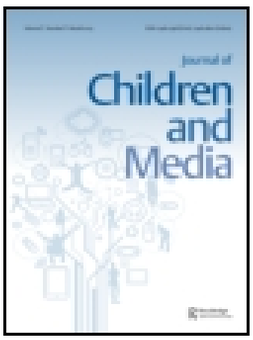

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Psychological, cultural and socio-structural factors associated to digital immersion in Chilean adolescents

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ABSTRACT

Nowadays, adolescents grow up in environments where many aspects of their lives are mediated by digital technologies. The aim of this study was to examine the influence of psychological, cultural and socio-structural factors in the level of digital immersion in adolescents from southern Chile. A non-probabilistic sample of 469 adolescents was collected from schools with different socio-economic backgrounds. A multigroup analysis was performed using structural equations modelling. The results indicate that family income moderate digital immersion model. Furthermore, for low-income and middle-to-high-income students, the attitude towards the use of digital technologies was the most important factor to predict digital immersion, followed by motivation. However, the results indicate differences between groups by family income in the following model's path: from navigation skills to social skills; motivation to satisfaction; self-transcendence value to social skills; and attitude towards the use of technology to motivation. This study provided an opportunity to move forward in the understanding of the relationship between Chilean adolescents and their technology use. These results indicate the existence of deep cultural changes in Chilean adolescents' life, which are strongly marked by the profuse use of digital technologies.

Impact Summary:

Prior State of Knowledge:

The use of digital technologies has been studied in different contexts, considering diverse population, but adolescents' immersion in digital technologies has not been addressed in the Chilean context. This lack of knowledge might affect a deeper understanding of technology use.

Novel Contributions:

The current study addresses and proposes a new definition of adolescents' digital immersion taking into consideration psychological, cultural and socio-structural factors, allowing a more integrated, and empirically based, approach to the phenomenon.

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Practical Implications:
As the use of digital technologies occurs in a complex ecosystem, the findings reached in this study represent relevant data for policy makers, in order to define and promote digital immersion in Chilean adolescents, and other similar contexts.

1. Introduction

We believe that nowadays adolescence is strongly influenced by digital technologies. For example, teenagers communicate to one another by instant messaging or other forms of social media as naturally as they do in person, and they are also able to effortlessly contact people from faraway places (Boyd, 2014). Moreover, they often access to multicultural contents, acquire knowledge or benefit from ubiquitous learning, and freely engage in leisure gaming and artistic self-expression, among other things they do by using digital technologies (Ito et al., 2009). The use of technologies by adolescents has many edges. There have been numerous studies discussing a wide range of topics about the use of technology by adolescents around the world. For example, adolescent sexting (Baiden, Amankwah, & Owusu, 2020); social networks (Muhametjanova, Afacan Adanır, & Akmatbekova, 2019); Internet addiction (Leung, 2008); cyberbullying (Milosevic & Vladisavljevic, 2020); etc. Beyond these topics, there is a lack of understanding about how deeply immersed adolescents are in this digital world.

Although the notion of immersion has been used mostly in relation to videogames, some authors have linked it to different dimensions of digital technologies. For example, Rosenfeld (2016) defines digital immersion as " ... the breadth and depth of an individual's digital use and time spent in cyberspace." (p. 123). Owston (2009) suggests that digital immersion relates to time spent on Web 2.0 activities combined with the use of other media; while Jenkins (2006) associates digital immersion with the widespread, frequent and intense use of digital technologies. These authors also point out that digital immersion should include the ability to proficiently use different technological devices (computers, smartphones, tablets, etc.) and use a wide variety of applications while performing most daily activities. According to Brooks (2003) definition, immersion is an act of involvement in a specific context, not only physically, but also mentally and emotionally. If immersion is considered as an act of involvement, it is possible to infer that it has a strong relationship with motivation and the attitude the subjects have. Overall, all these approaches highlight the persistent, continuous and enthusiastic use of digital media and devices in the definition of digital immersion.

Despite the current theoretical contribution in the field represented by these definitions, there are some other aspects, pointed out by other scholars, we consider relevant. Georgiou and Kyza (2017) consider cognitive involvement significant for focusing on activities that involve the use of technology and multitasking. Another aspect, conceived by Carter and Grover (2015), is related to technological identity on different elements. They consider a sense of close relatedness, some sort of blurring of boundaries between the notions of "self" and technologies, which is experienced as feelings of connectedness with the digital world. This comes along with a sense of emotional commitment, the individual's enduring feelings of emotional attachment and enthusiasm in relation to the

use of technologies. Technological identity comes also coupled with the individual's sense of dependence on technology. It seems that digital immersion is a construct that evolves according to the new possibilities and use of digital technologies. A new and more encompassing definition of digital immersion is needed in order to provide an appropriate starting ground for further study and understanding of this phenomenon.

Based on a literature review in the topic, and the empirical facts related to the measurement of digital immersion, we propose a new definition covering a few elements related to a variety of technology use, intensity of use, multitasking, involvement and dependency of technology. Variety refers to the different types of use of technology. Intensity addresses the daily time spent using technologies. Multitasking considers the ability to perform several activities at the same time. Involvement refers to the degree of closeness that a person has with the culture that surrounds the use of technologies. Finally, dependency of technology covers the degree of relevance of digital technologies in people's lives.

In addition, and from a different but supplementary perspective, we chose to design the current study based on Flynn, Betancourt, and Ormseth's model (2011) which focus on culture and behaviour. According to this model, psychological factors are the most relevant/important processes associated with behaviour. Cultural factors, in turn, can influence behaviour either directly and/or through its effects on psychological factors. Finally, socio-structural factors, such as the place of residence, income and gender, are seen as sources of cultural diversity (Betancourt, 2015). We take into consideration this model, based on its relationships among different factors that influence a specific behaviour under study. According to Betancourt, it is impossible to develop a study without considering cultural factors, because these factors affect people's behaviour in a direct way or through its impact on people's intern processes. Betancourt addresses that trying to explain people's behaviour without taking into account the structure of relationship between cultural and psychological factors may result into an error, because this could present a specific fact as a universal principle, being only a form taken by the phenomenon under study in the original context where it is studied. Accordingly, the present study takes a wider and more integrative approach with the aim of assessing the psychological, cultural and socio-structural factors that may influence digital immersion in Chilean adolescents.

