. In contrast, an unfaithful appropriation occurs for example if learners do not fully comprehend a sophisticated LMS and need to shift their focus on understanding the technology itself,

which in consequence detracts from the overall learning process (Gupta and Bostrom, 2009) and, hence, influences TML outcomes, such as learning success, negatively. Therefore, we hypothesize:

H1: A faithful TML appropriation positively influences learning success.

Another important aspect of TML appropriation are attitudes of individuals, which heavily influence learning (Arbaugh, 2002; Arbaugh and Duray, 2002; Piccoli *et al.*, 2001). In general, attitudes in TML refer to the impression of a learner regarding their participation in TML (Sun *et al.*, 2008). In specific, AST refers to the attitudes of comfort and respect (Gopal *et al.*, 1992). The level of comfort with technology is defined as how confident and relaxed users are in using the technology (DeSanctis and Poole, 1994; Song *et al.*, 2004). In contrast, respect refers to the extent to which a user perceives that technology adds a specific value to their work practice (DeSanctis and Poole, 1994). Considering TML, we acknowledge the value one perceives that the specific structures contribute to individual learning outcomes. Therefore, more positive attitudes toward TML contribute to effective learning (Piccoli *et al.*, 2001), for example when TML users are not afraid of the complexity of using TML for learning (Sun *et al.*, 2008; Song *et al.*, 2004). Otherwise, negative attitudes may reduce the interest in using TML and, in consequence, negatively influence learning. Therefore, we hypothesize:

H2: The level of comfort with technology positively influences learning success.
H3: The degree of respect for technology positively influences learning success.

Since TML offers numerous possibilities for collaborative learning, we must acknowledge how learning group members appropriate collaborative learning, which deals with the perceptions of rules and norms (Gupta and Bostrom, 2009). Collaborative learning supported by IT, for example by means of discussion forums, offers the possibility to interact with peers and therefore enables a more interactive way of knowledge acquisition and sharing. Nevertheless, if these structures are not well appropriated, for example if a discussion forum is not perceived as a support in the learning process, collaborative learning structures may not support learning success (So and Brush, 2008). Hence, we consider, in line with Gupta and Bostrom (2013; 2009), that the perceived richness of collaborative learning suggests its appropriation and ultimately leads to higher learning outcomes (So and Brush, 2008).

H4: Collaborative learning appropriation positively influences learning success.

After developing our hypothesis considering the influence of TML appropriation on learning success, we now consider the impact of cultural differences on the appropriation process. For this purpose, we first refer to the influence of uncertainty avoidance (UA) on the appropriation of IS in TML (Swierczek and Bechter, 2010). If such IS are unknown and new to the learners, they may feel threatened and express this through anxiety, nervous stress, or the need for predictability (Srite and Karahanna, 2006). Therefore, individuals who espouse higher levels of UA will feel more threatened when encountering ambiguous situations than individuals who espouse lower levels of UA (Zhao and Srite, 2013). Findings from IS research suggest that UA may hinder the adoption of IT artifacts (Straub, 1994; Srite and Karahanna, 2006). When transferring these thoughts onto TML, we conclude that this might also apply. The adjustment from classic offline learning environments involves change and uncertainty. Individuals with high espoused UA are late adopters who perceive change negatively. In consequence they won't perceive TML artifacts as useful for their learning process (Ford *et al.*, 2003; McCoy *et al.*, 2005). If learners do not use TML, as for example web-based trainings, the effects of the provided methods and structures are limited. This is particularly evident considering the appropriation process reflected by the comfort level with IT. Individuals with a high espoused UA may understand IT artifacts as a source of uncertainty and change, therefore emphasizing the need and impact of comfort (Perez-Alvarez, 2009). These effects could also apply to the appropriation of collaborative learning, which is characterized by open-ended learning scenarios that are dependent on others, often unstructured, and therefore offering a high amount of uncertainty (Phuong-Mai *et al.*, 2005). This could emphasize the need of individuals with a high espoused UA for a successful collaborative learning appropriation to achieve learning outcomes. Hence, we formulate the following hypotheses regarding the

influence of espoused UA on the relationship between the comfort with technology and learning success, as well as collaborative learning appropriation and learning success:

H5a: The relationship between the level of comfort with technology and learning success appropriation is moderated by UA such that the relationship is stronger for individuals with high espoused UA.
H5b: The relationship between collaborative learning appropriation and learning success appropriation is moderated by UA such that the relationship is stronger for individuals with high espoused UA.

