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The Influence of the Learning Environment (Digital, Physical and Social) on the Propensities for Second Language Learning

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Spécialité : Psychologie

Par

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The Influence of the Learning Environment (Digital, Physical and Social) on the Propensities for Second Language Learning.

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L'influence de l'environnement d'apprentissage (numérique, physique et social) sur les propensions à l'apprentissage d'une langue étrangère.

Mots Clés : *Environnements d'apprentissage, apprentissage des langues étrangères, modélisation structurelle, psychologie environnementale.*

Cet essai cherche à reprendre certains aspects de ce que la science a appris sur les espaces d'apprentissage et à les relier en même temps à ce qui est actuellement conçu comme un environnement éducatif, en mettant en relation des environnements que nous explorons au quotidien, y compris des environnements virtuels (ou basés sur la cybernétique). Dans le même temps, nous cherchons à comprendre comment ces environnements et leurs transactions influencent des facettes particulières de l'éducation, telles que l'enseignement et l'apprentissage des langues chez nos élèves.

L'un des motifs sous-jacents à la composition de ce travail est de sauver les connaissances théoriques et conceptuelles de la vision systémique-écologique et d'incorporer empiriquement les environnements numériques dans le récit historique de la psychologie environnementale. Il reste encore beaucoup à faire dans ce domaine, car il faut approfondir la recherche sur les concepts de cyberspace afin de mieux comprendre le fonctionnement de ces écologies.

De cette façon, cette étude s'engage dans la vision théorique de la psychologie environnementale, étant donné que, par sa conception, la psychologie environnementale est la psychologie de l'espace et qu'elle interprète les attitudes, les perceptions et les

comportements impliqués dans la relation individu-environnement, en argumentant cette relation par l'analyse de la proxémique (L'étude de l'utilisation humaine de l'espace ainsi que ses effets sur le comportement, communication et interaction sociale) et la chronologie (étude du rôle du temps dans diverses interactions). Ici, nous nous référons non seulement à une disposition spatiale, mais nous ajoutons également l'histoire ou la définition de cet espace et la manière dont il est lié à l'histoire et aux actions des individus qui s'y comportent (Moser, 2003 ; Navarro-Carrascal, 2005).

Dans le respect de cet axe d'analyse, nous pouvons affirmer que l'environnement numérique est un domaine où le potentiel d'apprentissage mérite d'être exploré. Compte tenu de sa facilité d'utilisation par les appareils mobiles, il permet d'interagir avec les contenus et avec les autres utilisateurs sans concevoir un tel appareil comme un ordinateur, mais de le percevoir comme un espace (Lindaman et Nolan, 2015). Les dispositifs technologiques ont changé ce que les gens font, comment et quand ils le font, comment ils se comportent en présence physique et virtuelle des autres. Ces sous-produits comportementaux peuvent être observés dans plusieurs types de scénarios comportementaux (Stokols, 2018).

Le modèle hypothétique proposé comprend un total de huit constructions théoriques présentes dans cette étude (l'environnement d'apprentissage, composé de l'environnement numérique, de l'environnement physique, de l'environnement social ; les propensions à l'apprentissage d'une langue étrangère, composées de la satisfaction à l'égard de l'apprentissage des langues, des croyances sur l'apprentissage des langues et de la volonté de communiquer dans une langue étrangère). Les hypothèses de recherche font allusion à la relation entre les variables et leurs constructions d'ordre supérieur en plus de l'effet direct

de l'environnement d'apprentissage sur les propensions à l'apprentissage d'une langue étrangère.

L'objectif global de la présente recherche était de tester un modèle de variables latentes de l'effet de l'environnement d'apprentissage sur les propensions à l'apprentissage d'une langue étrangère. Cette étude nous a permis de déterminer si les modèles décrivant les relations entre les différentes sphères des environnements d'apprentissage pouvaient être utilisés pour prédire un effet sur les propensions à l'apprentissage d'une langue étrangère lorsque les différences individuelles des apprenants en langues mentionnées ci-dessus sont connues.

L'échantillon était composé de 455 participants (dont 157 hommes, 289 femmes et 9 non genrés). L'âge moyen des participants est de 21,82 ans (Adultes ≥ 18 ans), étant des étudiants de niveau universitaire, inscrits à un cours de langue à l'Université du Sonora au sein du Département de Langues Étrangères dans l'État du Sonora, au Mexique.

Notre recherche a utilisé 6 échelles différentes : L'échelle de satisfaction de l'apprentissage des langues, l'échelle de volonté de communiquer dans une langue étrangère, le questionnaire sur l'environnement physique de la classe, le questionnaire sur les environnements d'apprentissage virtuels, l'inventaire des croyances sur l'apprentissage des langues et l'échelle sur l'environnement social de la classe. Le questionnaire numérique comprenait l'ensemble des 75 items avec différentes échelles de type Likert, ainsi que des questions d'ordre sociodémographique.

La première procédure effectuée dans cette étude a été de calculer les statistiques univariées des 13 échelles du questionnaire en ligne, puis de calculer leur cohérence interne

à l'aide du coefficient Alpha de Cronbach. Ensuite, une analyse des corrélations entre les variables de ces mêmes échelles a été réalisée à l'aide du coefficient de corrélation de Pearson. De plus, une modélisation par équation structurelle a été réalisée afin d'estimer le cadre théorique proposé. Deux modèles de variables latentes (environnements d'apprentissage et propensions à l'apprentissage des langues) ont été calculés et analysés séparément. Pour finir, un modèle complet de variables latentes de l'effet direct de l'environnement d'apprentissage sur les propensions à l'apprentissage des langues a également été proposé au EQS et calculé.

Sur la base des résultats, nous faisons les observations suivantes : Premièrement, en ce qui concerne les variables au sein de chaque facteur de second ordre et l'effet de la variable Environnement d'apprentissage sur la variable Propensions à l'apprentissage des langues (comme l'indiquent les différentes indices d'adéquation de l'ajustement du modèle : $\chi^2 = 417.94$ (123 df), $p = .000$; BBNFI = .95, BBNNFI = .95, CFI = .96; RMSEA=.07), tous les paramètres du modèle qui se sont avérés significatifs, et le fait que, pris ensemble, nous réunissons les différents aspects de notre modèle qui expliquent une partie significative de la variance correspondant aux propensions à l'apprentissage des langues. ($R^2 = .90$). D'après l'analyse effectuée sur les données et l'effet direct que nous avons observé dans notre modèle, nous pouvons conclure que lorsque les étudiants perçoivent certaines qualités et propriétés de l'environnement dans lequel une langue est apprise, Celles-ci peuvent avoir un impact sur les propensions de l'apprenant. Dans ce cas, nous pourrions dire qu'un environnement propice à l'apprentissage ou l'idonéité de la situation d'apprentissage peut favoriser la perception de l'apprenant sur des questions qui concernent son propre processus d'apprentissage des langues, comme sa propre satisfaction à l'égard de

l'apprentissage des langues, ses croyances sur l'apprentissage des langues et sa propre volonté de communiquer dans une langue étrangère.

Après avoir subi une évaluation rigoureuse, il a également été découvert que la variable environnement physique n'était pas liée de manière adéquate au facteur de second ordre de l'environnement d'apprentissage dans aucun des modèles ($\beta = .23$, voir les annexes pour le modèle de l'environnement d'apprentissage et la covariance avec l'environnement physique), ni aux autres variables de l'étude. Il n'est pas possible d'en tirer des conclusions fortes, principalement en raison de la situation actuelle concernant la pandémie de COVID-19 et des règlements sanitaires imposés par les universités. Les étudiants n'ont jamais été une seule fois dans leur salle de classe habituelle pendant la période de collecte des données, ce qui a certainement affecté la mesure de cette variable dans le modèle. Nous pouvons affirmer que, pour l'instant, l'environnement physique de la salle de classe n'était pas un élément pertinent de ce qu'ils percevaient comme leur environnement d'apprentissage. Compte tenu des circonstances, ce résultat peut donc être considéré comme raisonnablement satisfaisant, principalement en ce qui concerne la véracité du modèle dans de telles conditions.

Nos résultats peuvent nous faire franchir une étape dans les connaissances actuelles sur les approches écologiques de l'e-learning (Frielick, 2004). Nous ne pouvons pas encore prouver que la présence virtuelle ou télé présence ne sera jamais une réplique complète de la présence incarnée/écologique ou que les environnements d'apprentissage virtuels peuvent à eux seuls fournir un substitut efficace aux relations contextuelles intégrées qui caractérisent les environnements d'apprentissage authentiques et intégrés, mais nous savons que les environnements d'apprentissage virtuels sont significativement liés aux

environnements d'apprentissage sociaux et que, ensemble, ces deux sphères peuvent aider à prédire les propensions et les différences individuelles des apprenants, ayant pour preuve permanente un domaine aussi varié et complexe que l'apprentissage des langues étrangères.

En conclusion, les résultats de notre étude fournissent des preuves en faveur d'une théorie et d'une conceptualisation environnementales sur l'influence de ce qui est aujourd'hui considéré comme un environnement d'apprentissage. Par conséquent, en reconnaissant le modèle décrit précédemment, cette recherche est l'une des nombreuses étapes accomplies vers une compréhension plus profonde des environnements d'apprentissage virtuels et l'étude de l'étendue et de la complexité de la cybersphère dans les milieux éducatifs.

“If culture was a house, then language was the key to the front door, and to all the rooms inside”

-Khaled Housseini

« Pour chaque langue que l'on parle, on vit une nouvelle vie. Celui qui ne connaît qu'une seule langue ne vit qu'une seule fois »

-Proverbe Tchèque

“El lenguaje no es un regalo genético, es un regalo social. Aprender un nuevo idioma es como llegar a ser miembro del círculo íntimo de hablantes de esa lengua.”

-Frank Smith

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I. Introduction

Until today, plenty of research has been published on the topic of education, favorable or positive environments for learners in different educational levels. However, every day we face the need of reinventing or revisiting everything that has been built in the educational sciences, pedagogy, psychology, and philosophy over the years, given the importance and weight carried by the studies that shape these fields.

The intent of this present research is to retake some aspects about what these sciences have learned about learning spaces to merge them into what is currently conceived as an educational environment by interrelating environments explored in daily life; such environments include virtual (or cyber-based) environments. In turn, we seek to understand how these environments and the transactions within them influence specific aspects of education, such as the process of teaching and learning a foreign language.

There has been a vehement pursuit of studying the processes involved in learning languages since the United Nations Educational, Scientific and Cultural Organization (UNESCO) stated in 2017 that there is an ever-growing awareness about the fact that languages perform primordial functions in several aspects of human development, guarantee intercultural dialogue. They also play an important part in everyone's education and invigorate cooperation, the preservation of cultural heritage, and the construction of knowledge societies to apply the benefits of science and technology in sustainable development.

It is because of reasons such as these that every day there is a larger need to pay attention to sociocultural areas within sustainable development. Some of the aspects that are considered in this debate are in which way and how much is learning a language relevant for this equation.

Zygmunt (2016) has pointed out that, in any level or degree from university students to entrepreneurs and global decision makers, language education is considered more as a form of intercultural education, since the learning of a language might guide the people that speak it through the culture of its people. Thus, learners become cultural consumers that actively participate in the cultures where they share languages. This exchange of cultural meanings and language can only be fully appreciated when the speakers of a language can fully comply with the grammatical rules as practiced by other speakers and make use of a lexicon that has been directly influenced by the mindset of a community of speakers. This means that, instead of phrases, words, or sounds, it is thoughts that need to be translated.

It is precisely this intricate exchange of meanings and cultural values that holds a significant importance for the sociocultural spheres of sustainability, given that it receives an enormous benefit from internationally shared means of communication through language. This does not mean that there is a need of a language that is internationally recognized as official, but it fosters the rise in numbers of speakers of any other existing language by allowing them to perform in global environments, as well as to maintain relationships across the globe. In such scenarios, language learning can be a force that transforms speakers and learners of a language into individuals with adequate skills to debate, negotiate, and argue about economy, health, religion, climate change, sustainability, and many other environmental topics (Zygmunt, 2016).

Therefore, when researching a phenomenon that is related to the objectives and goals of sustainable development from a social science such as psychology, it is important to also identify the origins of the conceptual knowledge that will guide the empirical work. This will build and enrich the hypotheses regarding the event under research, as well as the results of said research

and their explanatory power. In the present thesis project, the events that will be thoroughly exposed will be explained from the perspective of environmental psychology.