2. Theoretical background

In general, it is widely accepted that today digital technologies have reconfigured the diverse purpose of use that young people assign to them (Boyd, 2014; Ito et al., 2009). These purposes, in adolescents and young people, might be characterized by the combination of possibilities brought by continuous changes on digital technologies, and the always increasing demanding users' needs. This edge of digital immersion, digital technology user type has been classified for young people and adult population through different taxonomies. Horrigan (2007), for example, describes users as: omnivores, connectors, lacklustre veterans and productivity enhancers. Howard, Rainie, and Jones (2001) instead consider the time the user has accessed the Internet and the frequency of home connections, classifying users' types in netizens, utilitarians, experimenters, and newcomers. Ortega, Recio, and Román (2007), on the other hand, classify users considering

the degree of adoption of technology in: laggards; confused or adverse; advanced users; followers and non-internet users. Authors like Selwyn, Gorard y Furlong (2006) put a strong focus on time of use: broad frequent users; narrow frequent users; occasional users; and non-users. Following the same diversity of labels and definitions, Blank y Groselj (2014) proposes the following user profiles: entertainment, commerce, information seeking, socializing, email, blogging, production, classic mass media, school and work, and vice. Beyond the taxonomies and diverse points of view, and their different proposal about user's labels and definitions, all of these taxonomies share a common core goal: they try to classify what people do with digital technologies. The most problematic issue, which affects all the initiatives for classifying digital technologies users, is the highly changing technology context, represented by new tech devices able to agglutinate new uses and services.

With the advances of digital technologies, users constantly get a wider array of possibilities of use of these tools in different activities and contexts. What people do with digital devices and applications is based on the user's need, expectations and technological availability. Since 2013, European countries have been working in the development of DigCom. As its name indicates, it is a framework for developing and understanding digital competence in Europe. The recent development of DigComp (Vuorikari, Punie, Carretero, & Van Den Brande, 2016) has allowed the identification of five areas, or dimensions, that a person should perform well using digital technologies. The first dimension, Information and data literacy, includes browsing, searching, filtering, evaluating and managing data information and digital content. The second dimension, Communication and collaboration, addresses interacting, collaborating, sharing, engaging in citizenship and managing digital identity with others, through digital technologies. The third dimension, Digital content creation, includes activities associated to developing, integrating and re-elaborating digital content, programming and copyright issues. The fourth dimension, Safety, is related to protecting devices, personal data and privacy, as well as protecting health and well-being and the environment. The fifth dimension, Problem solving, covers solving technical problems, identifying needs and technological responses, identifying digital competence gaps and the creative use of digital technologies. Further developments in the DigComp focus on the proficiency levels of each dimension considering the complexity of tasks, the level of autonomy versus guidance, and the cognitive domain. Each of these elements is being exemplified for the four domain levels: foundation, intermediate, advanced and highly specialized (Carretero, Vuorikari, & Punie, 2017). The ability to be fully immersed in this environment and perform well in these digital competences depends on formal education instances, as well as autonomous experiences of the users.

On the other hand, to our knowledge, there are no studies reporting factors that influence digital immersion. Considering this, and after reviewing the current literature in the area of digital technologies, we propose to measure a set of theoretical factors that could be related to the use of digital immersion in adolescents. Previous works have reported the relevance of several psychological, cultural and socio-structural factors with regards to the use of technologies (Calvo-Porral, Faíña-Medín, & Nieto-Mengotti, 2017; Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014; Labbé, 2006; Teo, 2011; Van Deursen, Helsper, & Eynon, 2016; Van Dijk & Van Deursen, 2014; Zhao, Lu, Huang, & Wang, 2010). We considered these factors, in this study, in order to establish whether they contribute to

the variation of digital immersion. Evidently, there are many other factors that could have been included as well, like academic tenacity or self-directed learning. However, we believe that the factors considered in our study are the most pertinent within our regional context.

Regarding psychological factors, we consider relevant to address issues related to motivation, digital skills and satisfaction. Motivation involves the individual's willingness and desire to act in a certain way (Ojo & Raman, 2017). A considerable amount of literature has been published on the subject of motivation and technologies. Lin and Lu (2011) revealed that motivation is the most influential factor in people's continued use of social networking sites. Van Dijk and Van Deursen (2014) suggested that a high motivation to use computers has been associated with a high use of computers. In a similar way, digital competence has been associated with the interest and the pleasure gained from using technologies (Fraillon et al., 2014). On the other hand, digital skills, like operational, navigational, social, and creative, are viewed here both as the basic and essential skills necessary to access and use devices able to surf the Internet (Van Deursen et al., 2016). Operational skills contemplate basic skills needed to use the Internet on stationary and mobile devices. Navigational skills are the ones needed to search, find, select, and evaluate sources of information on the Internet. The social aspect includes the skills needed for online communication and to understand and exchange meaning and acquire social capital. The creative skills consider the creation of different types of content and posting or sharing this content on the Internet (Van Deursen et al., 2016). Finally, satisfaction gained from using digital technologies refers to how well the technologies satisfy the various needs or desires from users (Calvo-Porral et al., 2017). Helsper, Van Deursen, and Eynon (2015) highlight the relation between satisfaction obtained from Internet use and digital skills. Calvo-Porral et al. (2017) indicate that the experience and satisfaction of users determine their engagement to digital technologies. They suggested that satisfaction positively influences engagement and interaction with websites (Calvo-Porral et al., 2017).

