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Research paper

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Abstract

Considering the speed at which new digital technologies are evolving, this paper aims to investigate the impact of digital transformation on multiple dimensions of literacy. An empirical research using antecedent factors of adoption is conducted to investigate the relationships between factors influencing digital immigrants' and digital natives' intentions to use digital technology. Using survey data on 177 digital immigrants and 183 digital natives, structural equation modelling (SEM) and a novel configurational thinking method—fuzzy-set qualitative comparative analysis (fsQCA)—are applied. The results, while showing some similarities, reveal that digital immigrants and digital natives utilize digital technologies differently and their intentions to use are influenced by different factors. For instance, for digital natives, information literacy has no significant effect on intention to use, while this path is significant for digital immigrants. Moreover, fsQCA results, while supporting the SEM findings, show that there are multiple configurations of conditions leading to the outcome of interest—intention to use digital technology.

Keywords: digital immigrants, digital literacy, digital natives, digitalization, information literacy

1   Introduction

It is commonly believed that young people have higher competency and capabilities to use technology than older people. According to Prensky (2001a), individuals born roughly after 1980 are referred to as "digital natives." They have grown up with digital technology, they have been exposed to digital media since their birth, Internet has always been part of their lives, they spend a considerable amount of time online and use new digital devices and services extensively. Prensky (2001a) further explains digital natives' media consumption habits and how they use information and communications technology (ICT): while on average, they spend less than 5.000 hours of their lives reading, they spend over 10.000 hours playing video games and almost 20.000 hours watching TV. Other digital devices and services such as computer games, emails, Internet, mobile phones, and instant messaging are an integral part of their lives (Prensky, 2001a, p. 1). This social group is used to parallel processing and arguably they are multitasking individuals—they are able to perform different tasks simultaneously. They are known to be producers of information and digital content. On the other hand, people who were born before 1980 are referred to as "digital immigrants." According to Prensky (2001a, b), these two groups are different in many ways. For instance, digital natives read content on the screen, while digital immigrants may print out an attachment rather than reading it on the computer screen. Moreover, in order to make sure that an email was received, they may call the recipient (Prensky, 2001a, p. 2).

Prior studies have shown that there is a gap between digital natives and digital immigrants (including teachers) in their competences in using digital technologies (e.g., Helsper & Eynon, 2010). Moreover, there are concerns that teachers may not have sufficient knowledge or that they are inadequately prepared to educate digital natives in terms of understanding of and engagement with digital technologies (Guo et al., 2008). For example, it has been argued that digital natives inherently possess digital skills, whereas digital immigrants may need to learn and obtain those skills, raising questions as to whether educational institutions—schools and universities—can educate or teach digital natives digital skills (Ng, 2012). Falck et al. (2018, p. 29) have found that "exposure to digital technologies and in particular to computers at the school has little if any effect on student achievement and computer literacy." Reed and Giessler (2002) also found that number of years of experience with computers does not automatically translate into high levels of ICT competencies. Based on these findings, we argue that exposure to digital devices, or number of years of experience with digital devices, are not reliable predictors for assessing digital competencies and computer skills, especially for digital natives. Given such contradictory findings, it is clear that more research is needed to assess digital natives' and digital immigrants' digital literacy capabilities, their differences, and their intentions to use digital technology.

A review of the literature reveals that despite the considerable attention given to digital natives and digital immigrants, few studies have focused on how information literacy and digital literacy influence intentions to use technology. Thus, the aim of this paper is (a) to contribute to the debate in this stream of research by identifying antecedent factors that influence individuals' intentions to use technology for performing daily routine and professional tasks, and (b) to determine if there are differences between digital natives and digital immigrants in their use of digital technologies on the basis of their digital and information literacy skills and capabilities. In other words, the research questions that guide this study are: (a) what are the most important factors that influence digital natives' and digital immigrants' intentions to use technology? and (b) are there any differences between these two groups with respect to their digital and information literacy capabilities? From a methodological standpoint, in addition to commonly used regression-based analysis (structural equation modelling [SEM]), this study employs a configurational method known as fuzzy-set qualitative comparative analysis (fsQCA) aiming to gain complementary insights in addition to SEM findings. The context of this study is a university in Finland, where empirical research was conducted to collect data from two groups. For digital natives, we collected data from students at different study levels, and for digital immigrants, we collected data from university employees with different positions—administrative staff, professors, lecturers, and technical and service staff members. For both groups we imposed strict criteria: for the digital native group, subjects must have been born after 1980, and for the digital immigrant group, participants must have been born before 1980. This paper contributes to the literature not only by focusing on various dimensions of

literacy, digital natives, and digital immigrants, but also by examining whether there can be different pathways to the outcome of interest—intention to use technology. The findings also have implications for academia by suggesting that policymakers need to focus on the curricula of digitalization and ensure that teachers are provided with the necessary opportunities to explore and take full advantage of the benefits enabled by digital transformation.