In the words of Gabriel Moser (2003), there are several concerns about sustainable development that have driven the growth and development of environmental psychology. However, there are still distinct aspects that have been neglected, to a degree, by this science. Consequently, it is necessary to retake cultural factors into environmental psychology, given that the societies we live in are not only increasingly intercultural, but also more tending towards multiculturalism each day.

One of the objectives of this theoretical perspective is to add to psychology a dimension that achieves an interpretation of the different behaviors, perceptions, attitudes, evaluations, and representations that are regulated and/or mediated by the relationship between the individual and the environment. These differences would be impossible to explain outside of these environmental contingencies, which necessarily include a cultural background and context (Moser, 2003).

Therefore, in this document, I present different elements that the project aims to address from the perspective of environmental psychology, with the purpose of extending and deepening existing knowledge on some of the factors pertaining the previously mentioned sociocultural spheres.

1.1 Background Literature

Hereafter comes a general vision of existing literature related to the research presented in this document. These existing works bring empirical evidence to learning environments, both physical and digital. Several studies have examined context as a variable in language teaching and learning

situations, even from an environmental perspective that will serve as the basis for the analysis in this research. Thus, the studies cited here are exclusively ones guided by a systemic-ecological vision.

1.1.1 Empirical background related to the study of physical environments.

The notion of classroom and physical environment of the learning place is a well-known one, since it has been a topic of interest for environmental psychology for a considerable amount of time; for already in the 1950s and 1960s, there were descriptions of a “*classroom’s psychological ecology*” (Wright, Barker, Nall & Schoggen, 1951; Sommer, 1967). These were some of the first resources derived from experimental research to understand concepts such as social interactions within the classroom, how it related to the classroom’s physical spaces, and the disposition and orientation of seats; thus, partly substantiating the need of knowledge about students’ real behavior and the real conditions of their life in school.

In the years thereafter, this topic was extensively embraced in the environmental research community. Work in this area of knowledge saw great advancement, and the results were notably used in other investigations describing increasingly more specific learning spaces for different developmental stages or school levels. Becker, Sommer, Bee & Oxley (1973) performed field studies to evaluate student participations in university-seminar-like classrooms of varying sizes and arrangements, with the intent of knowing if students perceived their own interest and performance differently according to where they were seated in the classroom. These authors claimed that the physical disposition of most university classrooms revealed a lot about the learning process. Similarly, Moore (1986) investigated the effects of spatial definition in child centers, where he observed the effects of different spaces in the social behavior and cognitive aspects of children in preschool stage. He concluded that the level of spatial definition in these

behavior scenarios could predict a range of behaviors in children: in this study, there were significantly more exploratory and social trading behaviors in spatially well-defined behavior environments when compared to environments that were moderately or poorly defined.

Recently, the aforementioned classical studies have raised considerable interest within the academic community of language education and learning. As for the language learning aspect, this interest has reappeared given the recent body of literature that has highlighted the impact of contextual variables in different factors that are related to the development of linguistic competence. As some examples, there are some proposed models about the willingness to communicate with another language and its relationship with the classroom environment, along with other variables such as motivation and student beliefs (Peng y Woodrow, 2010); the attitudes towards language learning (Khajavy, Ghonsooly, Hosseini-Fatemi & Choi, 2016); and the role of emotions (anxiety/enjoyment) in language learning (Khajavy, MacIntyre & Barabadi, 2018). Results from these studies about the interrelationships between the previously mentioned constructs have shown that the classroom environment can predict some of these variables that are positively associated to language learning. Lastly, there also exist studies about the relationship between these environments and variables of affective and cognitive nature, such as satisfaction with the course; in particular, studies like Han, Kiatkawsin, Kim & Hong (2018) have revealed that the correct environmental classroom conditions, as well as their spatial design and functionality, significantly improved the effects of evaluation in student satisfaction with the course, which in turn has the potential to directly affect learning outcomes.

1.1.2 Empirical background associated to the study of virtual environments.

During the period when there still was a lack of approaches towards virtual environments from an ecological perspective, Hayes (2006) performed a study about what she called the “ecology of learning of the virtual world” in a platform called Second Life. The main objective of her study was to determine how the social design and dynamics in a virtual world can support several types of learning, ranging from linguistic interactions to those that involve mastering a social dynamic. Based on this, she suggested possible implications for the use of virtual worlds in adult education based on web contexts, from formal online courses to informal contexts such as chatrooms. Her study adopted an ethnographic approach for data collection and analysis. The main questions belonging to this analysis were: 1) How is it that material, social, and cultural properties of Second Life help, mediate, and regulate the learning that participants might experiment? and 2) How do people and groups in Second Life create opportunities and spaces for learning and the creation of new collective knowledge? Participants in this project were adults, key informants who described their experiences in Second Life. Collected data included field notes, interview transcriptions, and screen captures. Findings were diverse: virtual worlds were characterized as a shared social space, a graphical interface belonging to each user that accentuated the perception of these environments as a situated interaction in real time, with active support for real social groups. Participants described Second Life as an anchor for the development of new abilities, identities, and diversified knowledge that reveal how a virtual world can support an impressive amplitude and depth of any type of learning.

In a similar direction and during the same year, Hampel (2006) conducted a study in the Walton Hall Open University that examined different levels of theory, design, and implementation of web platforms. This research, which made use of an audiographic conference

tool for the study, discusses the underlying theories and explains how they translate into the design of tasks for language tutorials. This research also attempted to explain how web platform design impacts practice with a series of variables such as learner-learner and learner-teacher interaction, the use of online multimodal tools, and the differences between on-site (in the classroom) and online teaching. In line with an ecological approach, one of its main findings related to the design of this platform showed that, while it is true that certain task characteristics that have been proven to foster language learning will be valid throughout different contexts, other factors will unarguably depend on the context. However, the factors that depend on the specific materiality of resources and the affordances of the available modes must also be taken into consideration when designing and implementing tasks for an online classroom. As current literature has shown, these affordances include both new possibilities as well as restrictions in interactions within this environment.

Laanpere, Pata, Normak & Põldoja (2014) proposed a model for the pedagogical design of online learning environments. The authors conducted a case study about the process of developing and implementing a digital learning ecosystem called the “Dippler” platform. The design of this affordance-integrating platform promotes and reinforces certain learning strategies and activity patterns that are desirable. This research describes the Dippler pedagogical base, which was based on a combination of four contemporary approaches: self-directed learning, competency-based learning, development of collaborative knowledge, and task-based instructional design. As for the methodology, the study followed the traditional practices of design-based research by organizing sessions of participation that involved potential users, followed by design experiments where the prototypes were validated in real life learning scenarios. This particular study made use of ethnographic studies to achieve a definition of the

context and use cases, in addition to the development and pilot testing of initial prototypes all the way to achieving functional software. As a conclusion, the authors defined the digital learning ecosystem as an adaptive sociotechnical system which consists of several digital parts that interact with one another (tools, services, content used in the learning process), with the communities of users that employ them (students, facilitators, experts) in conjunction with their social, economic, and cultural environment. In their approach to the study of how students perceived these learning environments, the authors found that the Dippler platform promoted self-directed, competency-based learning, since the learners perceived a higher degree of control over their learning environment.

Lindaman & Nolan (2015) analyzed an ensemble of mobile language learning application development projects made by foreign language teachers in the University of Minnesota Duluth. This research employed a design research methodology composed by an ecological constructivist framework (one that captures the interconnections of psychological, social, cognitive, and environmental processes, as well as the coexistence of pedagogical and technological elements that interrelate in a learning environment) to design, implement, and test their 2 applications: one for pronunciation in French and one for German grammar. These programs were created by a multidisciplinary team called Mobile Language Learning Group, which involved different members from the programming, project design, graphic work, and language pedagogy faculties. These experts not only performed different tasks required in the creation of mobile language learning tools, but also implemented the use of mobile devices in language learning classrooms. When implementing and evaluating both applications, they concluded that adequately designed mobile apps may function as mediations by bringing an improved learning ecosystem and mitigating environmental factors that generate negative emotional responses and impede

learning. Therefore, it is considered that language learning with mobile assistance has the potential to invite the learner to take a more active role in the learning process of a second language by linking this digital environment with a real life, dynamic learning environment.

Newgarden & Zheng (2016) worked on a comparison of three game episodes in World of Warcraft in the course of a semester with the objective to find in this platform some of the affordances to learn a second language. As for the methodology, they performed a multimodal analysis, framed by ecological viewpoints. In this study, the authors explored different types of verbalizations, linguistic interactions, and interactions by avatars of students of English as a second language. These participants learned to solve their recurrent in-game activities using skillful linguistic measures. These frequent chores coincided with some oral descriptors in the Common European Framework of Reference for Languages, which would imply that. When becoming involved in communicative activities, learners managed to developed classroom approaches oriented to oral interaction. However, in the digital context of World of Warcraft, interactions are spontaneous and not planned, they arise while players conduct themselves and interact in-game. Authors suggested that the ecological approach may enable future studies to better explain the complexities involved when learning a second language in virtual, multimodal, and multiplayer environments.

In 2017, the same authors investigated the contextual factors of technology in project-based learning, in an effort to demonstrate a comprehension of learning a second language, taking place in dynamics associated to Massively Multiplayer Online (MMO) games such as World of Warcraft (WoW), and multiuser virtual environments such as Second Life. Their research is characterized by being ecological, given their theoretical viewpoint about language learning is described as situated, dynamic, and focused on how second language learning studies

with games and visual environments deal with context. Findings in this chapter showed high levels of player and participant engagement in the previously mentioned platforms, possibilities for social coordination and interaction, the formation of communities of “knowledge producers,” and player-driven learning trajectories that can influence and improve language learning courses in schools. By adopting this ecological approach for language learning, they have managed to investigate about the educational potentials of online multiplayer environments and ascribed to them a new, special focus that a traditional vision could not have offered (Zheng y Newgarden, 2017).

Zheng, Hu & Banov (2019) studied different symmetrical and coactive dynamics to compare three environments in a Chinese school: a basic, traditional classroom using textbooks, the “Quest Atlantis” virtual environment, and a class comparable to a traditional classroom using printed pamphlets. Each one of these spaces has a different design and, therefore, characteristics that affect language. Because of this, one of the main research questions was: What are the language styles offered by the affordances of these three environments? To collect data, classroom sessions were videorecorded. The software programs “Camtasia” (for screen video) and “Morae” (for screen and participant’s live video) were used to capture video recordings of students. All of these resources were selected for focal transcription and analysis. Results showed that students can be active observers-actors both in the classroom and in virtual-world environments in varying degrees and with different types of language. A classroom’s traditional environment offered lineal, homogeneous, and predictable language where students knew what to do, or at least, they knew what was expected of them. Contrastingly, in the virtual space and printed classes, students were invited to participate in heterogeneous styles. There was a

distinctive qualitative difference between the two configurations, since the virtual environment offered a wider range of language and its uses.

After reviewing part of the existing literature about physical and virtual learning environments, we can conclude that, even though this evidence is available, it itself does not integrally support the assumption of interrelationship between a physical and a digital environment. The majority of the initial work about learning environments only focuses on the study of the classroom's physical environment and its effect on academic performance and school interactions; nevertheless, the existing work that was presented here can be divided into four main categories. The first one only studies variables in relation to the influence of the classroom's physical space, as was ordinarily known in the late 20th century. The second category completely separates digital learning environments from the physical environment, which is similar to studying them as the *future* possibility of providing classes only through digital means as has been done during the COVID-19 pandemic and was previously used with some long-distance education means. The third category comprises studies that look for the differences in learning that arise between the traditional classroom and the online classroom environments. Finally, the fourth category includes studies that analyze the conjunction of these environments in a learning situation by conceiving virtual platforms as simply another tool used in the course. Despite the theoretical progression in this topic, there is still no consensus about the function of this transaction between physical and virtual environments when fulfilling learning objectives or functions in students that, in the case of the present work, are focused on language learning.

1.2 Problem Statement

In the previous section, we have gone through some of the previous studies that have built the existing body of knowledge in regard to physical and virtual learning environments, their function in language learning, different methodologies that have served to tackle this issue, and how some of these works have even contributed to the theoretical development of said constructs. In this section, we will expose some of the data and statistics regarding questionnaires, national programs, and public policies in Mexico that reveal how the procedures of the present study are inevitably rooted in these administrative precedents, given that they represent the material reality of the current learning environments in the national outlook and the situations that precede the education that students receive in their classrooms.