Culture factors consist of both material and subjective elements (Triandis, 2002). In this study, material culture refers to the technological infrastructure (hardware, software, networks). It has been observed that the availability of technological infrastructure is directly related to the use of digital technologies (Zhao et al., 2010). Thus, technological infrastructure might be related to digital immersion. In fact, it has been found to be one of the major factors of the first-level digital divide (Scheerder, Van Deursen, & Van Dijk, 2017). On the other hand, some authors consider differences depending on the kind of devices used (Mossberger, Tolbert, & Hamilton, 2012; Van Deursen & Van Dijk, 2019). For example, creative content is usually better generated in computers; whereas social media tends to be shared via smartphones. These features gravitate on the second-level digital divide, which includes Internet use and skills (Scheerder et al., 2017).

Subjective culture considers the values and attitude towards technology. For the human values, we chose the empirical framework of 19 values orientation put forth by Schwartz et al. (2012). The authors showed that these basic values are part of four higher-order values that form two bipolar dimensions of motivationally incompatible values: self-transcendence versus self-enhancement and conservation versus openness to change. In a study about Chilean school teachers and their use of technology, Labbé (2006) found a direct relationship between the value dimension of openness to change and frequency of use and self-

perception of technology appropriation. A positive association between this level of appropriation and the dimension of self-transcendence was also found (Labbé, 2006). On the other hand, regarding attitude towards technology, Cheung and Huang (2005) established that a positive attitude towards the Internet correlated directly and significantly with Internet use. Teo (2011) mentioned that behavioral intention to use technology is directly influenced by the attitude towards its use. Celik and Yesilyurt (2013) suggested that a positive attitude towards use may be a significant predictor of computer self-efficacy.

Finally, in relation to socio-structural factors, several studies have reported that income has a significant impact on the use of technologies. According to Van Deursen and Helsper (2015), people from higher social groups obtain greater benefits from using the Internet mainly in terms of achieving results. In the International Computer and Information Literacy Study (ICILS), a higher income was associated with a better performance in digital literacy. In the case of Chile, when the family income was higher, the ICILS score was also higher (Fraillon et al., 2014). On the other hand, Zillien and Hargittai (2009) reported that high income users are much more likely to engage in online capital-enhancing activities than people with low income. Based on the evidence presented, we propose to test the following hypotheses (Figure 1):

H1: Creative (H1a), social (H1b), mobile (H1c), information navigation (H1d), and operational skills (H1e) are associated with digital immersion.

H2: Motivation to use the Internet and digital devices contribute positively with digital immersion (H2a), and to creative (H2b1), social (H2b2), mobile (H2b3), information navigation (H2b4), and operational skills (H2b5).

H3: Satisfaction with digital technologies contributes positively with digital immersion.

H4: Technological infrastructure contributes positively with digital immersion (H4a), and to creative (H4b1), social (H4b2), mobile (H4b3), information navigation (H4b4), and operational skills (H4b5).

H5: Self-transcendence (H5a1) and openness to change (H5a2) contribute positively with digital immersion. Self-transcendence contributes positively to creative (H5b1), social (H5b2), mobile (H5b3), information navigation (H5b4), and operational skills (H5b5). Openness to change contributes positively to creative (H5c1), social (H5c2), mobile (H5c3), information navigation (H5c4), and operational skills (H5c5).

H6: Positive attitude towards the use of technology contributes positively with digital immersion (H6a), and to creative (H6b1), social (H6b2), mobile (H6b3), information navigation (H6b4), and operational skills (H6b5).

H7: Income moderates the effects of psychological, cultural and socio-structural factors on predicting digital immersion.

The hypothesized relationships between digital immersion and the variables assessed in this study are presented in the theoretical model depicted in Figure 1.

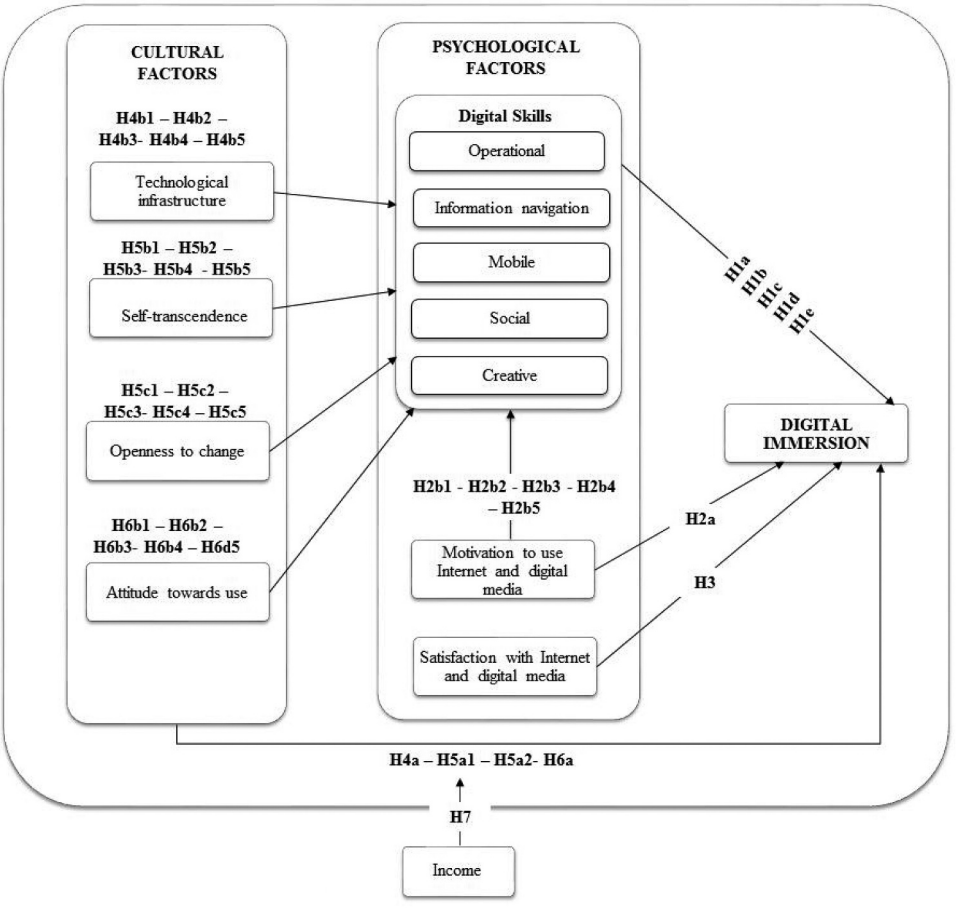

Figure 1. Conceptual model and hypotheses.