Collectivism/individualism (COL/IDV) might also affect the TML appropriation and its outcomes. On the one hand, individuals who espouse COL values tend to emphasize group needs. On the other hand, individuals who espouse IDV values emphasize personal needs that are driven by autonomy or independence (Zhao and Srite, 2013). Applying these concepts to TML, we acknowledge that TML is typically characterized by self-directed learning (Duggirala and Prakash Sai, 2013), thus primarily based on IDV attitudes and values that include for example "autonomy," "independence," and "freedom", which offer a free choice of learning opportunities (Braman, 1998). Transferring this to the appropriation process, we argue that individuals who espouse IDV values appropriate TML more faithfully and, in consequence, profit from higher learning outcomes. Also, collaborative learning in the learning process may be more appropriate in collectivist cultures, and self-regulated learning may be more appropriate in individualistic cultures (Hofstede, 1986; Fischer and Kopp, 2007). For instance, collectivistic individuals might more easily approach other learners and, thus, strengthening collaborative learning appropriation. We therefore argue that espoused COL moderates the relationship between collaborative learning appropriation and learning success in a positive way. Therefore, we hypothesize:

H6a: The relationship between the faithfulness of TML appropriation and learning success is moderated by COL/IDV such that the relationship is weaker for individuals with espoused collectivism.
H6b: The relationship between the collaborative learning appropriation and learning success is moderated by COL/IDV such that the relationship is stronger for individuals with espoused collectivism.

Furthermore, we argue that power distance (PDI) moderates the relationship of the degree of respect for technology and learning success. Individuals who espouse higher PDI values show a tendency to accept power and inequality more than individuals with lower PDI values (Zhao and Srite, 2013). As a result, a teacher-centered approach with a limited interaction between the trainer and the learner (Kamentz, 2006; Shen *et al.*, 2008) is often used in cultures with a high PDI (Downey *et al.*, 2005). As a first hypothesis, individuals with a high PDI might therefore value TML more likely for their own learning processes and accept the TML benefits in their practice. Additionally, when individuals have a low PDI, they might more easily interact with the provided TML structures and therefore are more likely to recognize the underlying TML spirit, thus supporting learning processes and outcomes. Hence, we conclude as a second hypothesis that influence of faithful appropriation on learning success might be stronger for individuals who espouse low PDI values. In summary, we hypothesize:

H7a: The relationship between the degree of respect for technology and learning success is moderated by PDI such that the relationship is stronger for individuals with high espoused PDI.
H7b: The relationship between the faithfulness of TML appropriation is moderated by PDI such that the relationship is stronger for individuals with low espoused PDI.

Finally, we assume that masculinity/femininity (MAS/FEM) influences the relationship between the degree of respect for technology and learning success. Individuals with masculine values have a greater emphasis for work goals and, in contrast, individuals with more feminine values place a greater emphasis on personal goals (Zhao and Srite, 2013). Accordingly, by applying these underlying concepts to TML appropriation, we acknowledge that the degree of respect for technology might have a stronger influence for individuals with masculine espoused cultural values, since the respect for technology reflects how an individual perceives whether or not TML adds value to the achievement of work goals (DeSanctis and Poole, 1994). This is in line with previous research regarding technology acceptance and the influence of espoused cultural values, emphasizing the relationship between masculine values

and its influence on the outcomes of attitudes that reflect work goals (Srite and Karahanna, 2006; Udo and Bagchi, 2011). Thus, we hypothesize:

H8: The relationship between the degree of respect for technology and learning success is moderated by MAS/FEM such that the relationship is stronger for individuals with high espoused MAS.