1.2.1 Data, realities, and issues pertaining to the physical environments and infrastructures for education in Mexico.

When dealing with educational environments in built spaces, we refer to Article 3 of the Political Constitution of the United Mexican States (in Spanish Constitución Política de los Estados Unidos Mexicanos) which regulates education in the country. It states that all educational establishments constitute a fundamental space for the teaching-learning process. Under this norm, the State must guarantee that the educational infrastructure, its maintenance, and the environmental conditions are idoneous and contribute to the purposes of each educational level, starting in basic education up to and including university education.

As stated in the Educational Model for Compulsory Education (in Spanish Modelo Educativo para la Educación Obligatoria, 2017), it is undeniable that infrastructure and school equipment contribute to the generation of environments favorable for fostering and encouraging active learning by students in any offered domain, whether it is scientific, cultural, or artistic.

However, despite what is constitutionally established, over the years, most schools in the country have allocated resources insufficient for the improvement of physical structures and daily functions, as per the Secretariat of Public Education (in Spanish Secretaría de Educación Pública, 2017).

According to the report Vision and Action 2030 (in Spanish Visión y Acción 2030), presented in 2018 by the National Association of Universities and Higher Education Institutions (in Spanish Asociación Nacional de Universidades e Instituciones de Educación Superior, ANUIES), Mexico is one of the countries with the least amount of public expenditure per student in the world amounting \$9,754 USD per student. In comparison, some of the countries with the highest public expenditure per student are Luxembourg (\$46,526 USD), Japan (\$32,410 USD) and the United States (\$25,887 USD). This amount per student encompasses different investments, mainly educational goods and services such as infrastructure and equipment.

In 2018, ANUIES also informed about the strategic objectives and courses of action to be planned inside said educational budgets heading to the year 2030, since every year has shown an improvement on the quality of education when compared to the previous year. The main goals concerning learning spaces include performing studies in each state to identify the need for new educational spaces, with specific purposes and to design strategies that enable the optimal use of infrastructure. Another goal is to certify teacher's competencies for the construction of educational environments centered on the learning of their students.

Even when university spaces have improved in recent years, there still exists the need to provide the students with environments designed to fulfill activities in different academic domains. According to Fernández-Fassnacht (2017), there is a need to reinforce educational infrastructure through the creation of technopoles, scientific-technological parks (both physical

and virtual), research centers, thematic libraries, laboratories, and specialized learning spaces that enable academic achievement.

1.2.2 Data, realities, and issues regarding the state of the furniture and support for connectivity and virtual environments for education in Mexico.

In relation to information technologies, ANUIES (2018) has extended proposals regarding the strategic objectives and courses of action for the continuous improvement on this topic in higher education. One of its main objectives is to generate learning environments through academic and knowledge networks by employing technologies and promoting action in universities and educational institutions to develop effective digital competencies for the labor market in students. While most of the courses of action are centered in the expansion of services as platforms and the enhancement of material, physical, and digital resources that sustain current learning spaces and experiences.

As for the consideration of the inputs available to accomplish the postulated objectives and the technologies available for their exclusive use in education, we considered the report Current State of Information and Communication Technologies in Higher Education Institutions in Mexico (in Spanish Estado Actual de las Tecnologías de la Información y la Comunicación en las Instituciones de Educación Superior de México) by ANUIES (2019). This report extensively describes the strengths and limitations regarding information technologies in Mexican universities.

Firstly, this document posits a new indicator for ANUIES, which aims to know what percentage of the budget assigned to information technologies is actually spent in the operation and growth of these technologies, respectively. The latest version of the document (2019) reports

that around 77% of the budget assigned to Information and Communication Technologies (ICT) is invested in operating ITC Services, while 23% is allocated to growing them. Afterwards, it mentions that the annual budget destined to information technologies in higher education institutions amounts to a total of \$8,712,019,292 MXN, with a total average annual budget of \$85,411,954 MXN per institution. From these amounts, only 19% of the budget is invested in educational software and specialized programs for each professional field, and 20% of it is spent on buying hardware, such as desktop computers and additional equipment for their use. The document also highlights that, on average, 56% of the budget assigned to ICT areas is invested on payroll and operational expenses. To describe the use that is made of this investment, the report states that around 1,032,780 students and 70,557 teachers access the virtual learning platforms of their universities, which implies an average of 8,606 students and 608 teachers per institution. It is estimated that 18% of these platforms were developed by the same institutions where they are used, 4% are software solutions rented or bought from a service provider (such as Moodle or Blackboard), while 4% of the institutions does not have a virtual teaching platform.

Lastly, another important indicator from this report to consider is related to emergent technologies. When studied in the educational framework, they fulfill the role of tools, innovations, and technological advancements that are employed in everything that is related to educational processes (ANUIES, 2019). This record endeavors to know the advancement level that exists in higher education institutions of investment and use of this type of technologies in the teaching-learning process. More concretely, percentages about emergent technologies show that 74% of higher education institutions have not considered exploring the technology called the Internet of Things, 55% have not considered Augmented Reality, 77% do not have any initiatives in the field of Artificial Intelligence, 77% do not consider Predictive Analytics, and 48% have

not forayed into Adaptive Learning. Likewise, 28% of higher education institutions report having no advancements regarding digital transformation, while 19% assert that they have a set strategy for this transformation. Ultimately, given these results, 64.8% of universities and higher education institutions have declared that they understand and accept their responsibilities in the offer and demand of information technologies and, especially, their role in the educational context.

It is because of these reasons that it is worth to reiterate the problem highlighted in this section. This issue is well documented in research, scientific literature, questionnaires, and international documents. As an example, Sánchez, Añorve & Alarcón (2017) have pointed out that currently in Mexico there is a technological exclusion in the educational environment. The authors have expressed in their work the need for improvements in the design of academic spaces that prove to be collaborative and interactive for university level students in Mexico, in such a way that they manage to improve their learning results. They detail that learning scenarios in higher education must have the means and technological structures that improve the efficiency of the corresponding teaching-learning processes, given that in present times, it would be almost impossible to attain an integral formation in notable professional competencies and abilities when being on the margins of an education that facilitates contacts with diversified information technologies. According to UNESCO (2013), it is essential to consider technologies in the educational sector, since they favor the ubiquity of educational experiences by nature of their being readily available and accessible from different devices, places, and moments.

1.2.3 Data about the state of language learning and teaching in Mexico

In general, describing the national scene regarding language learning is a certainly difficult concern to tackle, both in terms of linguistic diversity and in terms of public policies to agree on

educational regulations that orient the teaching and learning of languages. This presents an even greater challenge given the inconsistencies that arise when evaluating language mastery through the entire Mexican educational system in all its levels.

When referring to the formal evaluation of linguistic competence, there are few available indices that show the language learning results attained by the Mexican population. Among these documents is the English Proficiency Index (Education First, 2021), which measures adult English proficiency in 112 countries. In this ranking, Mexico obtained the 92nd place out of 112 in English language competency which classifies in the very low proficiency ranks with 436 out of 700 points and occupying the second to last position in Latin America. Mexico's score in the English Proficiency Index is the only one in Latin America that has consistently declined every year since 2011 (a drop of 69 points). This index also measured correlations between English proficiency and productivity, human capital, talent competitiveness and global innovation, showing how countries like Mexico with low English proficiency levels are less correlated with said attributes.

In light of results such as this, the compulsory education sector in Mexico has created the “English Language National Strategy” (in Spanish *Estrategia Nacional de Inglés*), which seeks to gather efforts so that every Mexican student that has obtained a high school diploma has developed an English language mastery and competence equivalent to the B2 level (consolidation, independent user) of the Common European Framework of Reference for Languages (Secretariat of Public Education, 2017).

The diagnosis made by the Mexican Council of Postgraduate Studies (COMEPO, 2015) has indicated that one of the main underlying problems coming from middle and higher educational levels is notoriously the lack of mastery of a second language, especially referring to

English language. This document insists on the importance of foreign language learning, which would allow and empower students to carry out stays, cultivate academic relationships and advance in their postgraduate studies in foreign universities. Reason why most postgraduate programs in the Mexican public sector (59%) indicate a certain proficiency level of a second language among their admission requirements for new students, affirming that having a second language allows students to have a fluid access to information that is not available in their mother tongue, enabling them to acquire the latest state of the arts knowledge.

Nevertheless, with regard to higher education in Mexico, there is no type of reform or policy that regulates the processes, incentives, plans, or programs that deal with the teaching and learning of second, foreign, and national languages. However, higher education institutions have agreed with the recommendations made by both UNESCO and ANUIES on this topic. The document “Education in a plurilingual world” (in Spanish “La educación en un mundo plurilingüe”), composed by UNESCO in 2003, accentuates on the importance of plurilingual education throughout all educational levels by mentioning teaching the mother tongue, a regional or national language, and an international language as it considers that bilingual or plurilingual education can drive teaching in the mother tongue as well as the acquisition of other languages used in the same country or in the world. Additionally, ANUIES (2018) has indicated that higher education institutions must assume the responsibility of providing their students with the means to develop new thinking skills, recreational behavior, solving complex problems, skills for the analysis and interpretation of large volumes of information, and mastering different foreign languages. This association has warned about the need to drive new educational models in the higher level to guarantee the development of these skills in face of the challenges of a new economy of knowledge. In the year 2016, ANUIES launched the initiative for the “Program for

the Training in English Teaching” (in Spanish “Programa de Formación para la Enseñanza del Inglés”) with the objective to outline an innovative proposal for English language teaching in the higher educational level. In the beginning, this initiative proposed the implementation of a manual of good practices to systematically carry out within the classroom that contribute to the invigoration of English language teaching. Afterwards, in 2018, ANUIES added the objective to diversify the options and facilitate student access to the learning of a second language in the document “Vision and Action 2030.”

Without overanalyzing, despite following the recommendations and the institutional efforts that have been performed in the right direction, the absence of specific public policies, innovations, and language learning regulations in higher education reflects in a way the neglect of a complex circumstance that has rarely taken into consideration that language teaching is not exclusively directed towards speakers of Spanish as their first language, but also towards speakers of native languages and dialects (who sometimes are already bilingual). This fact reveals a very diversified linguistic profile across the country, which warns about the improvements and needs to be considered given that language teaching occurs in every level and modality of the Mexican educational system (López, Bellatón & Emerson, 2012).

Considering the previously exposed information, we vigorously reiterate the need of a reformulation of the processes implied in the offer of multicultural and bilingual education, as well as their regulatory policies, which is especially conceptualized for the linguistic profile of the Mexican population. This reformulation should also grant attention to the specific learning needs of our students, along with attempting to complement this education with spaces dedicated to this purpose and the technological methods available in the present.

1.3 Justification and Motivations

From this point forward, some of the reasons that sustain the realization of the present study will be presented in an attempt to allude to certain knowledge voids when facing different social and academic commitments that the present research aims to fill.

1.3.1 Social Relevance

There are several benefits when working with digital learning environments that have been discussed in existing literature. One of the greatest potentialities in the use of digital devices and applications is the development of intercultural and pluricultural competencies, which can be explained as bidirectional representations that join different cultural groups by connecting different perceptions, assessments, and perspectives of one group with the ones of others (Hernández & Iglesias, 2017). In developing this research, it will be possible to closely analyze the variables associated to the transit in virtual environments, where it is common that participants exercise their intercultural competences in a consubstantial manner, given the nature of the transactions performed by them when sharing cyberspaces. These competences are rarely presented as a factor that takes a social relevance in the educational praxis, despite the role they play in forming citizens and nurturing the appreciation for diversity.

It is important to rethink these multicultural competencies in the educational context. We must question ourselves how higher education should be in order to facilitate the construction of a society that promotes respect, interaction, exchange, communication, and the deep knowledge of other cultures, as well as how we can work on multiculturalism to integrate it into new educational proposals that are adapted to the different cultural realities of our country (García-Aguilar & Sámano-Rentería, 2019).

Taking a closer look at the goals of the 20-30 Agenda for sustainable development, we can see the cultural aspects that we are obligated to take into account. As an example, we have goal 4.7 where reference is made to the objective of ensuring that all students acquire the theoretical and practical knowledge necessary to promote sustainable development, through education for global citizenship and the contribution of culture to sustainable development. This goal highlights the need for educational programs at all levels to include content related to cultural diversity, languages, and the role of cultural aspects in sustainable development. It is necessary that in the design of the curricula of even the highest educational levels a cultural approach prevails, including the recognition of local/international languages and the participation of cultural actors (Ciudades y Gobiernos Locales Unidos, 2018).