3. Method

3.1. Sample

Six schools, located in urban areas in the southern of Chile, were invited to participated in the study, but only 4 accepted. A total of 469 adolescents participated in this study (around 70% percent of the students enrolled). According to income national databases from the Chilean Ministry of Education, 251 subjects (54%) belong to low-income families and 218 subjects (46%) belong to middle-to-high income families. The sample's proportion is somewhat consistent with the national reality. Due to access issues related to sampling, it was impossible to do a probabilistic random sampling technique. Instead, convenience sampling was used to select the subjects. According to Tanaka (1987), a 5:1 ratio of cases to free parameters would be the minimum sample size for ML estimation with multivariate normal data. In our study, free parameters were 53, which would require a minimum sample size of 265. Therefore, our sample size of N = 469 met Tanaka's power

Table 1. Demographic profile (LIF: n = 251; MHIF: n = 218).

	Low-income families (LIF)		Middle-to-high income families (MHIF)	
	n	%	*n*	%
Gender, %				
Male	134	53.4	105	48.2
Female	117	46.6	113	51.8
Ethnicity				
Mapuche	72	28.7	13	6
Non-Mapuche	175	69.7	204	93.6
Other ethnicities	4	1.6	1	0.5
Schools				
School 1	0	0	111	23.6
School 2	0	0	107	22.8
School 3	123	26.2	0	0
School 4	128	27.2	0	0
Course level				
1º secondary*	64	25.5	66	30.3
2º secondary**	71	28.3	63	28.9
3º secondary***	51	20.3	45	20.6
4º secondary****	65	25.9	44	20.2

* Age (mean 14.63, sd 0.74; min 14, max 18)
** Age (mean 15.7, sd 0.69; min 15, max 17)
*** Age (mean 16.7, sd 0.64; min 16, max18)
**** Age (mean 17.7, sd 0.65; min 17, max 20)

criterion (involving a ratio of 8.8 cases per free parameter). The different demographic characteristics of the sample are summarized in Table 1.

3.2. Measures

To assess the model, the Spanish versions of the following seven measures were used. A general sociodemographic questionnaire was used to gather data related to each adolescent's profile (gender, school level, ethnicity and family income). Additionally, the Spanish versions of six instruments were used to measure cultural factors (Attitude Towards Use of Technology (Teo, 2011); Technological Infrastructure, and the Revised Portrait Values Questionnaire (McQuilkin, Garðarsdóttir, Thorsteinsson, & Schwartz, 2016)) and psychological factors (Internet Skills Scale (Van Deursen et al., 2016); Motivation Scale (Helsper, 2017); and the Adult Outcomes Questionnaire (Helsper et al., 2015)). Additionally, one scale was used to measure digital immersion (León, Cerda, Rehbein, & Saiz, in press). These Spanish versions of the instruments were obtained either, through direct communication with the authors or by accessing to academic databases.

Three instruments were used to measure cultural factors. First, a few items related to technological infrastructure availability were used (own a technological device, Internet services used). Second, the Revised Portrait Values Questionnaire (PVQ-RR) was used to measure values. This instrument contains 57 items and it uses a six-level measurement scale that varies from 1 (Not like me at all) to 6 (Very much like me). PVQ-RR has presented satisfactory goodness of fit indexes (McQuilkin et al., 2016). For this study, we considered the following factors self-transcendence (CFI = 0.96, SRMR = 0.04, RMSEA = 0.05) and openness to change (CFI = 0.97, SRMR = 0.04, RMSEA = 0.06). Data about reliability was not reported. Third, to measure attitude towards use of technology, three items were used (1.- Once I start using technology, I find it hard to stop; 2.- I look forward to those aspects of my job that require the use of technology; 3.- I like working with technology). These items use a five-level

measurement scale that varies from 1 (Strongly disagree) to 5 (Strongly agree). Cronbach's alpha for these items was α = 0.91 (Teo, 2011). Even though the authors reported goodness of fit indexes for the entire model (TLI = 0.974; CFI = 0.980; RMSEA = 0.058; SRMR = 0.027), no specific data was provided for the three items used in this study.

Three instruments also were used to measure psychological factors. First, the Internet Skills Scale was employed. It contains 35 items and uses a five-level measurement scale that varies from 1 (Strongly disagree) to 5 (Strongly agree). Cronbach's alpha for the factor of the scale was: operational (α = 0.86); information navigation (α = 0.89); social (α = 0.88); creative (α = 0.90); and mobile (n/a). Goodness of fit indexes for the entire model were (CFI = 0.93; RMSEA = 0.06; AIC = 1977.93) (Van Deursen et al., 2016). Second, a motivation scale about digital technology was used (Helsper, 2017). It contains 15 items and it uses a five-level measurement scale that varies from 1 (Strongly disagree) to 5 (Strongly agree). Due to the stage of development of this instrument, at the moment of use, no data was available in the literature about validity and reliability. Cronbach alpha of this scale for the current study was α = 0.80. Third, 33 items from Adult Outcomes Questionnaire were employed to measure satisfaction. The items use a six-level measurement scale that varies from 0 (Not applicable), 1 (Very dissatisfied) to 5 (Very satisfied). The authors implicitly report good indexes of reliability of this instrument, no data was provided about construct validity (Helsper et al., 2015).

Finally, the Digital Immersion Scale was applied. It contains 30 items and uses a five-level measurement scale that varies from 1 (Strongly disagree) to 5 (Strongly agree). Ordinal alpha for these factors were: variety of use (α = 0.82); intensity of use (0.85); multitasking (α = 0.83); involvement (α = 0.87); dependency (α = 0.79). The goodness of fit indexes (robust methods, SB) showed adequate levels for the entire model (RMSEA_SB = 0.04, TLI_SB = 0.91, CFI_SB = 0.918, SRMR = 0.07) (León et al., in press).