2   Background Information

Literacy means the condition of being literate, and a literate person is expected to be able to locate, retrieve, evaluate, and—with some level of competence and skill—to use and reproduce information in an appropriate manner (Bruce, 1999). In other words, a literate person has the basic ability to read, write, and understand her native language. With the rapid growth in access to information, the ability of people to evaluate and use this information in an appropriate manner has become a critical issue (Kerka, 1999). The need to appropriately evaluate information has always been central to achieve objectives and successful learning (Eshet-Alkalai, 2004); it is not unique to the digital era and information revolution. However, in the digital era and information age, as people are presented with unlimited digital information, some level of information literacy is required to successfully produce, publish, and modify these data. Therefore, the ability to evaluate and assess information in an appropriate manner has become a "survival skill" for individuals today (Eshet-Alkalai, 2004). Moreover, due to the digitalization and transformation of information, new dimensions of literacy have emerged; for example, digital literacy, technical literacy, media literacy, and financial literacy, to name just a few (Ng, 2012). In his seminal work, Gilster (1997) defines digital literacy as the ability to understand and use information in multiple formats from a wide range of sources available and presented through computers (p. 1). From a wider perspective, Martin (2005) states that digital literacy is the awareness and ability of individuals to operate and use digital tools and devices in an appropriate way (p. 135). As already discussed, "digital natives" refers to the population born after 1980, for whom Internet has always been part of their lives, and who are known to be producers of information on digital spaces. On the other hand, "digital immigrants" are people born before 1980, who are assumed to be users of digital content. Some authors argue that different dimensions of literacy have impacts on individuals' attitude to use technology for achieving their objectives and success in the tasks they perform in their workplaces (Eisenberg, 2008).

Moreover, Bennett et al. (2008) argue that digital technology impacts digital natives' education differently compared to students of previous generations (digital immigrants). Digital natives are assumed to be active experiential learners, proficient in multitasking, and dependent on communications technologies for accessing information and for interacting with others (Bennett et al., 2008, p. 776). Gu et al. (2013) address the differences between digital natives and digital immigrants and posit that digital natives have grown up in a digital environment that has shaped how they think, operate, behave, and act. The authors conclude that the difference between these two groups is radical when it comes to the use of technology (p. 329). Depending on how digital natives and digital immigrants use technology and how important they perceive it to be will impact their attitudes and intentions to use it. Digital natives are assumed to have a higher self-perception in relation to ICT skills than their counterparts. Digital immigrants perceive digital technology as a tool to perform their tasks, and for them, self-efficiency, personal innovativeness, and digital competency (i.e., digital literacy) are the most important factors in forming their attitudes and intentions to adopt and use technology.

3   Theoretical Background and Hypotheses

In the following sections, antecedent variables in relation to intention to use digital technology are explained and, based on the literature discussed, we posit our research hypotheses.

Social Norms and Self-Efficacy

Social norms refer to the extent to which pressure from others impacts one's decisions and is considered to be an antecedent factor influencing one's intention to use technology (Thompson et al., 1991). A

concept similar to subjective norms within the theory of reasoned action (Ajzen, 1991; Venkatesh et al., 2003). It has been argued that the social norms construct is not significant in voluntary settings (it may impact only perception about the technology), and it becomes significant when use is mandated (Venkatesh et al., 2003). Its effect is attributed to compliance in mandatory settings, causing a direct or indirect effect on intention (Venkatesh & Davis, 2000). In other words, reliance on others' views and opinions is significant only in mandatory settings. Therefore, we argue that, as a form of social pressure, social norms not only influence individuals to alter their attitudes in relation to technology use, but also positively influence their perceptions of information and digital literacies; thus:

H1a: Social norms are positively related to information literacy.
H1b: Social norms are positively related to attitude toward using digital technology.
H1c: Social norms are positively related to digital literacy.

According to Bandura (1995), self-efficacy refers to "one's capability to organize and execute the courses of action required to manage prospective situations" (p. 2). From the social cognitive theory perspective, Bandura argues that individual characteristics such as personality, situation, environment, and behaviour reciprocally impact one another (Bandura, 1977, 1982). Moreover, Vijayasarathy (2004, p. 751) argues that, in addition to beliefs (self-efficacy) about one's own capabilities to perform a behaviour, the likelihood of a person to engage in a particular behaviour is closely linked to her/his expectations toward the consequences of performing it. In digital technology use context, Compeau and Higgins (1995) define self-efficacy as "individual's judgment of one's capability to use a computer"; thus:

H2a: Self-efficacy is positively related to information literacy.
H2b: Self-efficacy is positively related to attitude toward using digital technology.
H2c: Self-efficacy is positively related to digital literacy.

Information Literacy and Digital Literacy

Information literacy is associated with critical thinking and the ability to search, locate, and assess web-based information and content (Ng, 2012). In the information age, a person lacking these competences may be considered an illiterate. The ability of individuals to evaluate and use information effectively, efficiently, and wisely has become increasingly important. This is not only due to the fact that access to information has be become relatively easy and inexpensive, but also because the ability to find reliable information is considered to be a vital competence. Moreover, the fact that information literacy has become a key ICT skill is closely linked to availability of and access to unlimited digital information, as people can easily publish and manipulate information (Eshet-Alkalai, 2004). Information literacy is the ability to effectively evaluate and assess information or, in other words, the skill, ability, or competence a person possesses to find the right information from the right source (Chanchinmawia & Verma, 2018). The central issue in evaluating information lies in the difficulty of assessing its credibility and originality. We argue that individuals' information literacy not only affects their attitude toward ICT use, but also positively influences their intentions to use technology; thus:

H3a: Information literacy is positively related to attitude toward using digital technology.
H3b: Information literacy is positively related to intention to use digital technology.

In terms of digital literacy, Ng (2012) posits that a person is considered digitally literate if he/she has the technical and operational competences to use digital technology for learning and in everyday activities. Chanchinmawia and Verma (2018, p. 389) define digital literacy as the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills. Moreover, a digital literate person is expected to be a critical thinker, able to use the Internet responsibly for communicating, to select appropriate software programs, and to use his/her ICT skills in searching and evaluating digital information for learning or performing a task (Ng, 2012, p. 1068); thus:

H4a Digital literacy is positively related to attitude toward using digital technology.
H4b: Digital literacy is positively related to intention to use digital technology.