As posed by Hernández & Iglesias (2017), school is a place where students have experiences both on-site and inside virtual spaces. It is in this latter type of spaces where participants have the possibility to blur differences and procure learning, participation, and exchange with other cultures. A better understanding of the transactions that take place in these environments would provide the keys to describe intercultural learning situations, since the virtual contexts do not have consideration for social, cultural, temporal, or geographical obstacles or limitations. Digital environments come to be a favorable ecological environment for the education of a society that is integral, multicultural, and ubiquitous: everywhere, all the time.

1.3.2 Theoretical value and conceptual frameworks

Another of the ulterior motives when structuring this research is to rescue theoretical and conceptual knowledge of the systemic-ecological vision and incorporate them in an empirical fashion to the historical rapporteurship of digital environments in environmental psychology. There is still plenty of work to be done in this area, and it requires more research about the

concept of cyberspace to form a more concise comprehension about the inner workings of ecologies of this kind.

In this way, this study comprises the theoretical vision of environmental psychology given that, by design, environmental psychology is the psychology of space, and it is this area that construes the attitudes, perceptions, and behaviors that arise in the individual-environment relationship. This is attained by arguing this relationship via an analysis of the proxemics (the study of the human use of space and its effects on social behavior, communication, and interaction) and the chronemics (the study of the role of time in different interactions) that not only refers to a spatial disposition, but also adds the history or definition of said space and how it connects to the history and actions of the individuals that act within it (Moser, 2003; Navarro-Carrascal, 2005).

Within this focus of analysis, we can assure that the digital environment is an area worthy of exploring the potential of learning within. In view of their ease of use, mobile devices allow users to interact with the content and other users without conceiving such a device as a computer, but rather as a space (Lindaman & Nolan, 2015). Technological devices have changed what, how, and when people do their chores and activities in both virtual and physical presence of others. These subproducts of conduct can be observed in different types of behavior scenarios (Stokols, 2018).

1.3.3 Methodological elements

Research projects like this one are also considered to deliver methodological products to the field of psychology, such as the construction of new instruments for measuring and their validation processes. Other than this, it is also important to underline the importance of the processes of adaptation and translation that contribute to the ecological validity in the use of instruments that

are validated in a different language and, therefore, that come from a different cultural background. Literal translation of a questionnaire is not enough; there must also be an additional effort to adapt it to the new cultural context in a relevant and comprehensible way, which in turn preserves the meaning and intent of the original elements that it anticipated to explore in its original form. The process of translating and adapting questionnaires for a different cultural group is a difficult task that requires a considerable investment of time and resources. It is worth noting that the validity of results stemming from translated questionnaires may lack precision and clarity, unless the translation and adaptation process is successfully implemented and verified (Sperber, 2004).

The present study aims to present new instruments for the collection of data about variables associated to the socio-physical and virtual environments that are dedicated to learning languages. Moreover, considering the sociocultural relevance of this topic, it intends to adapt, translate, and validate different scales for a context that is different to the ones that already exist (for the ones that were they were originally designed), for the purposes of measuring that are similar to the ones expressed in this work.

II. Theoretical Framework

This section presents the conceptual specification and definition of each of the variables contained in a hypothetical model in order to illustrate the foundation for the formulated hypotheses and the objectives that will be pursued within this research project.

These concepts will be explained from the perspective of environmental psychology, which studies the psychological experience of an environment that incorporates a confluence of social and physical environments, in addition to the bidirectional relationship between people and their environments (Clayton, 2012). It is in light of environmental psychology that we can understand environmental configurations for behavior and what these environments can afford for individuals. Environmental psychology allows the disaggregation of the transactions that occur when individuals modify their environments, and how their behavior and experiences change because of the environments they transit (Gifford, Steg & Reser, 2011).

2.1 Learning Environment

2.1.1 Virtual environments

According to Stokols & Montero (2000), virtual or digital environments refer to the ability of the Internet and cyberspace to bring spatially distant sources of information to electronically simulated, “virtual” spaces. A virtual environment is defined as the experience of being surrounded by an environment synthesized by a computer, mobile device, or cyberspace. This is to say that, unlike physical spaces, such an environment moves beyond a three-dimensional context (Stokols, 2018). It is already established that current studies in environmental matters must be oriented towards the ways that internet is transforming everyday transactions of people with their physical and social environments that are based in a determinate place (Stokols & Montero, 2002). In recent times, there has been attention on the role of cyber transactions, which

are exchanges between a behavior scenario (physical location) and a digital environment. These transactions are physically “invisible” in the environment but are perceived in the sense that they are the connections from a behavior scenario to the cybersphere. Any virtual environment is presumed to take place in a “real” physical environment, which can result to be complementary since the digital environment can reinforce the goals and activities of the hosting environment or place based (Stokols, 2018). These considerations highlight the importance of locating the interfaces between built, sociocultural, and virtual environments.

Stokols (1999) ponders on how the observations regarding the topic of virtual environments suggest that the ability of the Internet to influence in the development, processes, and results greatly depends on the context they are used and, specially, its availability. In the context of “abundance” (availability), access to the internet may generate positive processes and developmental results by exposing individuals to new information and stimuli, while at the same time encouraging a more active and structuring orientation towards the environment. In these circumstances, the Internet works as a characteristic that “instigates development” or potentialities of an environment. The author accentuates that these virtual elements must be studied within their specific context, since it is deeply challenging to specify the effective development context in multiple environments in daily life. Moreover, it is difficult to measure the cumulative influence of virtual (and real) environments in the developmental processes and results.

Stokols (2018) made a categorization of the different components of cyberspace, since identifying new units of analysis will allow for the possibility of a better representation of the way the physical and virtual spheres interconnect. Such categories are described as follows:

- Episodic cyber communications: Conversations in relatively short periods of time that are not as immersive as the more extensive online interactions (e.g., e-mail and text messages such as WhatsApp, Facebook Messenger, FaceTime, Skype, and Zoom).
- Virtual behavior scenarios: Sites that stay online for longer periods of time and develop a symbolic sense of “pace” or “place (e.g., electronic “shelves” or stores on Amazon or eBay; personal profiles on Facebook, Twitter, or Instagram; or themed blogs or websites).
- Virtual communities: groups that involve immersive and recurrent interactions between the participants, who develop a shared identity and a virtual sense of camaraderie (e.g., World of Warcraft, Second Life, online support groups, forums for questions, tutorials, guides, or comments about certain topics).

Mitev & De Vaujany (2013) have pointed out that in creating taxonomies of what an environment can afford its users, we can portray the niches of technological use as ecologies with particular possibilities and compare how they differ between specific contexts. These are the technological environments, where users can transit and interact, that comprise accessibility configurations available through the existing sociotechnical arrangements.

The context proposed in this work is the virtual environment of second or foreign language learning. Mainly, as mentioned by Godwin-Jones (2015), the experience of learning foreign languages in a virtual environment can provide a real interaction based on instances and exchanges that might present a language input that can range from vocabulary inquiries to questions about language pragmatics. Activities that are synthesized in a digital environment represent the use of real language, not the simulated reality and practice environment of a

classroom that is located in a place for learning foreign languages. The global extension of the internet means that these experiences tend to happen in multilingual, multicultural contexts that offer opportunities for linguistic learning and the integration of the cultural meanings of language.

As stated by Zheng, Hu & Banov (2019), foreign language learners need access to an environment where meaning is represented as real behaviors in such a way that learners can perform as observer-actors, with opportunities to establish the contextual keys that are given by the history of the community of speakers, as well as material the material actions related to verbal patterns that, initially, arise inside the classroom. This type of environment can mold ways of learning and vary the ways people are in and with the world. When turning towards technology and online spaces, language students find the patterns to act beyond the physical and sociohistorical limitations of a classroom. Usually, learners of a foreign language do not have incorporated or “incarnated” experiences in contexts where they can listen to or express the verbal patterns and, most of the times, the experience is limited to the verbal patterns hat are regulated by the formulaic competence established in textbooks, not the language and the most common or casual ways of regular, native usage that a student is exposed to in a virtual, simultaneous, and multimodal environment.

2.1.2 Physical environment of the classroom

According to Talbert & McLaughlin in their work “Measuring environments across the life span” (1999), the classroom is conceived as the core of the school context, where regular interactions happen and are sustained in the space and disposition of the classroom, the teacher, and the students. In a similar sense, Tapia-Fonllem, Fraijo-Sing, Corral-Verdugo, Garza-Terán & Moreno-Barahona (2020) define the classroom environment as the space for the delivery of

materials that correspond to the specific areas of knowledge where teachers and students interact with the furnishings that enable individual and group work.

Olivos (2010) emphasizes the role that physical elements of a school environment have in the teaching-learning process. He stresses the bidirectional, dynamic interaction between people and the physical environment to achieve experiences related to human development, social interaction, and learning. From the perspective of environmental psychology, we can assimilate different aspects about educational spaces, such as the utilization of opportunities that the physical elements of the school environment offer for development, learning, and the specific impact of the physical factors of the school environment. In this paper, we denote the notion that spatially well-defined behavior settings and activities can have a profound impact on behavior (Moore, 1986).

As Han, Kiatkawsin, Kim & Hong (2018) state, physical environments often influence the relationships between cognition-perception, affect-emotion, the evaluation of a situation, and their attributes. The same authors also express that the background characteristics of the environment and environmental conditions function as stimuli during the learning process. Commonly, environmental conditions of the physical classroom allude to the levels of comfortability that are perceived in the illumination, noise, temperature, and air inside a space. Additionally, object functionality and the design of the classroom environment refer to the perceptions regarding spatial disposition, size, and shape of the equipment, machinery, or furniture inside the classroom, if these objects really accomplish their designed function, and if they manage to satisfy the needs of the people who use the space.

2.1.3 Social environment of the classroom

This section posits the existence of a complex network of social relationships within schools (teachers with students, students with students, among others) as a critical part of the school environment (Maxwell, 2016). In the opinion of Joe, Hiver & Al-Hoorie (2017), the school environment of the classroom plays a primordial role in the learning process and in the way that students that belong to a group think and behave. They emphasize interpersonal relationships, the modes of communication between students, cooperative learning, and other group cohesion processes that exist in the classroom context as elements that can be understood as part of their social climate. When seen from the individual level of each student, the way that some aspects of the classroom's social environment are perceived can influence the nature, form, and reach of the commitment that the students materialize in their academic tasks and objectives. By situation in the context of language learning, the authors point out that an optimal social environment can facilitate the activities and interactions that promote basic competencies for learners of a second language.

The particularities of the previously explained environments have been described and defined with the purpose on materializing a theoretical vehicle of a higher order than them. Existing literature in environmental psychology has provided enough empirical support to affirm that the alteration of physical structures of educational spaces without adjusting the social structure do not lead to truly significant changes in student behavior (Becker, Sommer, Bee & Oxley, 1973). Likewise, other authors have incorporated physical environments and social context to behavioral analysis in an interactive perspective where the behavior of individuals, the modification of their environment, and the creation of groups according to their specific needs

intertwine in the analysis of the behavior of the individual, social units, and the physical environment (Stokols, 1981a).

Historically, this approach has highlighted the concept of place (the geographical and architectonic context, as well as the spatial disposition of behavior) in the bidirectional transactions that exist between people and places in social units and the environment (Stokols y Shumaker, 1981). Nowadays, Stokols (2018) proposes a multidimensional vision of the different human environments given the growing interdependency that exists between them on the rise of the Internet and digital technologies. In Stokols's judgement, only after understanding the transformations of our natural, built, social, and virtual environments will we be able to find solutions to manage their enviro-ecological impacts in a more effective way. On that account, the present study proposes the measuring of the virtual, physical, and social dimensions that integrate a learning environment in the present that, in this case, is especially intended for language learning.

2.2 Propensities for Second Language Learning

Individual difference research has a considerable history in applied linguistics and the study of psycholinguistic processes. Recent research has helped the characterization of individual differences in second language learning with a perspective where learners are viewed as individuals who possess different kinds of predispositions that influence their own learning in complex ways (Ellis, 2004). Some of the variables that will be analyzed in this work are the individual differences of language learners that may be classified as propensities.