3.3. Procedures

Participants were recruited at their schools. Collaboration was requested to the schools' principals to obtain the sample in the southern of Chile. Meetings with parents or guardians were held at the schools. At these meetings, the parents and guardians were informed about the study background, confidentiality, privacy and voluntariness to participate. Those willing, parents/guardians and students, to collaborate signed an informed consent, previously approved by the Science Ethics Committee of the Universidad de La Frontera. The questionnaires were applied to those subjects who signed the informed consent. The surveys were applied at the schools' facilities during class hours. The total application time was approximately 1 hour. The data were collected over a three-month period. The data were entered into a Microsoft Excel database and prior to being exported to the SPSS program (v20), data quality control actions were carried out.

3.4. Analyses

Prior to the analyses, the data were examined for accuracy of data entry, missing values, and fit between their distributions and the assumptions for multivariate analysis.

A path analysis approach in AMOS was used to test the conceptual model. First, the model built on pre-specified theoretical assumptions as proposed in Figure 1 was tested. Subsequently, the model was re-specified by trimming nonsignificant associations and re-

evaluating its fitness. Decisions about paths trimming were taken considering theoretical soundness and model fit statistics values. The model's goodness-of-fit was assessed by the following fit indexes: χ^2-statistic, the ratio of χ^2 to its degree of freedom (χ^2/df), the Tucker-Lewis Index (TLI > .95), Comparative Fit Index (CFI > .95), and the Root Mean Square Error of Approximation (RMSEA < .06) (Hu & Bentler, 1999). SEM analyses were conducted with AMOS 20 for Windows.

Multigroup comparison was used to test the impact of the family income variable, used as a moderator variable on the model. When multigroup comparison was performed, the model was trimmed. First, the sample was subdivided in subgroups according to family income, and the model was re-evaluated. To verify whether the moderator had a significant effect on the model, the unconstrained model (factor loadings and intercepts were left free between groups) and fully constrained model (factor loadings and intercepts were constrained to be equal between groups) were compared using the chi-square difference test. The moderator has a significant effect when a significant test rejects the hypothesis that the model is invariant across different levels of the moderator (Byrne, 2004). The analysis was based on the chi-square difference tests which indicate which pathway coefficients are significantly different between each level of the moderator variable (low-income and middle-to-high income). In order to test invariance goodness of fit indexes CFI and RMSEA were inspected to review changes. Also, a multigroup comparison was performed to test differences among schools. Multigroup comparison was conducted with AMOS 20 for Windows following a procedure described by Gaskin (2011).

4. Results

4.1. Sample characteristics

Considering the characteristics of the sample, when comparing groups according to family income (*student's t*), adolescents from middle-to-high-income households were younger (M= 15.92, SD=1.30) than the other group (M= 16.24, SD=1.36), t=2.57, df=467 p<0.001. The association between gender (X^2=1.27, df=1 p=0.259) and the course level was similar (X^2=2.62, df=3 p=0.454). Regarding ethnicity, there were more Mapuche people in the low-income group (28.7%) than in its counterpart (6%), X^2=42.86, df=2 p<0.001.

The scores of all scales used in the study are shown in Table 2. The scores in most of the scales were similar in both groups. Nevertheless, the creative skills score was higher in the case of adolescents coming from low-income households. In the case of value dimensions (openness to change and self-transcendence), students from middle-to-high-income families had a higher score than the other group. Unsurprisingly, in the case of technological infrastructure, participants from middle-to-high-income households had a higher score than their low-income counterparts.

4.2. Path analysis: relationship between psychological and cultural factors associated with digital immersion

The initial fit results obtained from testing the validity of a causal structure for the conceptual model were not satisfactory (RMSEA = 0.27; CFI = 0.44; TLI = 0.32). Some paths were not significant. The model was therefore refined to improve the good-fitting

Table 2. Sample characteristics (N = 469).

	Low-income (n = 251)	*Middle-to-high income (n = 218)*	Statistics
Immersion, mean (SD)	3.3(0.6)	3.4(0.5)	t = 0.10, df = 46 p = 0.731
Motivation, mean (SD)	3.7(0.6)	3.8(0.5)	t = −1.44, df = 46 p = 0.15
Satisfaction, mean (SD)	3.4(0.8)	3.5(0.6)	t = −1.94, df = 46 p = 0.053
Digital Skills (mean (SD))			
Operational	4.4(0.6)	4.4(0.6)	t = −1.35, df = 46 p = 0.177
Navigation	4.2(0.7)	4.3(0.7)	t = −0.62, df = 46 p = 0.538
Social	4.3(0.6)	4.4(0.6)	t = −0.50, df = 46 p = 0.618
Creative	3.5(0.9)	3.3(0.9)	t = 2.99, df = 46 p = 0.003*
Values (mean (SD))			
Openness to change	4.8(0.8)	5(0.7)	t = −2.57, df = 46 p < 0.001*
Self-transcendence	4.8(0.7)	4.9(0.7)	t = −2.72, df = 46 p = 0.007*
Technological, mean (SD)	7.8(3.4)	10.2(3)	t = −8.39, df = 46 p < 0.001*
Attitude, mean (SD)	3.6(0.7)	3.6(0.7)	t = 1.16, df = 46 p = 0.249

* A p value < .05 was considered statistically significant.