In conclusion, Figure 1 depicts our research model with the corresponding hypotheses.

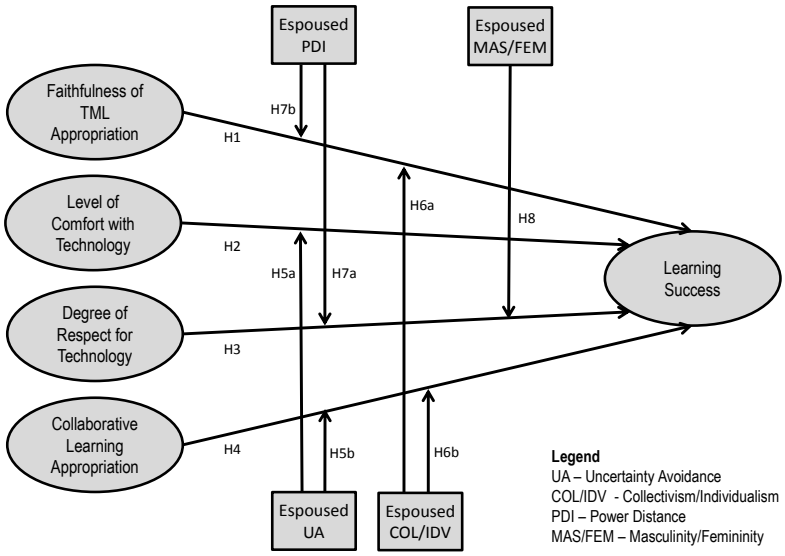

Figure 1. Theoretical Model

4 Research Method

4.1 Instrument Development

All indicators were applied from literature before being adapted to the context of the investigation object, if applicable. Table 2 presents the instrument of the final analysis for determining the respective constructs, their construct types, as well as the according literature sources for the indicators.[1] We measured all latent variables with reflective indicators. The indicators were therefore pre-evaluated regarding their correct specification according to the guidelines of Jarvis *et al.* (2003). To evaluate the items, a 7-point Likert scale was used ranging from 1 ("strongly disagree") on the left to 7 ("strongly agree") on the right, with 4 as a neutral point (Porst, 2011). In addition, the survey participants could select "N/A" if no statement was applicable in order to prevent a tendency toward neutral responses. In order to properly deal with missing values in the data set, we followed the advice of Hair *et al.* (2014) and used the mean replacement approach to impute the missing values in our data set.

4.2 Data Collection and Modeling Methods

An online-based survey was conducted with university students for the purpose of evaluating the theoretical model. The students who participated in the survey attended an introductory IS lecture that used an LMS as implementation device, ranging from the provision of learning materials and lecture vide-

[1] Please see the online appendix for the complete instrument: http://downloads.wi-kassel.de/ECIS16/Janson_et_al_2016.pdf

os, various mock exam resources such as tests and peer assessment features, to homework group forums (Oeste *et al.*, 2014; Janson *et al.*, 2016). Therefore, the described setting is suitable to investigate the relationships in the structural model, especially including the appropriation of collaborative learning with respect to the homework group forums (Janson *et al.*, 2016). We also took common method variance (CMV) that is caused by the measurement method rather than the construct measures into account (Podsakoff *et al.*, 2003; Sharma *et al.*, 2009). To control these biases, we made several procedural remedies. In order to ensure a psychological separation of measurement, we did not reveal the purpose of the survey and provided a cover story (Podsakoff *et al.*, 2003). Additionally, we guaranteed the anonymity of the participants. In order to control effects such as socially desirable responses (Paulhus, 2001), we assured that there were no wrong answers and that the respondents answered questions as honestly as possible (Podsakoff *et al.*, 2003). Regarding the statistical remedies, we decided to not conduct any test, since existing tests such as Harman's single factor test and the UMLC technique (Liang *et al.*, 2007) have been criticized for not being able to detect CMV (Chin *et al.*, 2012). In total, 175 students attended the lecture and we collected 173 valid data sets. The sample consisted of 80 male students and 86 female students (7 students refused to answer this specific question) with an average age of 24.5 years.