Propensities for language learning are defined as cognitive and affective qualities involving preparedness or orientation to language learning. These propensities involve the learner's personal preferences which tend to be more fluid rather than fixed. Language learning

propensities allow for the possibility of a continuum, helping us understand how success in learning is achievable in more than one way (e.g., communicative competence, proficiency level, speed of acquisition), given that learners vary enormously in how successful they are in learning a language (Ellis, 2004).

2.2.1 Language learning satisfaction

Being that universities are the organizations in charge of providing higher education and its complementary skills, it is only natural that the experience of students in classrooms is a primarily determinant factor in student satisfaction. The assessment of this satisfaction can be delimited by the general experience of learners in class and is not limited to the practices performed by the teacher, the students, or the institution (Wilkins y Balakrishnan, 2013).

Using a concept by Hui, Hu, Clark, Tam & Milton (2008), language learning satisfaction is defined as the perception about the possibility of success and the association of positive feelings about the results obtained in the course. It has been stated that, in the context of language learning, an environment that facilitates the exchange of knowledge and social interaction makes the learning process be perceived as pleasant, which is why satisfaction also encompasses the perception about the effectiveness of learning and the achievements acquired regarding language competence (Paepe, Zhu & DePryck, 2018).

2.2.2 Beliefs about language learning

From the first conceptualizations of this variable made by Elaine Horwitz (1988), beliefs about language learning have received attention from fields such as applied linguistics, psycholinguistics, and language teaching in general, since it is considered that these areas have a considerable influence in learning behaviors.

Generally, it is thought that students have various beliefs about the nature of language learning and that these beliefs contribute to the configuration of their behavior in the learning process (Lou & Noels, 2017). According to Ramírez (2009), cognoscitive views of psychology consider the opinions of students about themselves and their learning environment. This perspective assumes the influence of several affective variables, such as beliefs, that can potentially determine the mastery of learning a language.

The definition of student beliefs refers to the conceptions, ideas, and opinions that learners have about the second language learning process and about the structure of language itself (Kalaja, Barcelos & Aro, 2018). Reyes-Cruz, Murrieta & Hernández-Méndez (2009) define beliefs about language learning as preconceived notions about the learner's own study of foreign languages. According to the authors, the beliefs of students play a fundamental role in learning and, in the case of languages, they can have effects on the expectations of language learning and what appears to be easy or difficult in the language that is being studied.

2.2.3 Willingness to communicate in a foreign language

Khajavy, MacIntyre & Barabadi (2018) take to the classic definition of the concept, defining willingness to communicate as a “willingness to engage in discourse in a particular moment with a specific person or people, using a second language” (MacIntyre, Clément, Dörnyei, & Noels, 1998).

As MacIntyre, Baker, Clément & Conrod (2001) have noted, this variable has been recognized as a final step before open verbal action that is recognized as a psychological, cognitive process or a latent variable that is improbable, if not impossible, of being fully observed. It has been proven that foreign language learners' willingness to communicate in the target language varies substantially between individuals, when considering the wide range of

linguistic competences of speakers (that fluctuate from beginners to bilingual or polyglot fluency) and the possibilities of communication opportunities and competences that communicators have through time and different situations. Because of this, we can say that willingness to communicate in a second language is the result of a set of individual, linguistic, communicative, and contextual factors (Khajavy, MacIntyre & Barabadi, 2018).

Naturally, learners of a second language cannot become competent in a language if they do not make use of it in a communicative fashion. Some students seek or elicit opportunities to use the second language in the classroom, while others evade practice or participation situations. i.e., Learners with a strong willingness to communicate are likely to benefit more from communicative language teaching approaches, which place a premium on learning through communicating and interactions between learners, while those who are not so willing may learn better from more traditional instructional approaches (Ellis, 2004). Willingness to communicate in the second or a foreign language is a construct that explains the learners' differences in intention to communicate in the second language and is frequently regarded as one of the goals of language learning, given that a higher willingness to communicate in a foreign language facilitates the use of a second language (Khajavy, Ghonsooly, Hosseini-Fatemi, & Choi, 2016).

To summarize, the relationship between the three hitherto described variables is proposed to be as constituents of the same construct, since it is considered that they can be analyzed using cognitive theory to explain part of the sequence of processes that intend to identify, represent, and justify the chain of cognitive events that happen as well in language learning. This chain starts with the collection of information and ends with the cognitive recovery of , in this case, linguistic material and the corresponding feedback (Paniagua & Gago, 2018).

2.3 Proposed conceptual model and hypotheses

The model proposed in this research project shows how the classroom dynamic is influenced by the immediate learning context that is co-constructed by the perceptions of the involved students. Thus, it represents the way cognitive behaviors of students may be intertwined with the physical, virtual, and social environment.

The proposed theoretical model is shown in Figure 1. This figure includes a total of eight theoretical constructions present in this study (learning environment, which is composed by digital, physical, and social environment; propensities for second language learning, that comprises language learning satisfaction, beliefs about language learning, and willingness to communicate in a foreign language). The direction of the arrows in the model indicates the research hypotheses, which allude the relationships with variables and their higher order constructs, in addition to the direct effect of learning environments in the propensities for second language learning.

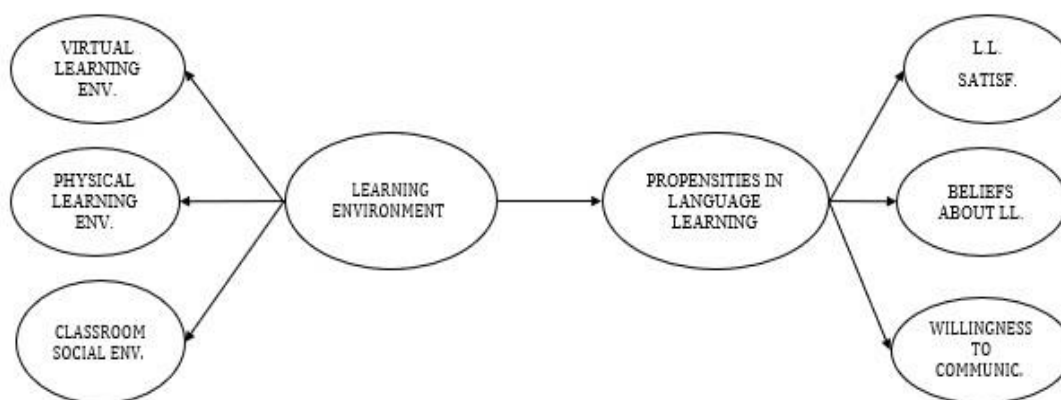


Figure 1. Model of relationships between variables of the study.

2.4 Objectives

2.4.1 General research objective

The general objective of the present research consists of statistically testing a latent variable model on the effect of the learning environment on the propensities for second language learning.

2.4.2 Specific research objectives

- Analyze the relationship between all 8 of the constructs present in this research, firstly by Pearson correlation and then by the means of structural equation modelling.
- Assess the adequacy of two latent variable models: *Learning Environment* (comprised by virtual, physical, and social learning environments) and *Propensities for second language learning* (integrated by language learning satisfaction, beliefs about language learning, willingness to communicate in a foreign language).
- Estimate the direct effect size (total model explained variance) of the variable Learning Environment on the variable Propensities for second language learning and determine its degree of certainty.

This study allows us to determine if models describing the relationships among the different spheres of learning environments could be used to predict an effect in propensities for second language learning when the aforementioned individual differences of language learners are known.

III. Methodology

With regard to the used methodology, we employed a multi-phased quantitative approach (*See Appendix A for the first two phases of the study*). The main study of our research is hereby described, including data collection procedure and a description of the various statistical procedures employed. Moreover, the type of our research design corresponds to a transversal, correlational type since the aim is to know and quantify the relationship or degree of association that exists between the variables in the study.

3.1 Participants.

The analysis population for this study comprised a sample of 455 university-level students in Mexico Hermosillo, Sonora, Mexico. The sample consisted of 157 male students, 289 female students and 9 non-gendered students (Adults ≥ 18 years, $M = 21.8$) enrolled in a language course at the University of Sonora in the department of Foreign Languages.

The type of sampling is based on an intentional or non-probabilistic sample, since the selection of the participants in this study does not depend on probability, but rather on specific criteria based on the researcher's decision making, which in this case is to belong to the groups of students of English, French, German, Japanese and Italian language in the department of foreign languages of the University of Sonora, so as to try to maintain a variety of students who study different types of languages (whether they were ideographic, Germanic or Romance languages).

Within our total of participants, 12 were studying Japanese, 330 were studying English, 27 were German language students, 16 studying Italian, and 70 French language students. All students pertained to different groups according to their respective levels of language proficiency, ranging from Level 1 (Beginner) to Level 6 (Advanced).

Table 1.
Participating students, by language studied

Language	Frequency	Percentage
English	330	72.7%
French	70	15.2%
German	27	5.9%
Japanese	12	2.6%
Italian	16	3.5%
	N= 455	100%

3.2 Instrumentation.

A questionnaire was developed specifically for this study to evaluate digital environments: the Virtual Learning Environments Questionnaire. This instrument contains 21 items in a 5-point Likert scale ranging from 0 (completely disagree) to 4 (completely agree). The instrument is divided into four subscales: (1) Episodic cybercommunications, (2) Virtual behavior settings, (3) Virtual Communities, and (4) Availability and Access to Connectivity

As for the physical environment of the classroom, the Physical Classroom Environment questionnaire (Han, Kiatkawsin, Kim & Hong, 2017) was adapted and translated to measure this variable. The original questionnaire comprises 12 items; furthermore, 3 additional items were designed to be included in this research, with semantic differential answer options. The instrument was composed of 3 subscales: (1) Environmental conditions, (2) Spatial disposition, and (3) Functionality.

Additionally, a brief scale, the Classroom social environment scale (CSES) was developed by the researchers for use in this study and contained closed-ended Likert five-point

scale items (ranging from 0 (completely disagree) to 4 (completely agree). The CSES contained only one section which comprises 5 items.

The next section used the BALLI (Beliefs About Language Learning Inventory. Horwitz, 1987) questionnaire to evaluate the beliefs about language learning. This instrument has been widely replicated, adapted, and used as part of research designs in several parts of the world, including the Mexican context. Its subscales are: (1) Aptitude for foreign languages, and (2) Expectations about language learning. There are a total of 12 items with 5-point Likert scales in this section.

Language learning satisfaction was measured with an adaptation and translation to Spanish of the Language learning satisfaction scale by Hui, Hu, Clark, Tam & Milton (2008). This scale comprises 5 items (3 additional items were developed for this study, for a total of 8) in a Likert scale with 5 options ranging from 0 (completely disagree) to 4 (completely agree).

Lastly, willingness to communicate in a foreign language was measured with a Spanish translation of the “Willingness to Communicate in a Foreign Language” scale (Peng & Woodrow, 2010). This scale is composed by 10 items in a Likert scale ranging from 1 (unwilling) to 5 (fully willing), divided in 2 subscales: (1) Meaning-centered activities, and (2) Form-centered activities.

In total, items in the inventory amounted 71 questions, with an additional 4 questions corresponding to demographic information.

3.3 Procedure.

The precise procedure for collecting data and the course of action for the analysis of the present research is hereby described.

3.3.1 Data collection.

For the application of the instruments, authorization was requested from the Coordinators of the English as a Foreign Language Program and General Foreign Languages Program in the Department of Foreign Languages of the University of Sonora, said authorization was granted. Through these instances, the links to the video calls were obtained (participants were gathered in group calls for their language course, given the conditions and sanitary regulations during the COVID-19 pandemic) in which the application of the instrument was carried out were provided. Data collection process took place from August through November 2021.

During this video calls, the participation of the students was requested, and the objective of the research was explained to them, instructions were given to respond to the questionnaire and the approximate duration of the application. Students received the questionnaire via a link (google forms) shared by their teachers, and then answered during their online classes. Meaning, digital version of the inventory was delivered to those who decided to participate. When they finished responding to the inventory, they signed an informed consent and voluntary participation box (last page on the questionnaire link). For every application, one of the researchers stayed in the group video call while the students were answering the survey. The duration of the inventory application ranged between 15 and 25 minutes.

3.3.2. *Data Analysis.*

The first procedure carried out in this study was to calculate univariate statistics of the 13 scales within the online questionnaire and then calculate their internal consistency using Cronbach's Alpha coefficient. Next, an analysis of correlations between the variables of these same scales was carried out using the Pearson correlation coefficient.