Attitude toward Using Digital Technology and Intention to Use

Attitude toward using technology is defined as an individual's overall affective reaction to using a system (Venkatesh et al., 2003). Moreover, it has been argued that attitude is the strongest predictor of behavioural intention. Buabeng-Andoh (2012) argues that teachers' (digital immigrants, in this paper) ICT skills are positively related to their computer attitudes. The more experience they have with ICTs, the more likely they will have positive attitudes toward using them in their classrooms (Rozell & Gardner, 1999; van Braak et al., 2004). Kennedy et al. (2008) investigated students' attitudes toward the use of technology in their studies and found a strong positive relation between students' degree of technology use and the degree to which they endorsed technology use in their studies at university (p. 116). We posit that the more confident digital natives and digital immigrants are about their ICT skills, the more positive their attitude toward using digital technology will be; thus:

H5: Attitude toward using technology is positively related to intention to use digital technology.

In this paper, the construct intention to use is adopted and considered as a proxy for individuals' acceptance of digital technology. Many prior studies have used this construct and have found it to be an appropriate predictor of future usage (Joo et al., 2018). This construct relates to motivational factors and is the most important determinant in predicting the decision to take a specific action or not (Ajzen, 1991). Given that this construct can be used to predict specific behaviour, in this paper we use it to investigate digital natives' and digital immigrants' intentions to use digital technology. Figure 1 shows the proposed conceptual model.
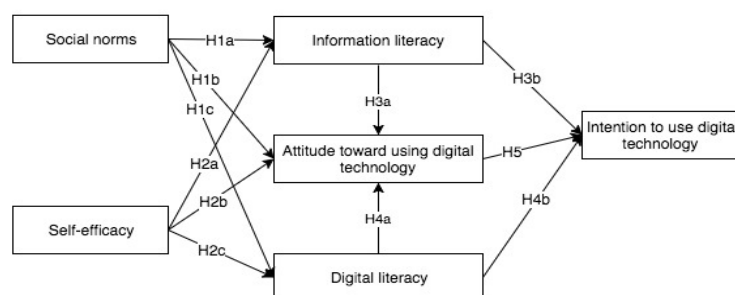

Figure 1.   Research model.

4   Research Methodology

In this paper we use two distinct methodological approaches—structural equation modelling using IBM AMOS v.23, and fuzzy-set qualitative comparative analysis using fsQCA 3.0 software for analysis of collected data. A combination of SEM and fsQCA has recently been used by some researchers (e.g., Nikou et al., 2018). The measurement items for social norms (three items) and self-efficacy (eight items), and the dependent variable intention to use (six items) were adopted from Venkatesh et al. (2003). The measurement items for information literacy (seven items), digital literacy (10 items), and attitude toward using technology (five items) were adopted from (Hargittai, 2005; Ng, 2012). This study considered—gender—as control variable which may impact on individuals' intention to use technology.

4.1   Data Collection

We used two online questionnaires to test the research hypotheses: one for digital natives and one for digital immigrants. The questions regarding the use of digital tools and academic applications were different for each group, but questions for measuring items within each construct in the conceptual

model were the same for both groups. We used the questionnaire as the instrument to collect data. Moreover, a survey questionnaire as the instrument to collect data was deemed the appropriate approach in the context of this study, as it is the most affordable way to gather quantitative, scalable, practical, and actionable data and to get results quicker, compared to approaches using for example case studies or interviews. The survey was administered in a well-known university in Finland. We used a nonprobability sampling strategy to collect data. The subjects were university employees in different positions, as well as students at bachelor, master, and doctoral levels who use digital tools and services for their work and study. We paid careful attention to recruit participants that fit only into one of the groups (natives or immigrants). We invited a number of students, as well as administrative and nonadministrative employees to check the questionnaire items to avoid ambiguity in expressions and statements. The measures were tested using a 7-point Likert-type scale (1 = strongly disagree, 7 = strongly agree). After distributing the questionnaires (on March 19, 2018), a reminder was sent at the beginning of April 2018 to encourage responses. Over the course of 4 weeks, 188 questionnaires were returned by digital natives, and 181 by digital immigrants; five natives' and four immigrants' responses were incomplete and were thus discarded. Finally, 183 (native) and 178 (immigrant) valid questionnaires were used for analysis. This means that we had adequate sample size to perform a robust analysis. According to Hair et al. (2010), the sample size should be at least 10 times the largest number of structural paths directed at a construct. For both groups, to test nonresponse bias, we followed an approach suggested by Armstrong and Overton (1977)—we compared the first 25% of the respondents with the final 25% of the respondents on all variables using a chi-squared test. The test results showed that the two groups did not significantly differ; thereby we concluded that nonresponse bias was not an issue in this study.

5 Results and Data Analysis

As data in this study were collected from a single source, common method bias test should be performed, given that common method bias can threaten the validity of the research results. Harman's one-factor test (via a principal component factor analysis) on the survey items was used to account for possible common method bias (Podsakoff & Organ, 1986). The result showed that no factor accounted for more than 50% of the variance. The test results yielded six factors that had eigenvalues greater than 1.0, accounting for 71.47% of the variance. Therefore, we concluded that common method bias is unlikely to be an issue in our study. In the digital native group, 49% of the respondents were studying their bachelor's degree, 48% were master's degree students, and 1% were doctoral candidates. The majority of the respondents (95.7%) indicated that they use mobile (smart) phones several times a day. Digital devices such as desktop PC (28.2%), tablet (11%), laptop (64%), as well as Internet (47%) and Wi-Fi (84.5%) were extensively used for performing daily education-related tasks (see Table 1).