The variance-based partial least squares (PLS) approach was applied in order to evaluate the structural equation model of this paper (Chin, 1998; Wold, 1982), since it is more applicable to evaluate the influence of specific determinants on target constructs than covariance-based approaches (Hair *et al.*, 2011; Hair *et al.*, 2014). Since all latent variables of our model are reflective, we used, in accordance with Hair *et al.* (2014), the product indicator approach for modeling the continuous moderators, that is, the espoused cultural values. SmartPLS 2.0 M3 was used as analysis tool (Ringle *et al.*, 2005).

5 Results

The evaluation of the model followed a two-step process, encompassing the evaluation of the outer model in a first step, followed by the evaluation of the inner model in a second step (Hair *et al.*, 2012; Henseler *et al.*, 2009; Hair *et al.*, 2011). In the first step, the evaluation focused on the measurement models in order to reveal the reliability and validity of criteria that are associated with latent variables. The evaluation of the inner model and the structural relationships followed in the second step, since the evaluation only makes sense if the outer model evaluation shows evidence of sufficient reliability and validity (Henseler *et al.*, 2009). The quality criteria of the outer model are reported in Table 2. We assessed the indicator reliability by using the standardized loadings. All indicators loaded above the value threshold of ≥ 0.70 (Hulland, 1999). We evaluated the internal consistency reliability by using the composite reliability (Hair *et al.*, 2012; Hair *et al.*, 2011). Values above 0.70 indicated an acceptable composite reliability (Bagozzi and Yi, 1988). We assessed the convergent validity by using the average variance extracted (AVE). Values of AVE were all above 0.50 and acceptable (Bagozzi and Yi, 1988).

Afterwards, we assessed the discriminant validity by using the Fornell-Larcker criterion (Fornell and Larcker, 1981). As Table 3 shows, this criterion is fulfilled because the square root value of each latent variable's AVE was higher than the latent variable's correlation with any other latent variable. Second, the results of the cross-loadings showed that all indicators loaded highest on their intended constructs (Chin, 1998). For the sake of brevity, we did not include the cross-loadings in the paper.

Since the outer model evaluation showed sufficient reliability and validity, we now proceed to the evaluation of the inner model, which included the path coefficients, explained variances, and significance levels. The evaluation also encompassed an assessment of the effect sizes and predictive relevance (Ringle *et al.*, 2012). In addition, we followed the guidelines of Hair *et al.* (2014) for evaluating structural models including continuous moderating effects in order to avoid false and misleading conclusions for the evaluation of the main effects (Henseler and Fassott, 2010). Therefore, we evaluated the model without the moderating variables (main effect model) in a first step. In a second step, we

evaluated each moderator concerning its influence on the hypothesized relationships with the product indicator approach and mean-centered indicators (Hair *et al.*, 2014). The complete results of the structural model including the moderating effects are depicted in Figure 2.

Construct	Construct Type	Source	Indicators	Loadings	AVE	Composite Reliability
Level of Comfort with Technology	Reflective	Gopal *et al.* (1992)	ComfTech1	.954	.874	.954
			ComfTech2	.921		
			ComfTech3	.930		
Degree of Respect for Technology	Reflective	Gopal *et al.* (1992)	ResTech1	.828	.711	.880
			ResTech2	.895		
			ResTech4	.804		
Faithfulness of TML Appropriation	Reflective	Chin *et al.* (1997)	FA1	.879	.710	.907
			FA2	.756		
			FA3	.933		
			FA4	.791		
Collaborative Learning Appropriation	Reflective	Gupta and Bostrom (2013)	CA3	.882	.701	.921
			CA4	.790		
			CA5	.880		
			CA6	.895		
Learning Success	Reflective	Alavi (1994)	LS4	.760	.633	.923
			LS5	.818		
			LS6	.833		
			LS7	.803		
			LS8	.788		
			LS11	.791		
			LS12	.772		
Espoused UA	Reflective	Yoo *et al.* (2011)	UA2	.866	.682	.896
			UA3	.844		
			UA4	.787		
			UA5	.805		
Espoused COL/IDV	Reflective		COLIDV1	.803	.718	.927
			COLIDV3	.860		
			COLIDV4	.875		
			COLIDV5	.800		
			COLIDV6	.893		
Espoused MAS/FEM	Reflective		MASFEM1	.902	.681	.895
			MASFEM2	.751		
			MASFEM3	.847		
			MASFEM4	.793		
Espoused PDI	Reflective		PDI3	.821	.697	.873
			PDI4	.795		
			PDI5	.886		

Table 2. Overview and Quality Criteria of the Constructs.