Furthermore, Structural equation modeling was performed in order to estimate the proposed theoretical framework. Two latent variable models (Learning environments and Propensities for Language Learning) were computed and analyzed separately. Lastly, a full latent variable model of the direct effect of Learning environment on the Propensities for language learning was also proposed and calculated.

All indicators were classified into parcels or indicator variables for the final model given its complexity and hierarchical levels of abstraction. Split parcel or indicator variable designs are used in factorial experiments in which the conditions of the material or the operations contemplated make it difficult to manage the entire combination of factors. This involves treating a main parcel as if it were a factor, which are typically arranged in classical experimental design. In some cases, sub-parcels within the main plot are randomized (Rodriguez, 2011).

All procedures were carried out employing SPSS 21 and EQS 6.1 for Windows.

IV. Results

This section summarizes the results and discusses the main findings of our work. The results of the analysis process are outlined according to our specific research objectives.

Table 2.

Internal consistency of the scales in the study.

<i>Scale</i>	<i>Factor</i>	<i>Cronbach's Alpha (α)</i>
<i>Virtual Learning Environment Questionnaire</i>	<i>Episodic Cyber Communications</i>	.95
	<i>Virtual Communities</i>	.92
	<i>Virtual Behavior Settings</i>	.91
	<i>Availability and Access to Connectivity</i>	.92
<i>Physical Classroom Environment Questionnaire</i>	<i>Ambient Conditions</i>	.88
	<i>Spatial Layout</i>	.86
	<i>Functionality</i>	.88
<i>Classroom's Social Environment Scale</i>	<i>Unidimensional Construct</i>	.92
<i>Language Learning Satisfaction scale</i>	<i>Unidimensional Construct</i>	.97
<i>Beliefs about Language Learning Inventory</i>	<i>Language Learning Expectations</i>	.91
	<i>Foreign Language Aptitude</i>	.81
<i>Willingness to Communicate in a Foreign Language</i>	<i>Meaning Focused</i>	.91
	<i>Form Focused</i>	.94

First, univariate statistics were obtained (*See annexes for descriptive statistics and English translations of every item*) and Cronbach's alpha coefficient was determined for each of the questionnaires (all scales were individually tested). Below, Table 2 shows the internal consistency of the scales. In general, all coefficients were satisfactory. Although there is no universal criterion, it is generally accepted that standardized tests used to make decisions about groups must have reliability coefficients of at least .65 (Cronbach, 1951). We can observe that all the scales present Cronbach's alpha values that were at least $>.85$, being that the scale that obtained the lowest value was Spatial Layout ($\alpha = .86$).

Subsequently, the intercorrelations between the scales were determined using Pearson correlation coefficient (Table 3). As can be seen, we found strong correlation values between the scales corresponding to each questionnaire, which indicates an adequate level of association between the previously factorized structures. We also found high values of correlations between most of the variables in the study and the Classroom social environment variable (E.g., relationship between Language Learning satisfaction and Classroom social environment $r = .76, p < .01$).

In addition to this, we also found that most of the variables presented low values when correlated with the physical environment variables: Spatial layout, Ambient conditions, and Functionality (all correlation values were $r = \leq .25, p < .01$ and non-significant). These low correlation values signaled that the entire variable had to be removed from the main analysis, given that there did not appear to be any significant patterns in the correlation matrix pertaining to the potential grouping of this variable in the Learning environment higher order factor.

	CC.	VBS.	Vir C.	AAC.	AmbCo.	Sp Lt.	Func.	SocEn.	Satisf.	Exp B.	Apt B.	WTCS	WTCF
CC.	1												
VBS.	.773**	1											
Vir C.	.707**	.816**	1										
AAC.	.617**	.684**	.613**	1									
AmbCo.	.058	.067	.061	.192**	1								
Sp Lt.	-.017	.043	.040	.165**	.756**	1							
Func.	.067	.137**	.112*	.200**	.551**	.500**	1						
SocEn	.629**	.681**	.640**	.617**	.207**	.200**	.207**	1					
Satisf.	.651**	.687**	.646**	.621**	.132**	.086	.226**	.763**	1				
Exp B.	.659**	.672**	.601**	.577**	.081	.050	.115*	.662**	.713**	1			
Apt B.	.496**	.523**	.510**	.465**	.162**	.108*	.195**	.575**	.630**	.691**	1		
WTCS	.337**	.339**	.337**	.312**	.144**	.085	.200**	.406**	.478**	.416**	.465**	1	
WTCF	.211**	.250**	.292**	.275**	.135**	.151**	.205**	.375**	.317**	.340**	.317**	.558**	1

Table 3. Correlation matrix between study variables. n=455 CC= Cybercommunications, VBS= Virtual Behavior Settings, Vir C= Virtual Communities, AAC= Availability and Access to Connectivity, AmbCo= Ambient Conditions, Sp Lt= Spatial Layout, Func= Functionality, SocEnv= Classroom's Social Environment, Satisf= Language Learning Satisfaction, Exp B= Language Learning Expectations, Apt B= Foreign Language Aptitude, WTCS= Form Focused Willingness to Communicate, WTCF= Meaning Focused Willingness to Communicate. Pearson *p < 0.05, **p < 0.01.

With this in mind, structural equation modelling was performed in order to evaluate the adequacy of two latent variable models: *Learning Environment* (now conformed by virtual and social learning environments) and *Propensities for second language learning* (integrated by language learning satisfaction, beliefs about language learning, and willingness to communicate in a foreign language). Figures 2 and 3 portray the obtained models. It should be noted that for both models, it was possible to form a second-order factor from the first-order constructs, which provide high and significant structural weights. By observing them, we can corroborate that the indicators of goodness of statistical adjustment were in both cases significant ($p=.000$). However, we may also remark that all factorial loads are equal to or greater than 0.50, and adjunct or practical goodness of fit indexes show that the model is well supported by the amount of observed data contained in our sample since fit index all values are equal to or greater than 0.90 and $RMSEA \leq 0.08$ (Bentler, 1990; Corral-Verdugo, 1995; Ullman and Bentler, 2012)

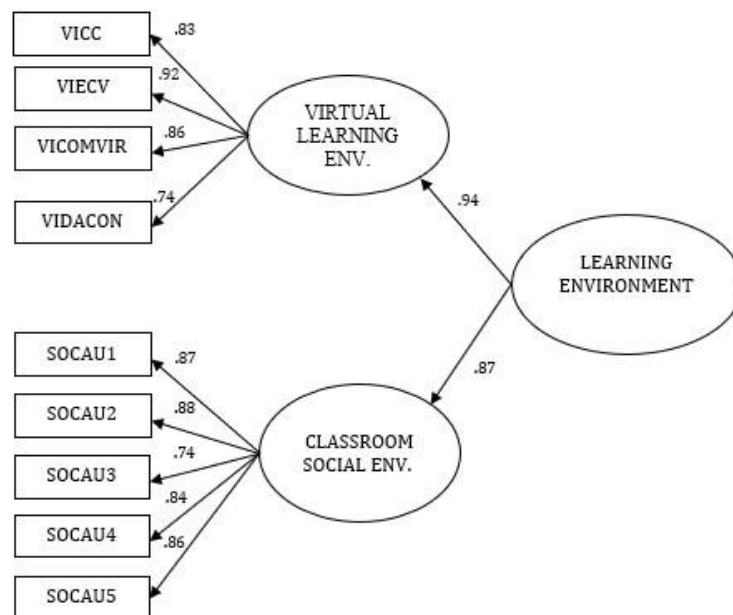


Figure 2. Latent variable model of Learning Environment. Errors for observed variables are not reported. $n= 455$. All factor loadings are significant ($p < .05$). Goodness of fit: $\chi^2 = 68.88$ (20 *df*), $p = .000$; $BBNFI = .98$, $BBNNFI = .97$, $CFI = .98$; $RMSEA = .07$.

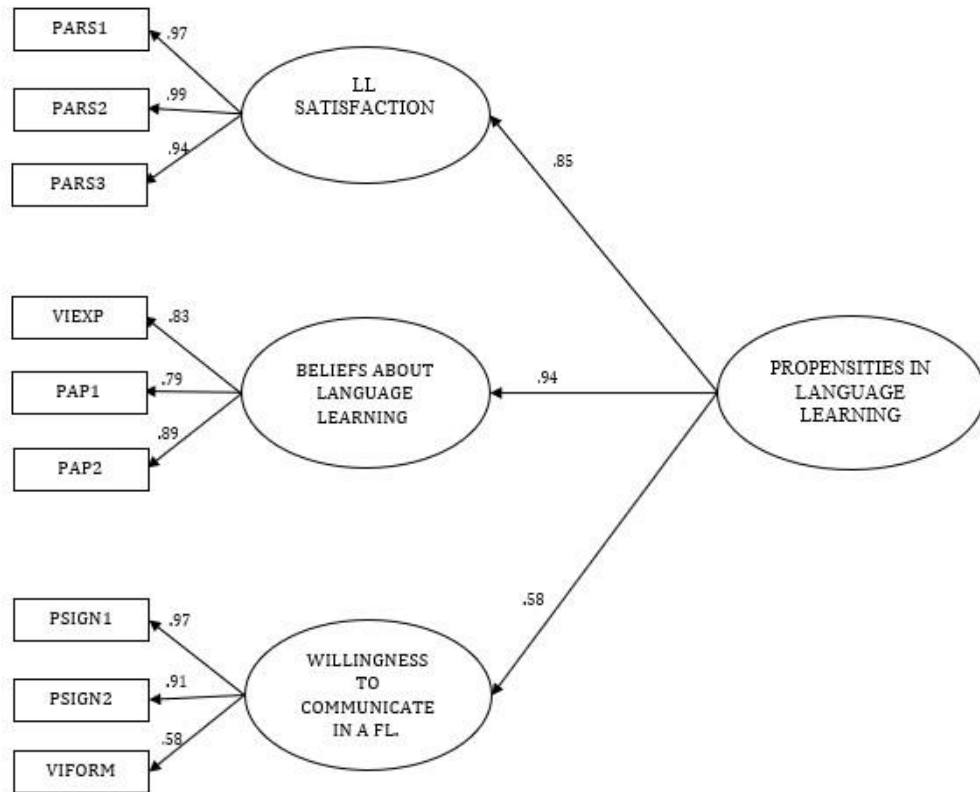


Figure 3. Latent variable model of Propensities for Second Language Learning. Errors for observed variables are not reported. $n = 455$. All factor loadings are significant ($p < .05$). Goodness of fit: $\chi^2 = 56.50$ (20 *df*), $p = .000$; $BBNFI = .98$, $BBNNFI = .98$, $CFI = .99$; $RMSEA = .06$.

Finally, Structural equation modelling was performed on a second stage in order to estimate the proposed theoretical framework. The practical goodness of fit statistics revealed that the proposed structural model included a satisfactory fit to the data ($\chi^2 = 417.94$ (123 *df*), $p = .000$; $BBNFI = .95$, $BBNNFI = .95$, $CFI = .96$; $RMSEA = .07$). Our model has an excellent ability to predict Propensities for language learning as it accounted for about 90% of the total variance explained. Figure 4 shows the results of the structural model on the direct effect size of the variable Learning Environment on the variable Propensities for second language learning.