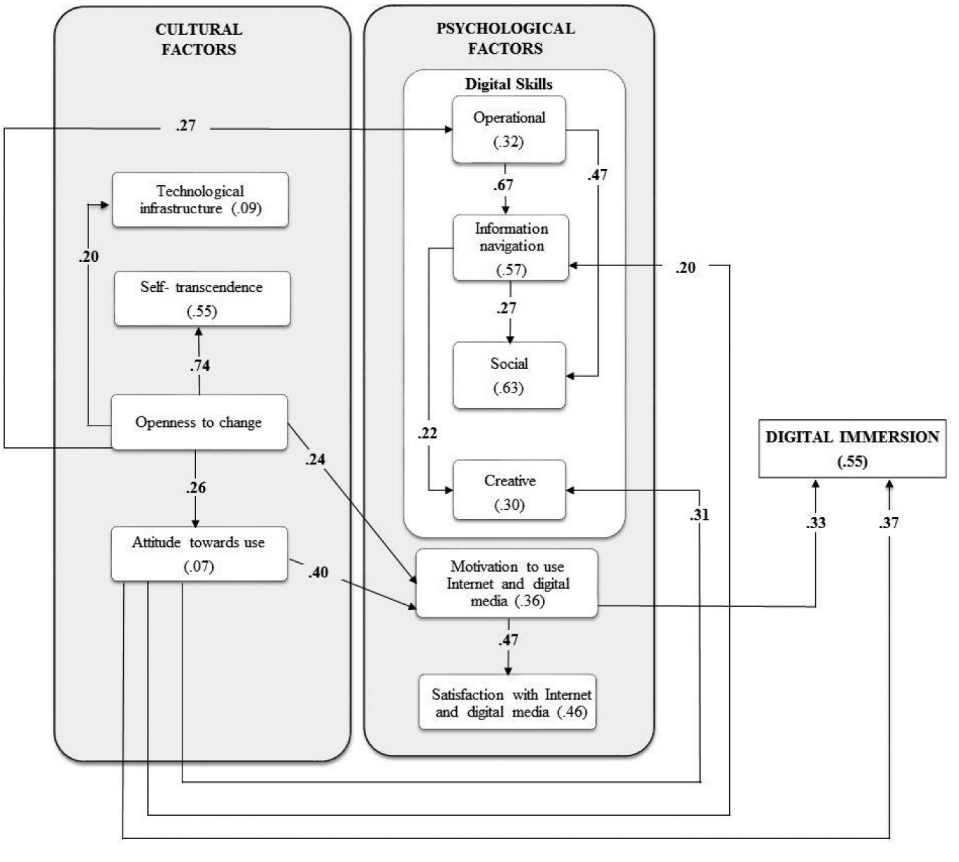

Figure 2. Final model.

measurement model. In the final model (depicted in Figure 2), all paths were significant. The model fit the data adequately (χ^2 = 30.4; df = 24, p = 0.17) and displayed fitness indexes were adequate for the commonly accepted thresholds (RMSEA = 0.024; CFI = 0.997; TLI = 0.994). The final model explained 55% of the variance of digital

Table 3. Direct, indirect and total effects of original hypotheses.

Hypotheses	Direct effects	Indirect effects	Total effects
Psychological factors:			
H1a. Creative -> Digital immersion	.00	.02	.02
H1b. Social -> Digital immersion	.00	−.00	−.00
H1c. Mobile -> Digital immersion	-	-	-
H1d. Navigation -> Digital immersion	.00	.00	.00
H1e. Operational -> Digital immersion	.00	.00	.00
H2a. Motivation-> Digital immersion	.33	.06	.39
H2b1. Motivation -> Creative	.13	.04	.17
H2b2. Motivation -> Social	.00	.11	.11
H2b3. Motivation -> Mobile	-	-	-
H2b4. Motivation -> Navigation	.00	.11	.11
H2b5. Motivation -> Operational	.17	.00	.17
H3. Satisfaction -> Digital immersion	.12	.00	.12
Cultural factors:			
H4a. Techn. infr. -> Digital immersion	.13	.08	.21
H4b1. Technological infr. -> Creative	.00	.06	.06
H4b2. Technological infr. -> Social	.00	.11	.11
H4b3. Technological infr. -> Mobile	-	-	-
H4b4. Technological infr. -> Navigation	.00	.11	.11
H4b5. Technological infr. -> Operational	.14	.03	.17
H5a1. Self-transc. -> Digital immersion	.00	.00	.00
H5a2. Openness -> Digital immersion	.00	.30	.30
H5b1. Self-transcendence -> Creative	.00	.00	.00
H5b2. Self-transcendence -> Social	.15	.08	.22
H5b3. Self-transcendence -> Mobile	-	-	-
H5b4. Self-transcendence -> Navigation	.00	.08	.08
H5b5. Self-transcendence -> Operational	.12	.00	.12
H5c1. Openness -> Creative	.00	.23	.23
H5c2. Openness -> Social	.00	.46	.46
H5c3. Openness -> Mobile	-	-	-
H5c4. Openness -> Navigation	.00	.37	.37
H5c5. Openness -> Operational	.27	.21	.48
H6a. Attitude -> Digital immersion	.37	.21	.58
H6b1. Attitude -> Creative	.31	.12	.43
H6b2. Attitude -> Social	.08	.18	.26
H6b3. Attitude -> Mobile	-	-	-
H6b4. Attitude -> Navigation	.20	.13	.33
H6b5. Attitude -> Operational	.10	.10	.20

immersion. Attitude towards the use of technologies is the most important factor to predict immersion, while motivation is the second one.

Table 3, original model, provides the original hypothesized relationships with direct, indirect and total effects. The hyphen symbol means that the path is not significant or could not be proven. This is the case of the path that involved mobile skills. Items relative to mobile skills did not obtain adequate values in the adolescent population, so it was decided to eliminate them from the study. The decision to add or delete some paths was taken considering first a theoretical standpoint and then modification indices.

The other parts of the final model are presented in Table 4. These paths were added to improve the good-fitting measurement model.

4.3. Family income: moderator of the structural model

The model that considers students coming from low-income families (n = 251) was compared with the model considering subjects from middle-to-high-income households

Table 4. Direct, indirect and total effects of the other paths of the final model.