	Digital Natives		**Digital Immigrants**	
Gender	Male: 75 (41%)	Female: 106 (58%)	Male: 77 (43.5%)	Female: 100 (56.5%)
Age	Minimum: 19	Maximum: 29	Minimum: 30	Maximum: 72
Education	Bachelor: 92	Master: 89	Staff:	Administration:
Please indicate (rate) your level of agreement about your literacy competences towards following ("1 = very low competence" – "7 = very high competence")			**Digital natives**	**Digital immigrants**
I think my level of digital literacy (e.g., the ability to use digital devices such as smartphone, tablets and laptops) is			M = 6.0	M = 5.8
I think my level of information literacy (e.g., the ability to locate, evaluate, and use effectively the needed information) is			M = 5.5	M = 5.9
I think my level of cognitive literacy (e.g., the ability to make meaning in and of my life) is			M = 5.4	M = 5.8
I think my level of social-emotional literacy (e.g., the ability to collaborate with peers or colleagues) is			M = 5.3	M = 5.7
I think my level of technical literacy (e.g., the ability to appropriately select and responsibly use technology) is			M = 5.4	M = 5.3
I think my level of network (Internet) literacy (e.g., the ability to communicate on the Internet appropriately) is			M = 5.9	M = 5.7

How skilled are you with the following Internet-related tasks and concepts? ("1 = not at all skilled" – "7 = very skilled")		
Downloading a file from the Web to your computer	M = 6.4	M = 6.4
Uploading (you know how to send a file that is on your computer's hard drive to someone using another computer)	M = 6.1	M = 6.3
Searching (you know how to search for information via a search engine)	M = 6.4	M = 6.5
You know how to open an attachment someone sent you via email)?	M = 6.5	M = 6.6

Table 1.   Sample demographic information.

In the digital immigrant group, 14% of the respondents were professors, 30% were university employees (administrative), 22% were researchers and lecturers, 5% were teachers and supervisors, 7% were researchers and supervisors, 13% were doctoral candidates, and almost 9% indicated that they had other duties at the university (e.g., ICT centre staff, technical employee). The majority of the respondents (96.1%) in this group indicated that they use mobile (smart) phones several times a day. Digital devices such as desktop PC (63.5%), tablet (26.5%), laptop (71.2%), as well as Internet (82.9%) and Wi-Fi (91%) were extensively used for performing daily tasks.

5.1   Measurement Model

A confirmatory factor analysis was used to assess the measurement model. Two test validities—convergent and discriminant—were computed to validate the measurement model in this study. Convergent validity was assessed by composite reliability and the average variance extracted. Table 2 shows the results of composite reliability, with values ranging from .79 to .96 for digital natives and .83 to .91 for digital immigrants, which are all above the recommended value of .70; AVE scores ranged from .53 to .80 for digital natives and from .51 to .65 for digital immigrants, which are also above the recommended threshold level of .5. In addition, all the Cronbach's alphas and item loadings were above the recommended level (> .70) for both groups. Values for digital immigrants are shown within brackets.

	Loadings (lowest-highest)	Cronbach's α	CR	AVE
Digital literacy	**.742-.876** [.837-.894]	**.887** [.897]	**.922** [.909]	**.628** [.516]
Social norms	**.719-.901** [.701-.867]	**.919** [.928]	**.808** [.830]	**.589** [.627]
Self-efficacy	**.669-.806** [.783-.879]	**.859** [.858]	**.927** [.913]	**.615** [.568]
Information literacy	**.742-.876** [.822-.948]	**.956** [.939]	**.787** [.832]	**.533** [.511]
Attitude toward use	**.773-.859** [.761-.854]	**.929** [.908]	**.895** [.878]	**.683** [.598]
Intention to use	**.798-.854** [.805-.918]	**.793** [.803]	**.959** [.914]	**.797** [.653]

Table 2.   Reliability and validity: digital natives [digital immigrants].

Finally, we measured the square root of the AVE to assess discriminant validity. Table 3 shows square root of the AVE values for all constructs, indicating that the obtained values are greater than the correlations among them, thereby confirming discriminant validity.

Table 3. Discriminant Validity: Natives [Immigrants]						
	Digital literacy	Social norms	Self-efficacy	Information literacy	Attitude toward use	Intention to use
Digital literacy	**.792 [.719]**					
Social norms	.335 [.350]	**.767 [.792]**				
Self-efficacy	.662 [.656]	.417 [.390]	**.785 [.754]**			
Information literacy	.740 [.649]	.343 [.396]	.558 [.539]	**.744 [.715]**		
Attitude toward use	.462 [.627]	.277 [.300]	.657 [.673]	.482 [.537]	**.827 [.773]**	
Intention to use	.558 [.456]	.375 [.366]	.390 [.389]	.475 [.398]	.435 [.390]	**.893 [.808]**

Table 3.   Discriminant validity: digital natives [digital immigrants].