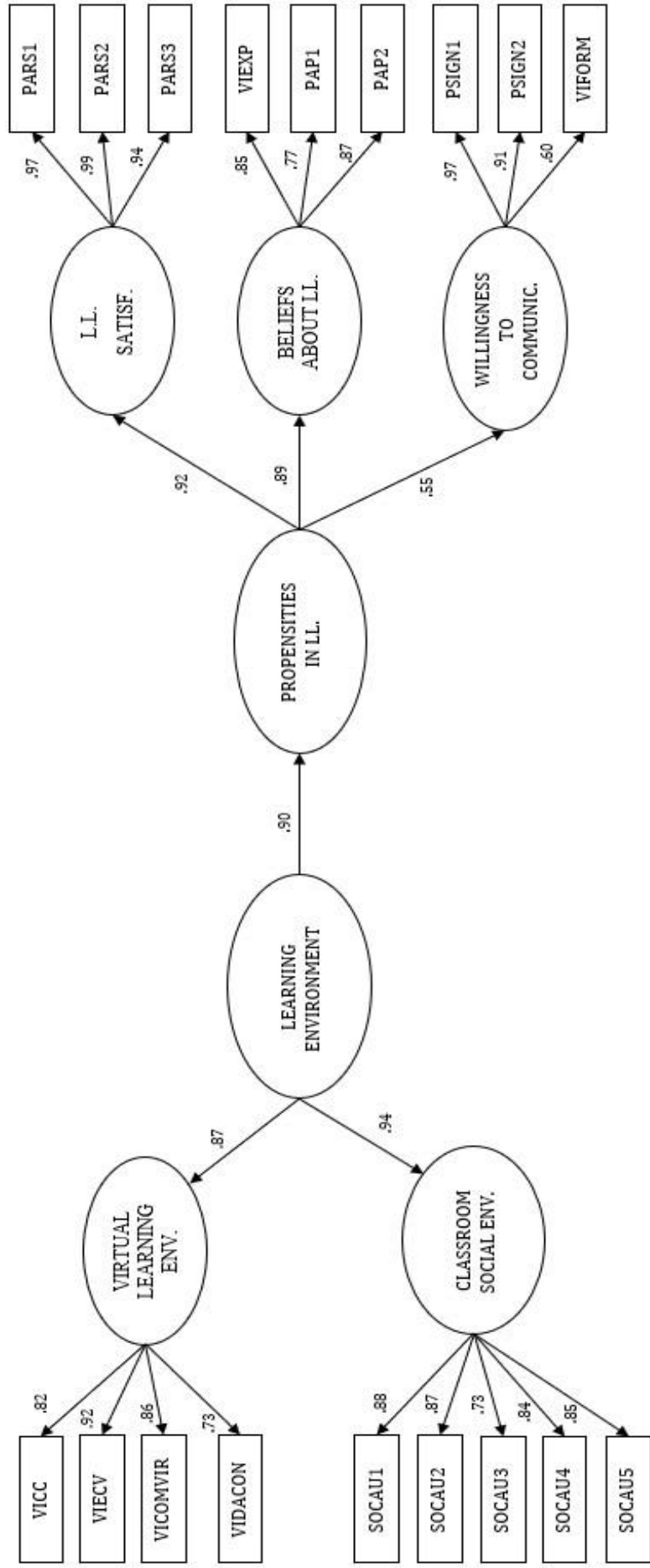


Figure 4. Full Structural model of Propensities in Language Learning predicted by Learning Environment. Errors for observed variables are not reported. $n = 455$. All factor loadings and paths are significant ($p < .05$). Goodness of fit: $\chi^2 = 417.94$ (123 *df*), $p = .000$; $BBNFI = .95$, $BBNNFI = .95$, $CFI = .96$; $RMSEA = .07$. Propensities in Language Learning $R^2 = .90$.

V. Conclusions

The successful development of the empirical model corroborates the hypotheses raised about the relationships among the set of selected variables. Both in terms of the variables within each second-order factor, and the effect of the Learning Environment variable on the Propensities for Language Learning variable, just as indicated by the various measures of practical goodness of fit of the model, all of the parameters in the model proving to be significant, and the fact that taken together, the various aspects of our model explain a significant portion of the variance Propensities for Language Learning ($R^2 = .90$).

From the analysis performed on the data and the direct effect that we observed in our model, we can conclude that when students perceive certain qualities and properties of the environment in which a language is learned, these can impact the propensities of the learner. In which case, we could say that a propitious learning environment or the idoneity of the learning situation can favor the learner's perception of issues that concern their own language learning process, such as their own satisfaction with language learning, beliefs about language learning and their own willingness to communicate in a foreign language.

By carefully examining the data, it is found that classroom social environment and Language learning satisfaction were highly significant factors to this model (presenting structural weights of .94 and .92 respectively, highest obtained values) besides being highly correlated to each other ($r = .763, p < .01$). Hui and collaborators (2008) reported similar observations in their study, where Learning community support (a variable similar to social environment) acts as a predictor of Learning satisfaction in a group of English language learners in a virtual setting.

In the course of this work, we discovered that by addressing the context of transactions between people and the environment, contextual theories like the one presented here are congruous to approach the interfaces between different levels of environmental influence on behavior and various aspects of human life, such as learning and education. Thus, implying that said transactions possess relative psychological importance (Stokols, 2019).

This findings are also consistent with the notion of the educational and social affordances embedded in the learning environment. Our model agrees well with the existing conceptualization provided by Bower & Sturman (2015) where educational affordances are the characteristics of an educational resource that indicate if and how a particular learning behavior could possibly be enacted within the context (in this case, the educational affordances within the context of a virtual learning environment) and social affordances are aspects of the online learning environment that provide social-contextual facilitation relevant to the learner's social interaction.

After rigorous examination, it was also discovered that the physical environment variable was not adequately related to the learning environment second order factor in any of the models ($\beta = .23$, *See annexes for model of Learning Environment and covariance with Physical Environment*), nor to the rest of the variables in the study. It is not possible to draw any strong conclusions from this, mainly because of the current situation regarding the COVID-19 pandemic and the sanitary regulations imposed by universities. Students were never once in their regular classroom settings during the data collection period, which certainly affected the measurement of this variable within the model. We may assert that for the time being, physical classroom environment was not a relevant part of what they perceived as their learning

environment. Given the circumstances this result can thus be considered reasonably successful mainly regarding the veracity of the model in such conditions.

Our results may take us a step further regarding current knowledge about ecological approaches to e-learning (Frielick, 2004). We cannot be able yet to prove that virtual or tele-presence ever be a complete replication of embodied/ecological presence or that virtual learning environments alone can provide an effective substitute for the embedded contextual relationships that characterize authentic and integrated learning environments, but we do know that virtual learning environments are significantly related to social learning environments and that together, both of these spheres can help predict propensities and individual differences of learners, having as a standing proof for it a domain as varied and complex as foreign language learning.

VI. Discussion

Conclusively, the results of our study provide evidence in favor of an environmental theory and conceptualization on the influence of what today is considered a learning environment.

Therefore, by acknowledging the previously described model, this research is one of the many steps taken toward a more profound understanding of virtual learning environments and study of the scope and complexity of the cybersphere in educational settings.

Applications foreseen are not only in the area of psychology and learning but also in education as a whole. Especially during the last two years, while enduring the COVID-19 pandemic, we have all personally witnessed the change and developed a deep understanding of how indoor human environments, namely our own homes, have been reshaped by constant technological, environmental, and sociodemographic shifts. All of this rapid changes have pushed further and challenged the previously distinct spatial and temporal boundaries of indoor ecosystems. One of the most evident changes, was that of turning indoor environments such as bedrooms or dining rooms into learning environments mediated by cyber technologies, making them progressively more polyfunctional. *“The digital communications and virtual communities encompassed by the cybersphere (e.g., online classrooms and scientific collaboratories) are now more than ever interwoven with individuals’ place-based environments and exert as profound an influence on a person’s day-to-day activities, social behavior, and well-being as one’s physical (non-virtual) surroundings.”* (Stokols, 2018).

Thus, future studies about learning environments (not only considering school settings as learning environments, but also including indoor environments when the context is given) are expected to result in more comprehensive explanations of the transactions between online/virtual

and place-based ecologies, as well as the changes in behavior they produce and the learner's sense of embodiment and presence in virtual learning environments (Schultze, 2010).

One of the most significant aspects to discuss in this regard is that there are several implications of these findings for the development of better online education programs. Online education today is having a more global rather than local orientation. Students are no longer merely locally based but potentially based anywhere at all (Czerniewicz, 2018). This perspective gives us much to think about how virtual learning environments can positively influence and benefit the delivery of the contents taught to our students. For example, different authors have made valuable contributions to the field of sustainability, within the topic of "Preparing the next generation of sustainability scientists" (Killion, et al. 2018), describing how advancing the integration of social and natural dimensions in sustainability research should be reflected into new ways of experiencing coursework, seminars, and research communities. Since learning can take place in various formal, informal, and non-formal settings, it can tailor and promote indigenous knowledge systems, languages, multicultural contents, (re)connect learners with nature or connect with other institutions and expand the intention of learners to act in meaningful ways towards the environment (Wals & Benavot, 2017). We think virtual learning environments could be an ideal mean to deliver effective learning for sustainability science, given what we now know about their potential educational and social affordances.

The results of this work also shed light on the understanding of variables related to language learning. The context of foreign language learning must promote the transmission of cultural values through examples and specific tasks or activities to be carried out during the development of classes and thereby achieve a living environment for language learning, always changing, as is the real use of language (Almendros, 2016). Since online learning favors

multicultural contents, communications, language barriers, and culturally relevant activities, it can be adaptively used in possibly challenging situations in order to foster language learning strategies and ultimately language proficiency. In essence, virtual settings may afford the university community and its social environment the multilingual and multicultural skills essential to respond effectively to the challenges of our society and our ever-increasing cultural diversity.

Despite the results obtained, this work suffers from a number of limitations. Most of them related to the conditions of data collection. The design of our study was planned to be implemented just by the time quarantine periods commenced, for this reason we collected the data corresponding to the physical learning environment even when students were fully immersed in a routine away from classroom environments. Future studies should consider recalculating the learning environments latent variable model, as to verify the proper integration of physical classroom environment factor. Coupled with this idea, Other studies may lead to new variables that could be added to the Propensities for Language Learning construct.

The obtained results justify further development of the method, several interesting aspects may be explored to a greater extent by adapting the instruments and methods of this study to the needs of other populations in different educational levels. Granted this study only portrays the reality of language learners, future works could encompass a broader array of language learners (foreign, endemic, ethnic and indigenous languages), but also but also moving towards different directions such as including diverse kinds of students different areas and fields of knowledge, while also associating their virtual, physical, and social contexts in order to further detail the interconnection between these environments and its impact on variables related to learning processes.

Future directions in this area are related to the use of different measurements and methodologies, given that interesting aspects of virtual language learning and virtual learning environments may be explored further by virtual reality experiments, or qualitative studies about particular virtual settings employing *Netnography* or social network analysis as a main technique. Further work foreseen also includes an extensive study on complementary, neutral, and conflicted real-virtual environment units (Stokols, 2018).

Finally, a key strength of this research lies within the fact that recently developed, translated, and validated questionnaires (some of them exclusively developed for the specific pursuits of this thesis work) performed adequately through empirical testing and provided useful information about the proposed model on the effect of learning environments on the propensities of language learning. This can be considered to be a significant step forward into detailing the perception of cybertransactions, and the influence they can have in real life learning situations.

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APPENDIX

Appendix A: Previous phases of this study.

This study was conducted in three phases. Phase I involved the construction and piloting of the Virtual Learning Environments Questionnaire using exploratory approaches (EFAs). Phase II involved the process of validating the instrumentation using confirmatory factor analyses (CFAs), where the identified factor structures of the instrumentation, combined with the existing literature, served as a priori structures for model specification in the subsequent main study. Phase III was the main study, where we tested the hypothesized structural relationships among the variables using SEM.

Phase 1: Virtual Learning Environment Questionnaire development and factor analysis.

The Virtual Learning Environment Questionnaire development procedure began in November 2020. The questionnaire was written in Spanish with an initial item pool of 26 items. The questionnaire was made available to students in December 2020. The recruitment process was tailored to ensure that the learners received the questionnaire via a link shared by their teachers, and then answered during their online classes

The study sample consisted of 510 students (Adults ≥ 18 years, $M = 20.6$) in the departments of Psychology and Education from Universidad de Sonora. This sample included 205 male students and 305 female students in the city of Hermosillo, Sonora.

Exploratory factor analysis was carried out as preliminary step to locating the latent variables that were to be studied via structural modeling. We employed the Principal component analysis extraction method. An extraction of four factors was considered appropriate because of the structure provided by the taxonomy in which the questionnaire was based on. This four extracted factors explained 78.30% of the total variance. Variances explained by each of the four extracted factors were 22.01% for Episodic Cyber

Communications (ECC), 21.86 % for Virtual Behavior Settings (VBS), 18.36% Virtual Communities (VCOM), and 16.05 % Availability and Access to Connectivity (AAC).

Cronbach's α was calculated for each of the 4 new derived factors as a measure of internal consistency, with α s of .95 for ECC, .91 for VBS, .93 for VCOM and 0.92 for AAC. While calculating the coefficient alphas, items on each scale were reviewed for deletion in order to improve the reliability of the scale

Six items (CC6, CC7, VBS6, VCOM6, AAC7, AAC8) cross loaded on three factors. Since these items cross loaded strongly ($>.30$) on more than one factor and performed poorly in the reliability analysis, they were deleted from the scales. Thus, obtaining the 21 Item pool which was further investigated for conceptual clarity employing measurement models. All measurement models (*See annexes for measurement model figures and descriptions*) possessed adequate factorial weights and fit index values equal to or greater than 0.90 and RMSEA < 0.10 (Ullman and Bentler, 2012).