Construct	1	2	3	4	5	6	7	8	9
1. Level of Comfort with Technology	**.935**								
2. Degree of Respect for Technology	.657	**.843**							
3. Faithfulness of TML Appropriation	.416	.535	**.843**						
4. Collaborative Learning Appropriation	.459	.197	.002	**.837**					
5. Learning Success	.477	.366	.292	.404	**.795**				
6. Espoused UA	.265	.285	.141	.010	.235	**.826**			
7. Espoused COL/IDV	.107	.092	.067	.135	.317	.138	**.847**		
8. Espoused MAS/FEM	.046	-.085	-.193	.170	.119	-.029	.123	**.825**	
9. Espoused PDI	.208	-.085	-.118	.332	.223	-.010	.125	.308	**.835**

* Diagonal elements are square roots of the AVE and all off-diagonal elements are correlations of the latent variables.

Table 3. Assessment of Discriminant Validity.*

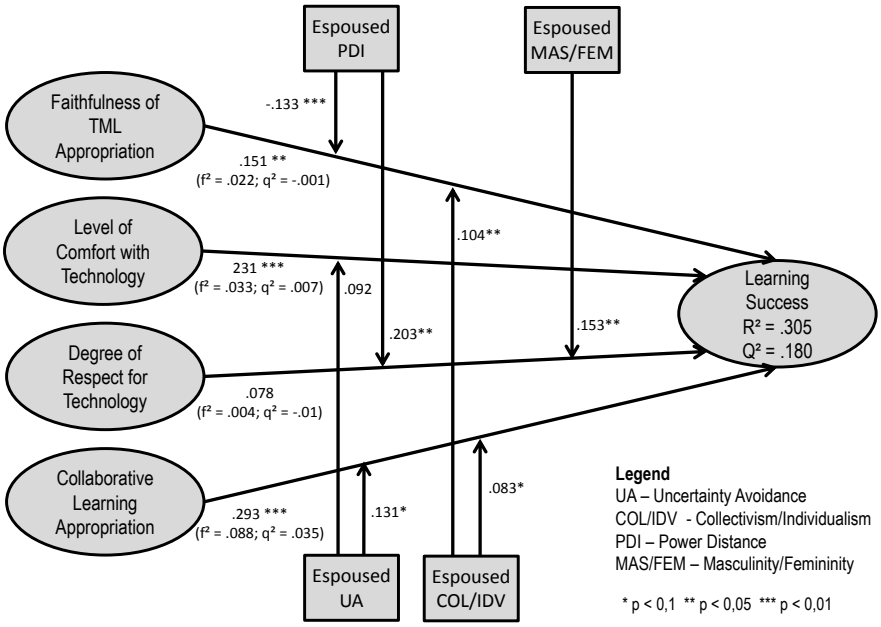

Figure 2. Results of the Theoretical Model.

The results of the main effect model without the moderating effects indicate that all relationships, except for the degree of respect for technology on learning success, are supported and significant at a level of at least .05 percent. According to the value of the path coefficients, the collaborative learning appropriation has the highest effect on learning success. Level of comfort with technology and the faithfulness of appropriation also have a significant effect on learning outcomes. However, the degree of respect for technology has no effect on learning outcomes. In conclusion, we can confirm hypotheses 1, 3, and 4 in our main effect model. The explained variance of learning success is $R^2 = 0.305$.