5.2   Structural Model

As the measurement model exhibited good measurement properties, it was examined through structural equation modelling (SEM) using IBM AMOS v.23. According to the model fit criteria suggested by Hair et al. (2010), the structural model fitted the data relatively well for digital natives, $\chi^2 = 776.450$, df = 411, CMIN/df = 1.889, CFI = .92, TLI = .91, NFI = .85, GFI = .87, AGFI = .79, RMSEA = .070; and for digital immigrants, $\chi^2 = 1,235.814$, *df* = 606, CMIN/df = 2.039, CFI = .89, TLI = .86, NFI = .79, GFI = .81, AGFI = .79, RMSEA = .77. Furthermore, the path coefficients were examined to test the hypotheses. As indicated in Figure 2, intention to use digital technology was explained by a variance of 47%, indicating that the predictors explained a large amount of variation. Attitude toward using technology, information literacy, and digital literacy were explained by variance values of 46%, 29%, and 53%, respectively. The results of the analysis revealed that social norms show no direct effect on attitude toward using technology and digital literacy; therefore, both H1b and H1c were not supported by the model. However, we found that social norms has a significant, but weak effect on information literacy, as indicated by the SEM analysis showing a significant path ($\beta = .147$, $p < .05$), thus supporting H1a. The results showed that self-efficacy has very strong positive relations to information literacy ($\beta = .459$, $p < .001$), attitude toward using digital technology ($\beta = .611$, p < .001), and also digital literacy ($\beta = .70$, $p < .001$), thus H2a, H2b, and H2c were supported by the model. In Hypotheses 3a and 4a, it was postulated that information literacy and digital literacy have direct impacts on attitude toward using technology; the analysis results confirmed only one of the hypotheses—H3a ($\beta = .170$, $p < .01$)—and we did not find any significant path between digital literacy and attitude toward using technology. The SEM analysis revealed that attitude toward using technology ($\beta = .241$, $p < .001$) and digital literacy ($\beta = .415$, $p < .001$) have a significant effect on intention to use digital technology, supporting H5 and H4b, but surprisingly, information literacy had no significant effect on intention to use, thus H3b was rejected. Taking the results of the SEM analysis and the coefficients of the determinants of intention to use digital technology, self-efficacy emerges as the most powerful predictor relative to other constructs in the model. In addition, this construct appears to have the largest effect, through digital literacy and attitude toward using technology, on intention to use it (see Figure 2).
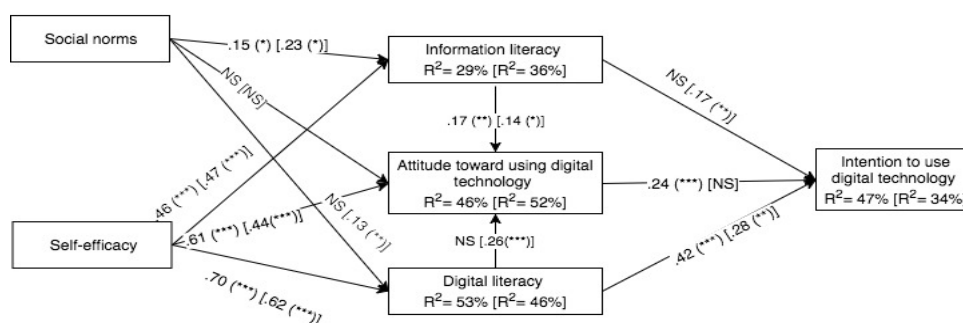

Figure 2.   Structural model results.

As for the digital immigrant group, values are in the bracket in Figure 2, the SEM analysis revealed that intention to use digital technology was explained by a variance of 33.7%, indicating that the predictors explained a relatively large amount of variation. Attitude toward using technology, information literacy, and digital literacy were explained by variance values of 52%, 36%, and 46%, respectively (see Figure 2). Results of the analysis revealed that social norms show no direct effect on attitude toward using technology, thus H1b was not supported by the model. Unlike the case of the digital native group, social norms as a positive relationship with digital literacy ($\beta = .126$, $p < .01$); therefore, H1c was supported by the model. Moreover, it was found that social norms has a significant effect on information literacy ($\beta = .230$, $p < .05$), thus H1a was supported. The results showed that self-efficacy has very strong positive relationships with information literacy ($\beta = .468$, $p < .001$), attitude toward using digital technology ($\beta = .439$, $p < .001$), and digital literacy ($\beta = .62$, $p < .001$); thus H2a, H2b, and H2c were supported by the model. In Hypotheses 3a and 4a, it was postulated that information literacy and digital literacy have

direct impacts on attitude toward using technology; the analysis, unlike the case of the digital native group results, confirmed both of the hypotheses—H3a (β = .144, p < .05) and H4a (β = .256, p < .003). The SEM analysis revealed that attitude toward using technology has no influence on intention to use it, thus rejecting H5. This finding was not expected. However, information literacy (β = .171, p < .01) and digital literacy (β = .276, p < .002) both have significant effects on intention to use digital technology, supporting H3b and H4b. Taking the results of the SEM analysis and the coefficients of the determinants of intention to use digital technology, self-efficacy again emerges as the most powerful predictor relative to other constructs in the model. In addition, this construct appears to have the largest effect, through digital literacy and information literacy, on intention to use digital technology (see Figure 2).