Path	Direct effects	Indirect effects	Total effects
Psychological factors:			
Motivation -> Satisfaction	.47	.02	.50
Operational -> Navigation	.67	.00	.67
Operational -> Social	.47	.18	.65
Operational -> Creative	.18	.05	.22
Navigation -> Social	.27	.00	.27
Navigation -> Creative	.22	−.04	.18
Social -> Creative	-,15	.00	-,15
Creative -> Satisfaction	.15	.00	.15
Cultural factors:			
Technological infr. -> Motivation	.19	.00	.19
Openness -> Motivation	.24	.15	.39
Openness -> Satisfaction	.12	.25	.37
Openness -> Technological infr.	.20	.05	.24
Openness -> Self-transcendence	.74	.00	.74
Openness -> Attitude	.26	.00	.26
Attitude -> Motivation	.40	.03	.44
Attitude -> Satisfaction	.11	.27	.38
Attitude -> Technological infr.	.17	.00	.17

Note: All paths are significant

(n = 218). The model fit the data significantly (χ^2 = 63.35; df = 52, p = 0.135) and retained good fitness indexes (RMSEA = 0.02; CFI = 0.99; TLI = 0.99). The unconstrained model (RMSEA = 0.02; CFI = 0.99; TLI = 0.99) and fully constrained model (RMSEA = 0.03; CFI = 0.98; TLI = 0.98) were significantly different (χ^2 difference = 57.96; df = 29, p = 0.001). This indicating that family income was associated with a significant moderator effect at model level (Δ RMSEA = 0.01; Δ CFI = – 0.01).

The main differences in path coefficients are reported in Table 5, which clearly shows that attitude towards the use of technologies is the most important factor to predict digital immersion in both groups, while motivation is the second most important factor. In addition, technological infrastructure and satisfaction with Internet use and digital media consumption are also significant predictors of digital immersion. The value of the motivation-to-digital-immersion standardized regression weight in the case of students from middle-to-high income households is higher than in their low-income counterparts. Nevertheless, the two groups do not differ significantly on this path.

Chi-square difference tests (Table 5) indicate what the following pathway coefficients are significantly different between both groups: from navigation skills to social skills; motivation to satisfaction; self-transcendence value to social skills; attitude towards the use of technology to motivation.

Regarding the statistical significance of the paths (Table 5), the paths were not significant for adolescents from low-income households in the following associations: from attitude towards the use of technology to satisfaction; creative skills to satisfaction; self-transcendence value to social skills. In the case of students from middle-to-high-income families, the following paths were not significant: attitude towards the use of technology to operational skills; social skills to creative skills; operational skills to creative skills; navigation skills to creative skills; openness to change to technological infrastructure.

Table 5. Effects of family income on specific pathways of the model.

	Low-income		Middle-to-high income		
Path	Estimate	*p*	Estimate	*p*	Chi-square
Psychological factors:					
Creative -> Satisfaction	0.09	0.11	0.26	***	65.82
Social -> Creative	−0.30	**	−0.08	0.36	66.31
Navigation -> Social	0.40	***	0.20	**	**70.02**
Navigation -> Creative	0.33	***	0.15	0.08	65.51
Operational -> Navigation	0.66	***	0.67	***	63.65
Operational -> Social	0.48	***	0.45	***	63.46
Operational -> Creative	0.27	**	0.13	0.17	64.28
Motivation-> Digital immersion	0.29	***	0.38	***	64.54
Motivation -> Creative	0.15	*	0.14	*	63.35
Motivation -> Operational	0.16	*	0.17	**	63.46
Motivation -> Satisfaction	0.53	***	0.39	***	**67.94**
Satisfaction -> Digital immersion	0.13	0.03	0.11	*	63.35
Cultural factors:					
Technological infr. -> Digital immersion	0.17	***	0.10	*	64.64
Technological infr. -> Operational	0.13	*	0.17	**	63.72
Technological infr. -> Motivation	0.19	***	0.19	**	63.35
Self-transcendence -> Social	0.06	0.13	0.27	***	**75.54**
Openness -> Operational	0.34	***	0.37	***	64.10
Openness -> Motivation	0.18	***	0.28	***	64.78
Openness -> Satisfaction	0.10	*	0.15	**	63.53
Openness -> Technological infr.	0.20	**	0.10	0.12	64.26
Openness -> Self-transcendence	0.76	***	0.71	***	63.36
Openness -> Attitude	0.33	***	0.20	**	64.75
Attitude -> Digital immersion	0.35	***	0.40	***	63.40
Attitude -> Creative	0.27	***	0.30	***	63.60
Attitude -> Navigation	0.23	***	0.17	***	63.98
Attitude -> Operational	0.14	*	0.04	0.50	64.42
Attitude -> Motivation	0.52	***	0.25	***	**78.99**
Attitude -> Satisfaction	0.10	0.13	0.12	*	63.35
Attitude -> Technological infr.	0.17	**	0.28	***	64.34

Note: The numbers in bold indicate that the chi-square value is greater than the chi-square threshold (67.19 (95% confidence)). This fact demonstrates that both groups are different on this path. The sign *** indicates *p* value <.001. The sign ** indicates *p* value <.01. The sign * indicates *p* value <.05).

4.4. Schools: moderators of the structural model

In order to control the potential effect of the school variable on the model, six multigroup comparison analysis were performed. The results show that this variable account of a significant moderator effect at model level, considering differences among school 1 and schools 2, 3 and 4. The same effects is observed between schools 2 and 4. No effects were observed in the case of school 3 and schools 2 and 4. Table 6 shows different statistic values associated to the analysis performed.

Chi-square difference tests indicated that there are several significant pathway coefficients among schools. Three between school 1 and 2 (motivation to digital immersion; satisfaction to digital immersion; openness to change value to satisfaction); five between school 1 and 3 (self-transcendence value to social skills; openness to change value to technological infrastructure; attitude towards the use of technology to motivation; navigation skills to social skills; creative skills to satisfaction); four between school 1 and 4 (self-transcendence value to social skills; attitude towards the use of technology to motivation; navigation skills to social skills; navigation skills to creative skills) and nine between school 2 and 4 (technological infrastructure to digital immersion; self-transcendence value to

Table 6. Schools level statistic values.