In a next step, the effect size f^2 was measured for the determinants of learning success (Henseler and Fassott, 2010). f^2 constitutes the influence of exogenous constructs on an endogenous construct by considering the changes explained by the variance R^2 (Cohen, 1988). Values above 0.02, 0.15, and 0.35 indicate a low, moderate, or high effect on the structural level (Henseler *et al.*, 2009). The results therefore indicate that faithfulness of appropriation ($f^2 = 0.022$), level of comfort with technology ($f^2 = 0.033$), and collaborative learning appropriation ($f^2 = 0.088$) have a low effect size on learning success. However, degree of respect for technology ($f^2 = 0.004$) has no effect on learning success.

In a last step, we evaluated the predictive relevance as a conclusive assessment of the structural model (Chin, 1998) by assessing it using the blindfolding procedure proposed by Stone (1974) and Geisser (1975), which omits one part of the data in a systematic way and uses the resulting estimates to predict the omitted part (Hair *et al.*, 2011). We chose d = 7 as omission distance, which is not a multiple integer of the analyzed cases (N=173) (Hair *et al.*, 2012). We assessed Q^2 as the cross-validated redundancy measure to estimate the structural model and measurement models for the data prediction (Hair *et al.*, 2011). The blindfolding procedure is applied to endogenous reflective constructs and if the value of Q^2 is larger than zero for a particular construct, its explanatory variables have a predictive relevance (Henseler *et al.*, 2009). This is the case for learning success ($Q^2 = 0.184$) and therefore indicating the predictive relevance of the structural model. The relative impact of the predictive relevance can be evaluated by the measure q^2: values above 0.02, 0.15, and 0.35 indicate a small, medium, or large predictive relevance of constructs, explaining the endogenous construct that is evaluated (Henseler et al. 2009). We therefore neglected effects of the moderating effects of espoused cultural values regarding their predictive relevance (Henseler and Fassott, 2010). Our results show that faithfulness of appropriation ($q^2 = -0.001$), degree of respect for technology ($q^2 = -0.01$), and level of comfort with technology ($q^2 = 0.007$) have no relative predictive relevance for learning success. Finally, collaborative learning appropriation ($q^2 = 0.035$) has a small relative predictive relevance for learning success.

In view of the influence of our moderating effects, we received mixed results considering our hypotheses of the research model. Regarding the impact of the espoused cultural value of UA, we found no evidence for a significant positive influence on the structural relationship between the level of comfort with technology and learning success. However, we could confirm a positive influence of a high espoused level of UA on the relationship between collaborative learning appropriation and learning success. Nevertheless, considering the first hypothesis regarding espoused COL/IDV, we found an inverse effect. Our results showed that the relationship between the faithfulness of appropriation and learning success is stronger for individuals with espoused COL values. Therefore, we found no support for hypothesis 6a. Taking hypothesis 6b into account, we confirmed the positive influence of a high espoused COL on the relationship between collaborative learning and learning success. Considering PDI, we found support for both hypotheses 7a and 7b. It is noteworthy for hypothesis 7b that the influence of PDI on the path value of the relationship between the faithfulness of TML appropriation and learning success is -0.133. This indicates that the relationship is significantly stronger for individuals with low espoused PDI values, since the instrument for PDI is coded in a way that high values indicate a high espoused value of PDI (Yoo *et al.*, 2011). Finally, hypothesis 8 was also confirmed, showing the significant influence of espoused MAS values on the relationship between the degree of respect for technology and learning success. However, in the main effect model, the relationship between the respect for technology and learning success was not significant at all.

6 Discussion and Implications

To the best of our knowledge, our study is the first to investigate the appropriation process of TML against the background of espoused cultural values to enable user-centered TML offerings. For this purpose, we developed a theoretical model that draws on AST as well as the concept of espoused national cultural values. Our model is constituted by TML appropriation, how TML appropriation influences learning success, and how espoused cultural values affect the appropriation process. We evaluated the model in a study embedded in a highly IT-supported learning scenario to investigate TML appropriation. Hereafter, we discuss the results of our RQs and implications for research and practice.