As for the moderating effect of gender on the path relationships, interesting results emerged. In terms of the most important differences between males and females in the digital native group, it was found that the path relationship between information literacy to attitude toward using technology is significant for females (β = .261, p < .002) but not for males. Also, the path between attitude toward using technology to intention to use it was found to be significant for females (β = .418, p < .001) but not for males. On the other path relationships, we did not find any major significant differences. As for the moderating effect of gender in the digital immigrant group, it was found that the path relationship between social norms to information literacy is significant for females (β = .255, p < .05) but not for males. Also, the path between information literacy to attitude toward using technology was found to be significant for males (β = .243, p < .001) but not for females. It was also found that digital literacy has a positive impact on intention to use digital technology for males (β = .527, p < .001), whereas this path was not significant for females. We did not find any differences on the other path relationships.

6 Fuzzy-set Qualitative Comparative Analysis

In this section, we discuss the method used in this study and then the results are illustrated. fsQCA was introduced by Ragin (1987) and since its conception has been increasingly used by scholars in various disciplines, and more recently in business and information systems studies (e.g., Nikou et al., 2018; Woodside, 2013). This method provides a means to overcome some of the limitations of conventional statistical methods, such as regression-based analysis; for instance, it enables to account for the complex interdependencies, conjunctive paths, and the causal relationships between variables which might better inform the factors influencing the outcome variables. Qualitative comparative analysis (QCA) is an analytic technique using Boolean algebra to implement logical comparison. Both variable-oriented (quantitative) and case-oriented (qualitative) methods can utilize this approach. This method has two main extensions, crisp-set QCA and fuzzy-set QCA (fsQCA, a set-theoretic technique; Schneider & Wagemann, 2007). Crisp-set analysis is dichotomous, which means that a case can only be either "in" or "out" of the set. For example, a set of gender with two binary values: "in" (1 = female) and "out" (0 = male). However, fsQCA can be used to present the membership in terms of intervals between 0 and 1. One of the main distinctive differences between fsQCA and other variations of QCA is its ability to present dependent and independent variables in a fuzzy scale (continuous) instead of as binary values, and also to help find patterns of elements leading to the outcome. These advantages are comparable with other statistical methods such as regression-based and correlational methods that identify correlations between independent and dependent variables.

6.1 Procedures in fsQCA Analysis

The first step in fsQCA analysis is calibration. As in this study dependent variable and independent variable were measured on a Likert scale, they should be calibrated into fuzzy sets, that is, transforming values into fuzzy-set ranges from 0 to 1. The value of 0 indicates "fully out" or no set membership, and the value of 1 indicates "fully in" or full set membership (Ragin, 2008). When calibrating the values, we used three anchors to indicate the degree of membership for each condition (Woodside, 2013): (a) fuzzy score = .95 for full membership, (b) fuzzy score = .05 for full nonmembership, (c) and fuzzy score = .50 for cross-over point. The next step is the necessity analysis. The necessity analysis examines if there are any variables (conditions, in terms of fsQCA) which could be considered as necessary for the

outcome of interest to occur (Ragin, 2006). A condition is necessary when it must be present for the outcome to occur, and it is considered a sufficient condition when it can produce an outcome by itself. In terms of importance and relevance of the necessity relationships, consistency values can be used, with values higher than .90 indicating considerable relationships (Schneider & Wagemann, 2007).

We conducted the necessity analysis and the results showed that there are no conditions with values higher than .90. Thus, we conclude that there are no conditions in the data that can be considered as necessary for the outcome of interest (intention to use digital technology) to occur for both groups—digital natives and digital immigrants. In the next step, the truth table must be constructed. The truth table of 2^k rows is constructed after calibrating all values into fuzzy sets, where k is the number of predictor variables (conditions) and each row represents a possible combination (Mikalef & Pateli, 2017). Ragin (2008) suggested to set the consistency levels to > .75. Thus, in this paper, configurations that did not comply with the threshold were removed from analysis. The solution coverage assesses the empirical relevance of a consistent subset and it is similar to the explained variance (R2; Mendel & Korjani, 2012). The fsQCA generates three sets of solutions: (a) parsimonious, (b) intermediate, and (c) complex. Ragin (2008) recommend using the intermediate solutions for describing the findings, emphasizing that researchers' knowledge domain plays an important role in describing the results (Ragin, 2008). We will use the following notations in presenting the results in our tables. Black circles (●) indicate the presence of a condition, and blank circles (○) indicate its absence. Blank spaces indicate "do not care," that is, the causal condition may be either absent or present (Ragin & Fiss, 2008). When gender is included in the analysis, the following notations are used: black circles (●) indicate "male," and blank circles (○) indicate "female."

6.2   fsQCA Results (Digital Natives and Digital Immigrants)

For the digital native group, the fsQCA for intention to use digital technology revealed four solutions (configurations), without including gender of respondents as a condition (moderator) in the analysis. In most of the configurations, the presence of attitude toward using technology and digital literacy (either present or absent) was found (see Table 4). The findings of the fsQCA, while reinforcing the structural model results, emphasize the important role of attitude toward using technology and digital literacy. The configurations in Table 4 suggest that digital literacy, by itself, is necessary—but not sufficient—for the outcome of interest to occur, as this condition is included in all four solutions. The other four conditions (social norms, self-efficacy, information literacy and attitude toward using technology), when taken alone, are neither necessary nor sufficient. It is interesting to note that social norms and self-efficacy appear separately in most of the solutions (see Solutions 1–3). Solution 1 indicates that the absence (negation) of digital literacy and the presence of social norms and attitude lead to the outcome of interest.