Schools Comparison	Schools 1–2	Schools 1–3	Schools 1–4	Schools 2–4
χ^2 (df)	81.02(60)	93.80(62)	73.19(60)	64.07(60)
p	0.037	0.006	0.057	0.336
χ^2 difference (df)	37.29(25)	35.79(24)	45.72(25)	54.01(25)
p	0.005	0.005	0.007	0.001
Δ RMSEA	0.003	−0.01	0.008	0,024
Δ CFI	−0.012	0	−0.018	−0.021
RMSEA*	0.04	0.05	0.04	0.02
CFI*	0.98	0.97	0.99	0.99
TLI*	0.96	0.95	0.97	0.99
RMSEA**	0.04	0.05	0.04	0.04
CFI**	0.97	0.96	0.97	0.97
TLI**	0.96	0.95	0.96	0.97

Note: The sign * indicates values of the unconstrained model. The sign ** indicates values of the fully constrained model.

social skills; openness to change value to satisfaction; attitude towards the use of technology to motivation; navigation skills to creative skills; social skills to creative skills; motivation to creative skills; motivation to satisfaction; motivation to digital immersion).

5. Discussion

This study examined the influence of psychological, cultural and socio-structural factors on digital immersion for adolescents in the southern of Chile. The final model shows that the attitude towards the use of technologies and followed by motivation are the most important factors to predict digital immersion. This finding is coherent with the digital immersion definition presented in this study, where digital immersion involves the persistent, continuous and enthusiastic use of devices and digital media accompanied by the ability to perform multiple tasks simultaneously with feelings of self-efficacy, reliance, dependence, and identification with technology.

In regard to some specific results, it is interesting to note that digital immersion scores were similar in both family income groups. These findings further support the idea that most adolescents are developing within an environment in which multiple aspects of their lives are mediated by digital technologies (Boyd, 2014). On the other hand, our findings support the use of the Flynn et al.'s (2011) of human behaviour as a model able to explain the relationship of variables. This model takes a wider integrative approach. Therefore, the results obtained regarding attitude demonstrate how cultural factors can directly influence behaviour; and the relevance of motivation in our model highlights the importance of the psychological processes and their significant influence on behaviour.

Multigroup structural equation modelling revealed that family income was associated with a significant moderator effect at model level, especially when some paths are significantly different between adolescents from different income households. For example, the case of influence of the self-transcendence value on social skills, which is not statistically significant for students from low-income households, does have a significant effect in the case of adolescents from middle-to-high-income families. The evidence presented thus far supports the direct relation between self-transcendence and prosocial behaviour presented by authors such as Yang, Fu, Yu, and Lv (2018). On the other hand, the next paths have a higher value for subjects coming from low-income families: from navigation skills to social skills; motivation to satisfaction; and attitude towards the use of

technology to motivation. For that reason, these aspects should be included when performing interventions in the field of digital immersion with these adolescents. It is interesting to notice how other studies (Magen-Nagar & Shonfeld, 2018) show the importance of the relation between motivation, satisfaction and attitude towards the use of technology in the incorporation of a program that uses technologies with adolescents.

These findings could be an important contribution to future studies on adolescents and in the field of the digital divide. Studying the digital immersion of Chilean adolescents was considered relevant for different reasons: (a) to increase the knowledge regarding Chilean adolescents and how they relate to technology; (b) adolescents of the current generation are genuinely "born digital", as they do not know a time without access to the Internet and digital technologies, thus becoming the best examples to measure the amplitude and depth of digital immersion; (c) adolescence is the stage of development characterized by the greatest social, cognitive, biological and psychological changes in one's lifespan (Giedd, 2012). Therefore, once the digital immersion levels are known, it would be of interest to further study the way in which the immersion modulates or interacts with the changes mentioned.

In the field of the digital divide, it was interesting to study family income as a moderator variable. As Van Deursen and Helsper (2015) demonstrated that more socioeconomically advantaged Internet users acquire greater digital capital and derive greater benefits from Internet usage. Because of this, studying the socioeconomically less advantaged and their counterparts was considered especially interesting in order to know what differences exist between both groups, and to consider these aspects in future interventions.

Regarding the theoretical development of a model, it is important to note that developing a model is always an ongoing process. Developing a model represents a challenge. First, in general authors need to deal with issues related to theory able to support the association among variables. Even though theory could be integrated into the model, data measured needs to be grounded in responses provided by participants. This raises a second relevant issue, which is measurement. All the instruments used in this research were translated from English into Spanish and used assuming their internal validity measurements. In this first development stage of the model, we were dealing with several issues related to path trimming, taking decisions contrasting theory soundness and statistics values. The second phase of this model development might be the improvement of instruments used to measurement and adjusting theory associated with three main factors taken into consideration (psychological, cultural and socio-structural). As a first development phase, we had to deal with some limitations.

Regarding the limitations of the study, first, the digital immersion scale needed to be further perfected and tested in other samples so that there is more evidence of validity. Moreover, data collection in this study was cross-sectional and these results could be confirmed with a longitudinal study. According to Rajulton (2001), a longitudinal study, conducted in an adequate manner, could better support the identification of causality among variables. Furthermore, it is necessary to consider that the participants were selected by a non-probabilistic sampling for convenience, an aspect that may influence the representability of the data, because the results presented here may not be the reality of the population of all Chilean adolescents. Therefore, future studies with larger samples and samples of other regions of Chile are required to confirm these findings and make comparisons.

Second, as a limitation, it should be considered that self-reported instruments were used in this study. This type of instruments presents difficulties when participants hide their attitudes or feelings for some particular reason or when people do not remember the whole background of the question. However, just as these instruments present difficulties, they also facilitate access to events that cannot be observed efficiently or over a short period of time (Kimble et al., 2002). In addition, if we consider that adolescents are accustomed to this type of instruments and a climate of security and confidence in the application of the instruments was fostered, it can be expected that these difficulties were minimized.

Finally, the model in this study provides an important understanding of how psychological, cultural and socio-structural factors influence digital immersion in Chilean adolescents. This is highly consistent with Park's (2017) vision that indicated that the use of technologies occurs in a complex ecosystem which is influenced by individual (needs, motivations and attitudes) and external (social context and infrastructure) factors. For that reason, it is especially important that other similar studies consider an integrative approach in the study of digital culture. The information provided in this study represents relevant data for policy makers to make decisions in order to define and promote digital immersion in adolescents in the Chilean context.

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