Considering our first RQ regarding the effects of TML appropriation on TML outcomes in terms of learning success, our study showed a significant influence of faithfulness, comfort with technology, and collaborative learning appropriation on learning outcomes. In contrast to previous AST-based research (Gupta and Bostrom, 2013; Gopal *et al.*, 1992), we could not confirm the influence of respect for technology on TML outcomes. Our main effect model could explain 30.5 percent of the variance of the key TML outcome learning success. Faithfulness has the lowest, but still statistically significant, positive effect on learning success, indicating the importance of a faithful appropriation of the provided learning methods and structures. Therefore, it is necessary for TML designers to implement design components that leverage faithfulness when using TML. For example, heavily IT-supported learning scenarios such as massive open online courses (MOOCs) are often not used in a way consistent with the spirit, therefore impeding learning success and hindering the success of an innovative learning approach and according business models (Adamopoulos, 2013; Ebben and Murphy, 2013). Design implications could include adaptive learning paths, which support the use process according to the underlying TML spirit and therefore improving TML outcomes. In this context, scaffolds known from educational research also serve as a design implication initially supporting the learner in their learning process (Gupta and Bostrom, 2009; Delen *et al.*, 2014). They might ensure faithful TML appropriation by preventing learners from being overwhelmed by large amounts of learning material and allowing them to focus on the learning itself. Level of comfort with technology has the second highest impact on learning success according to the path values of the structural model indicating the need of individuals' positive attitudes toward technology. Therefore, when implementing TML, designers and instructors should foster these attitudes by offering explanations of the underlying learning scenario and on how TML is used to engage learning outcomes of individual learners, thus engaging relaxedness

and confidence with a new learning scenario. This is especially prevalent considering learning in organizations when TML users are not accustomed to such heavily IT-supported learning scenarios, emphasizing the need to recognize individual differences in the deployment of TML. Degree of respect as the third theoretical constituting variable of TML appropriation has no statistically significant influence on learning success in our study. We therefore acknowledge that in our research model, TML adds value to the work practices but does not matter in a significant way for the improvement of learning outcomes. However, further research should elaborate on this relationship, for example by evaluating our model in organizational training. Collaborative learning appropriation has the highest influence on learning success, showing the major influence of collaboration and its perception in TML (Gupta and Bostrom, 2013, 2004). Thus, TML design should acknowledge this particular impact by leveraging perceptions regarding collaborative learning to support the appropriation process. Possible starting points can be found in the domain of peer learning (Topping, 2005) or computer-supported collaborative learning by offering structured learning activities in peer groups with scaffolds such as scripting (Suthers, 2006) to initially support the learning process (Delen *et al.*, 2014).

With respect to the discussion of our second RQ and the influence of espoused national cultural values on the appropriation process, our results showed mixed findings. Concerning espoused UA, our results revealed that UA had no impact on the relationship between the level of comfort with technology and learning outcomes. As Perez-Alvarez (2009) noted, the impact of UA on the appropriation process may differ by the type of technology. However, as hypothesized, the influence of the collaborative learning appropriation on learning outcomes is statistically more important for individuals with a high espoused UA. This finding implicates that in cultures with a high UA, collaborative structures should be designed to meet the expectations of such individuals. Possible design implications include the structuring of group tasks with the above mentioned collaboration methods or applying the concept of goal emphasis to allow individual team participants to focus on a team goal (Janson *et al.*, 2016). Both measures should reduce uncertainty in this specific appropriation process and therefore engage learning success. The value pair COL/IDV was hypothesized to have impact on the outcomes of the faithfulness of TML appropriation as well as the collaborative learning appropriation. Our findings showed that a high espoused collectivism moderated both relationships in a positive way, therefore highlighting the role of faithfulness and collaboration for collectivistic cultures. This emphasizes the collaborative nature of TML, since the relationship between a faithful appropriation and learning success is stronger for individuals with COL values. Our findings especially add value considering the on-going discussion of the influence of collectivism on the outcomes of the appropriation process (Hornik and Tupchiy, 2006) by showing that collaborative learning appropriation is more important in collectivistic cultures and therefore contrasting to previous research, which states that collectivism could impede collaboration in groups (Thongprasert and Cross, 2008; Chow *et al.*, 2000). PDI moderated appropriation outcomes significantly in two ways. First, the outcomes of respect for technology are stronger for individuals with a high espoused PDI. However, this relationship was found to be insignificant in the main model. Second, individuals with a low espoused PDI have greater need for a faithful TML appropriation. This highlights the role of appropriation measures for low PDI individuals, such as the aforementioned individual learning paths (Hofstede, 1986) or scaffolds for the learning process (Janson and Thiel de Gafenco, 2015). Finally, concerning the value pair of espoused MAS/FEM, we conclude that the outcomes of respect for technology as a specific goal orientation of TML are stronger for masculine individuals. However, the main effect of respect for technology was insignificant. Still, when applying TML in cultures with high masculine values, one should consider emphasizing the work and goal support of TML to engage appropriation.