FsQCA Result: Digital Natives (Without Gender Included)										
Solution	SN	SE	IL	ATT	DL	Raw coverage	Unique coverage	Consistency	Solution coverage	Solution consistency
1	●			●	○	.627	.011	.922	.783	.911
2		○		●	○	.586	.002	.935		
3		○	○	○	●	.728	.001	.875		
4	○	●	●		●	.748	.001	.956		

FsQCA Result: Digital Natives with Gender Included										
#	GEN	SN	SE	IL	ATT	DL	Raw coverage	Unique coverage	Consistency	Solution coverage	Solution consistency
1	○	●			●	●	.207	.003	.911	.724	.986
2	○		○		●	○	.370	.005	.924		
3	○	●	○				.159	.001	.853		
4	●	●	●		●	○	.112	.001	.961		
5	●	●	●		○	●	.106	.011	.917		
6				●	●	●	.623	.019	.998		

Table 4.   FsQCA results: digital natives.

Solution 2 indicates that the presence of attitude toward using technology and the negation of digital literacy and self-efficacy lead to the outcome. Solution 3 shows that the presence of digital literacy and the negation of self-efficacy, attitude, and information literacy lead to the outcome of interest. This configuration implies another route to intention to use that should appeal to individuals for whom digital literacy is an important ability. Solution 4 is the most important solution from the perspective of consistency value and shows that the presence of digital literacy, information literacy, and self-efficacy in addition to the absence of social norms lead to the outcome of interest. This solution is the only configuration that includes the presence of both information and digital literacies, as well as the presence of self-efficacy in addition to the absence of social norms. An interesting observation is that social norms and self-efficacy play different roles in all obtained solutions. We do not have any configurations that indicate the presence of both conditions. fsQCA results show an overall solution consistency of .911.

A separate analysis was performed to determine the configurations of conditions when gender of respondents was included in the analysis as a condition. As Table 4 shows, six distinct solutions (configurations) that can stimulate intention to use digital technology emerged. It is interesting to note that gender has an important role in five solutions. The first three solutions relate to females and Solutions 4 and 5 to males. Solution 6 is the only configuration that applies for both genders. Solution 1 represents a configuration indicating that, for females, the presence of social norms, attitude, and digital literacy lead to the outcome of interest. Solution 2 shows that, for females, the lack (absence) of digital literacy and self-efficacy in addition to the presence of attitude lead to the outcome. Solution 3 shows a configuration that applies to females only and, again, the absence of self-efficacy and the presence of social norms are sufficient conditions to lead to the outcome. What is clear here is that for females, the presence of social norms is extremely important along with the absence of self-efficacy. These findings might suggest that females do not believe in their own capabilities and depend mostly on the pressure of others to use digital technology. Solution 4 presents a configuration that applies only to males, in which the presence of social norms, self-efficacy, and attitude together with the absence of digital literacy lead to the outcome of interest. Solution 5 shows that for males, the presence of social norms, self-efficacy, and digital literacy in addition to the absence of attitude lead to outcome. These two solutions indicate that for males, two conditions are important—social norms and self-efficacy. Moreover, there are two other conditions that provide interesting insights: if attitude is present in a condition, then digital literacy is absent; and if digital literacy is present in a configuration, then attitude is absent. Finally, Solution 6 shows a configuration in which the presence of information literacy, attitude, and digital literacy are conditions sufficient to lead to the outcome, and this applies to both females and males. fsQCA results show an overall solution consistency of .986. These six configurations explain almost 72% (total coverage = .724) of the intention to use digital technology.

	FsQCA Result: Digital Immigrants (Without Gender Included)									
Solution	SN	SE	IL	ATT	DL	Raw coverage	Unique coverage	Consistency	Solution coverage	Solution consistency
1	●	○		○		.295	.010	.997	.705	.992
2	●	●			●	.606	.063	.925		
3	●		●	●		.603	.029	.957		
4		○	●		●	.252	.005	.998		
5		○		○	●	.363	.002	.963		
	FsQCA Result: Digital Immigrants with Gender Included									
#	GEN	SN	SE	IL	ATT	DL	Raw coverage	Unique coverage	Consistency	Solution coverage	Solution consistency
1		●		●	●	●	.580	.023	.967	.783	.911
2	○	●	○	●		●	.225	.012	.952		
3	○	●	●	●	●		.304	.008	.988		
4	●	●	●	●		●	.247	.008	.944		

Table 5.   FsQCA results: digital immigrants.

For the digital immigrant group, the fsQCA for intention to use digital technology revealed five solutions (configurations), without including gender of respondents as a condition in the analysis. In most of the configurations, the presence of social norms was found (see Table 5). fsQCA findings, while reinforcing the structural model results, emphasize the important role of social norms, which was not apparent in the SEM analysis. The configurations in Table 5 suggest that social norms, especially when gender is included in the analysis, by itself, is a necessary—but not sufficient—condition for the outcome of interest to occur. Solution 1 indicates that the absence (negation) of attitude and self-efficacy and the presence of social norms lead to the outcome of interest. Solution 2 indicates that the presence of social norms, self-efficacy, and digital literacy leads to the outcome of interest. Solution 3 shows that the presence of social norms, information literacy, and attitude leads to the outcome of interest. Solution 4 is the most important solution from the perspective of consistency value, showing that the presence of digital literacy and information literacy, and the negation of self-efficacy lead to the outcome of interest. This solution is the only configuration that includes the presence of both information and digital literacies. Solution 5 shows a configuration that includes the presence of digital literacy and attitude and the negation of self-efficacy, fsQCA results show an overall solution consistency of .992 and coverage value of .705, indicating that solutions cover almost 71% of the cases. In a separate analysis, we included gender as a condition and obtained four solutions. The results show that gender is indeed an important condition and play an important role in the configurations. There is only one solution in which gender does not play a role—Solution 1. In Solution 1, the presence of social norms, attitude, and both literacies—information and digital—leads to the outcome of interest and it is the second most important solution with respect to consistency value. Solution 2 shows a configuration that is applicable only to females. In this solution, the presence of digital and information literacies in addition to the presence of social norms and the negation of self-efficacy lead to the outcome. Solution 3 applies also to females and indicates that the presence of social norms, self-efficacy, information literacy, and attitude leads to the outcome of interest. This solution is the most important configuration among all four solutions. Finally, Solution 4, which applies only to males, shows that the presence of social norms, self-efficacy, information literacy, and digital literacy leads to the outcome of interest (see Table 5). The overall solution consistency is .911 and the overall coverage value is .783, indicating that these four solutions cover almost 78% of the cases.