7 Limitations and Future Research

We acknowledge several limitations to this study, which then underline a demand for future research. The study examined TML appropriation with a single measurement and did not consider its longitudinal nature (Gupta and Bostrom, 2009). Therefore, it is also reasonable to check which effects espoused cultural values have on TML

appropriation over time. Connected to this are limitations considering the data collection and measurement. We used the same instrument to assess the dependent and independent latent variables among all participants of the study, allowing for possible CMV. Nevertheless, procedural remedies were taken to avoid biases ex ante. Since no sufficient statistical test for CMV exists (Chin *et al.*, 2012), biases cannot be excluded. Also, it should be noted that "no single methodology is able to address the inclusive set of criteria relevant to culture assessment in business studies" (Lenartowicz and Roth, 1999, p. 787). We therefore draw on a direct value-based approach to capture cultural differences. However, as stressed in section two, there are other approaches in research. Each of them has its own potentials and limitations. When considering the concept of espoused national cultural values, we are able to derive generalizable conclusions on how certain values (Soares *et al.*, 2007) influence the relationship of TML appropriation and its outcomes. However, a more diverse data set, for example from an international MOOC provider, would further contribute to the generalizability of the findings. Additional analysis, for example qualitative studies across different cultures, would expand our research. Therefore, it would enable to derive further insights into specific TML appropriation moves of different cultures and the appropriation process.

8 Conclusion

TML appropriation is crucial considering an application of TML across different cultures. To evaluate how the appropriation influences learning success across cultures, we draw on adaptive structuration theory to answer our first RQ. We therefore formulated a research model that is constituted by faithfulness of TML appropriation, comfort with IT, respect for IT, and collaborative learning appropriation as appropriation constructs and learning success as the TML outcome. To answer our second RQ, we followed the concept of national espoused cultural values to investigate how cultural values relate to TML appropriation. Afterwards, we operationalized and evaluated the model concerning TML appropriation and the influence of espoused cultural values. The data were collected as part of a heavily IT-supported introductory IS lecture with an LMS as essential part of the teaching-learning scenario. The results indicate that faithfulness of TML appropriation, comfort with IT, and collaborative learning appropriation have a significant positive impact on learning success in reference to the first RQ. With respect to the second RQ, our results showed mixed findings. We confirmed that both espoused UA and COL have a positive influence on the relationship of collaborative learning appropriation and learning success. In addition, our results revealed the influence of espoused PDI on the relationships of both degree of respect for technology and learning success, as well as faithfulness of TML appropriation and learning success. Finally, we confirmed the positive influence of espoused masculinity on the relationship between the respect for technology and learning success. Our results therefore clearly reveal the urgent need for evaluating the appropriation process of TML in general and across cultures and serve as a theory of explanation and prediction (Gregor, 2006) for TML across cultures. Against the background of a worldwide adoption of IT-supported learning scenarios such as MOOCs, it is necessary to recognize individual differences as identified in our study, for instance learner-centered design approaches that take cultural differences into account (Ernst *et al.*, 2015). Further steps have to follow in order to deepen and accordingly implement the presented insights to ensure learning success across cultures, highlighting the role of modular learning across cultures (Janson *et al.*, 2014a).

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