7   Discussions

By applying social norms, attitude toward using technology, and self-efficacy from established acceptance and adoption theories, in addition to information literacy and digital literacy, this study develops a conceptual model to investigate intention to use technology. We found that social norms as an important influencing factor that plays a different role in the decision making of digital natives and digital immigrants. For instance, while this construct has no influence on digital literacy and attitude toward using technology for the digital native group, it has a positive influence for digital immigrants. This is consistent with prior findings by Liu et al. (2018) and Twenge (2014) indicating that as digital natives grew up during a time of change in social norms, they follow standards and norms that emphasize independence and individualization. Furthermore, our findings show that information literacy has no effect on intention to use digital technology for digital natives, while it has a strong effect on digital immigrants' decision to use technology. The SEM results showed an unexpected finding in contrast to prior studies that indicate that attitude has a positive effect on technology use—we did not find any positive relationship between attitude and intention to use technology for digital immigrants (a result inconsistent with previous work; e.g., Taylor & Todd, 1995). However, this relationship is positive for digital natives. A possible explanation is that for this group, Internet and digital technology have always been part of their lives; therefore, their attitudes to use technology have perhaps been formed since they were born. Moreover, the findings showed that when gender is included as a control variable, differences between females and males are found in some of the path relationships. For example, the path relationship between information literacy and attitude toward using technology is significant for females but

not for males. Moreover, the role of gender was also important in the path between attitude toward using technology and intention to use it, as it was found that this path is only significant for females. For digital immigrants, it was found that the path relationship between social norms and information literacy is significant only for females. Also, the path between information literacy and attitude toward using technology was found to be significant only for males. These findings have implications for universities aiming at digitalization in research and education. For example, it is important for university policy-makers to understand the differences between students and teachers in terms of abilities and skills related to information literacy and digital literacy. It is common practice to use the same ICT tools, but from different points of departure. This means that the differences discussed in this paper must be carefully considered in order to implement successful digital transformation strategies. While it is not the aim of this paper to make strict statistical comparisons between the two methods used—structural equation modelling and fuzzy-set qualitative comparative analysis—it can be noted that additional and complementing results were found using fsQCA. For instance, we found that digital literacy is considered to be more important than information literacy by digital natives. Moreover, we found that social norms play a vital role in digital immigrants' intention to use digital technology. More interestingly, we found that when gender was included in the analysis, information literacy was a necessary condition for the outcome of interest to occur. Furthermore, we found that the role of self-efficacy is less important, and sometimes its negation leads to the outcome of interest. If we were to stop here, we would not be able to gain these important insights, specially about the role of gender. These findings suggest that there are multiple and equally important paths that lead to the outcome. Unlike the SEM results, where we found the importance of one-to-one path relationships, in fsQCA, we found different configurations of conditions that lead to the outcome.

8 Conclusion

This is one of the first studies comparing digital natives' and digital immigrants' use of digital technology in a university context. Building on the digital literacy and information literacy perspectives presented here, future research should focus on identifying constructs that can add to the prediction of intention to use digital technology beyond what is already known and understood. Given that the inclusion of social norms, self-efficacy, information literacy, attitude toward using technology, and digital literacy explains as much as 47% (digital natives) and 34% (digital immigrants) of the variance in intention to use digital technology, we argue that we may be approaching the possibility to explain individuals' (digital native or digital immigrant) decision to use digital technologies. The literature informs us that there are several competing explanatory models of individuals' use of digital technology. This paper advances this stream of research by applying two methodological approaches: one is a common method in the literature (regression-based analysis), and the other, a more recent approach in information systems, information science, and business (a configurational thinking method—fuzzy-set qualitative comparative analysis), incorporating gender as a moderator to account for the dynamic influence of this important variable. The findings of this research show that, while important insights can be gained from SEM analysis, the results of fsQCA not only reinforce those of SEM but also show that there are multiple configurations that can lead to an outcome of interest. There are some limitations in this study and, by discussing them here, we hope to show some possible directions for future research. For example, we did not collect information about the level of education of digital immigrants. Moreover, we collected data from an educational organization (a university in Finland). Therefore, we are not able to generalize our findings to a larger population or geographical region. We suggest future studies examine other countries (e.g., a Nordic country) and investigate whether our conceptual framework is applicable to them. The responses in the survey were self-reported, thus there might be bias regarding perception of information literacy and digital literacy capabilities measure. Finally, we considered self-efficacy and social norms as antecedents of attitude to use digital technology; other factors might also be related to intention to use, we therefore urge other researchers to take further steps to include other factors such as hedonic motivations.

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