In this stage of our research, we decided to perform EFA, as a means to approach a hypothesized factorial structure. Although "EFA is by no means a necessary step. Theory and hypothesis may lead directly to other forms of structural models or even confirmatory factor analysis, and the obtained diagrams provide a natural and convenient way of representing the hypothesized structures of latent and manifest variables that the analyst wishes to compare to real-world data." (Loehlin, 2004).

Phase 2: Questionnaire validation and confirmatory factor analysis.

Second phase of our research began with the translation of 3 of the 6 scales selected (Language learning satisfaction scale, Willingness to communicate in a foreign language scale and Physical Classroom Environment questionnaire) which were originally written in English and translated to Spanish by a professional translator and assessment of the research team. The rest of the scales were already validated or developed in Spanish and readily available for application (Virtual Learning Environments Questionnaire, Beliefs About Language Learning Inventory and the Social classroom environment scale). Promptly after the translation process was finalized, data collection was initiated by inviting participants to volunteer and partake in the online study from April through May 2021.

The study sample consisted of 320 students (Adults ≥ 18 years, $M = 19.4$) in the departments of foreign languages from Universidad del Valle de Mexico, Instituto Tecnológico de Hermosillo, Universidad Tecnológica de Hermosillo, and the English language department of Universidad de Sonora. This sample included 115 male students and 205 female English and French language students.

Confirmatory factor analysis was carried out for each of the 6 constructs employing structural equation modeling and covariance analysis. Here, the modeling of latent variables provides convergent and discriminative evidence of the validity of the construct (Cohen and Swerdlick, 2006). This method specifies the number, meaning, associations, and pattern of parameters in the factor loading matrix before a researcher analyzes the data (Bollen, 2002). In this situation CFA was the preferred statistical technique because it accounts for measurement errors when calculating parameter estimates.

The obtained models were: Virtual Learning Environments ($\chi^2 = 668.04$ (179 *df*), $p = .000$; BBNFI = .92, BBNNFI = .93, CFI = .94; RMSEA=.08; *For further illustration see enclosed publication manuscript: Moreno-Barahona, Fraijo-Sing, Fleury-Bahi, Navarro-Carrascal & Tapia-Fonllem, 2022*); Physical Classroom Environment (Goodness of fit: $\chi^2 = 368.26$ (81 *df*), $p = .000$; BBNFI = .91, BBNNFI = .91, CFI = .93; RMSEA=.09); Beliefs About Language Learning ($\chi^2 = 188.70$ (39 *df*), $p = .000$; BBNFI = .94, BBNNFI = .94, CFI = .96; RMSEA=.09); Willingness to communicate in a foreign language (Goodness of fit: $\chi^2 = 120.01$ (24 *df*), $p = .000$; BBNFI = .96, BBNNFI = .95, CFI = .97; RMSEA=.09). Unifactorial constructs were assessed employing measurement models: Classroom Social Environment ($\chi^2 = 7.60$ (4 *df*), $p = .100$; BBNFI = .99, BBNNFI = .98, CFI = .99; RMSEA=.04); and Language Learning Satisfaction ($\chi^2 = 82.29$ (16 *df*), $p = .00$; BBNFI = .98, BBNNFI = .97, CFI = .98; RMSEA=.10).

By observing each model (*See annexes for CFA model figures and descriptions*), we can corroborate that the indicators of goodness of statistical adjustment were in every case significant (except for Classroom Social Environment). However, we may also remark that all factorial weights in each model are equal to or greater than 0.50, and adjunct or practical goodness of fit indexes show that the models are well supported by the amount of observed data contained in our sample of language learners.

This phase also sought to account for the factorial structures that precede the main study, where the indicators and factors found in this phase will be grouped into indicator variables or parcels.

Appendix B: Glossary of key Methodological Terms

We hereby present a brief summary for each term coined in the methodology and results section. This glossary contains definitions for terms in the main text that may remain unclear to the average reader and would further elucidate on the way to interpret the obtained research results.

Structural Equation Modelling (SEM): Powerful, multi-variate technique found increasingly in scientific investigations to test and evaluate multivariate causal relationships (Fan et al., 2016). SEM allows for tests of theoretical propositions (in the form of equations) in nonexperimental data. The equations imply a set of correlations that can be tested against data that you collect. The diagrams for SEM show the assumed casual relations. If the parameters of the model are identified, a covariance matrix can be used to estimate the parameters of the model, one parameter corresponding to each arrow in the diagram. The structural model is the part of the model in which we define the relationship between latent variables and other measured variables that are not indicators of some other latent variable. These two parts of the model are combined to make a whole model that comprehensively describes the relationships between variables that are free of measurement error (Field, 2016).

Latent Variable: A latent variable is a hypothetical construct that is invoked to explain observed covariation in behavior. Latent variables are also called factors and have a rich history of statistical developments in the literature on factor analysis. The main idea is that a latent variable or factor is an underlying cause of multiple observed elements (Corral Verdugo, 1995).

Indicator variable: Given the complexity of the complete latent variable model, indicator variables in this work were handled as a different type of parcel, by encapsulating the indicators from a factor into one single factorial load (computing variables in SPSS with the means of the different items for each factor) . Therefore, what once had 3 different levels of abstraction could be summarized into two in order to reduce the complications of model estimation.

Measurement Model: The part of the model that relates the measured variables to the factors is sometimes called the measurement model. Here, we may find figures displaying the direction of arrows connecting a construct (factor) to its indicators. The construct *predicts* the measured variables. Since it is impossible to measure this construct directly, we do the next best thing and measure several indicators of it (Ullman & Bentler, 2012). The measurement model is basically the part of the general model in which latent variables are prescribed. Therefore, we determine which measured variables are indicators of a factor (Field, 2016).

Statistical Goodness of fit: According to Bentler (1990), in order to evaluate the certainty of a model in terms of its factorial structures it is necessary to perform goodness-of-fit tests. This is a process in which a statistical package compares a saturated model where all the variables are correlated against the model proposed by the researcher, where only some of the possible correlations are specified. To perform this test, the program will produce a χ^2 coefficient that desirably would result as non-significant (ideal results are ≥ 0.05). The χ^2 provides a test of whether residual differences between matrixes converge in probability to zero as the sample size approaches infinity. As typically used, the model is rejected if the χ^2 is large relative to the *df* and accepted if the χ^2 is non-significant or small. However, other

experts have noted the dubious logic of inferring support for a model from a non-significant χ^2 (i.e., attempting to prove the null hypothesis) because the χ^2 can be made small simply by reducing the sample size. Because of this influence of sample size, a poor fit based on a small sample size may result in a nonsignificant χ^2 , whereas a good fit based on a large sample size may result in a statistically significant χ^2 . Meaning that for very large sample sizes, nearly all models are rejected regarding their statistical goodness of fit (Marsh, Balla & McDonald, 1988).

Adjunct or Practical Goodness of fit: Given that the fit of models estimated with large samples is often difficult to assess, fit indices have been developed to address this problem. There are different classes of fit indices. The ones employed in this study were: Bentler-Bonnet Normed Fit Index (BBNFI), Bentler-Bonnet Non-Normed Fit Index (BBNNFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). *Normed (BBNFI) and Non-Normed fit indices (BBNNFI)* are useful for comparing the fit of a particular model across samples that have unequal sizes. The absolute value of these indexes may be difficult to interpret but that values of less than .90 usually mean that the model can be improved substantially (Marsh, Balla & McDonald, 1988). Values equal to or greater than .90, imply that there is closeness between the saturated model and the model being tested (Bentler, 1990).

Comparative Fit Index (CFI) assesses fit relative to other models as the name implies. Fit indices that employ a comparative fit approach place the estimated model somewhere along a continuum, with .00 indicating awful fit and 1.00 indicating perfect fit. Values greater than .95 are often indicative of very good fitting models. The CFI is normed to the 0 – 1

range and does a good job of estimating model fit even in small samples (Ullman & Bentler, 2012).

The Root Mean Square Error of Approximation (RMSEA) estimates the lack of fit in a model compared to a perfect or saturated model. Values of .06 or less indicate a close-fitting model, while values *larger* than .10 are indicative of poor-fitting models (Ullman & Bentler, 2012).

Effects in SEM: Strictly speaking, SEM doesn't allow one to draw causal inferences. By drawing a path between latent variables, we can fit the obtained data with parameters in our model. Statistically speaking, this means that when we analyze data from non-experimental situations, but we cannot conclude anything about cause an effect. Thus, structural equation modeling is an attempt to provide a flexible framework within which causal models can be built (Field, 2016). Conclusively, effects in SEM are directional relations between two variables. Here, the parameters representing these effects are values of the regression coefficients (represented as weights in the regression equation).

ANNEXES

Annex 1: Supplementary tables

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
I use cyber communications because I think they are efficient (e.g., I can communicate with a classmate quickly and without complications).	0	4	3.26	1.232
I make use of cyber communications because I think they provide a wide range of different experiences for my learning.	0	4	3.02	1.226
I use cyber communications because I think they are a way to be active in interaction with others.	0	4	3.04	1.284
I use cyber communications because I think they are useful for the distribution and acquisition of resources/materials for learning (e.g., sharing my notes or class notes).	0	4	3.13	1.246
I use cyber communications because I think they help me get in touch with others in the place or place where I am from my usual device.	0	4	3.26	1.275

Supplementary Table 1. Descriptive statistics for the Episodic cyber communications Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
Virtual communities provide information that is well organized and easy to find.	0	4	2.70	1.115
I reach out to virtual communities because they offer variability of learning experiences (e.g., consult fan pages / forums to learn more about a topic, read user reviews).	0	4	2.80	1.200
I reach out to virtual communities because they are a way of being present and active in a community or group from which I can learn.	0	4	2.77	1.226
I reach out to virtual communities because in them it is easy to create, find and share with others the materials that could contribute to our learning.	0	4	2.91	1.228
Virtual communities can provide me with information at the time it is required from my usual device (e.g., ask a question or query in a group while I am heading home on the bus).	0	4	3.08	1.196

Supplementary Table 2. Descriptive statistics for the Virtual Communities Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
In these virtual spaces, obtaining information is fast and efficient.	0	4	3.07	1.108
I go to these virtual spaces because they are diverse and varied (e.g., I can find different ways to learn and practice such as visiting a blog or a web page).	0	4	3.16	1.125
I frequent these virtual spaces because they give a sense of presence when interacting with other people.	0	4	2.80	1.176
I go to these virtual spaces because through them you can create, acquire, and distribute materials for my learning (e.g., Share with classmates a book that you download in a digital library).	0	4	3.16	1.122
In these virtual spaces, information is accessible at any time and place from my usual device (e.g., search for information on a specialized web page from wherever I am).	0	4	3.27	1.159

Supplementary Table 3. Descriptive statistics for the Virtual Behavior Settings Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
I have sufficient resources and efficient means for connectivity (Internet access) inside and outside my school.	0	4	2.81	1.347
In my school/university there are virtual schooling services or platforms that allow students to expand their study opportunities.	0	4	3.05	1.238
My school/university has a training program/course/guidance subject on technology management and virtual learning platforms.	0	4	2.71	1.341
My school/university provides access to computers and other equipment that give students the tools to work on their academic assignments.	0	4	2.88	1.300
My school/university provides access to an information base (databases, repositories, digital libraries, etc.) that is constantly expanding online.	0	4	2.83	1.389
My school/university provides access to a variety of free software that allows students work on different academic tasks and assignments.	0	4	2.75	1.394

Supplementary Table 4. Descriptive statistics for the Availability and Access to Connectivity Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
The air quality in this classroom is...	0	5	4.13	1.042
The temperature in this classroom is...	0	5	4.08	1.034
Generally, The odor in this classroom is...	0	5	3.86	1.178
The lighting in this classroom is generally...	0	5	4.33	1.007
Overall, the noise level of the classroom is...	0	5	3.95	1.081
Regularly, the interior of the classroom is...	0	5	4.34	.922

Supplementary Table 5. Descriptive statistics for the Ambient Conditions Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
The seating layout in this classroom is...	0	5	3.81	1.207
The electronic/electrical facilities in this classroom are generally...	0	5	4.14	1.043
Does the classroom have basic amenities for education? (e.g., projector, screen, audio system, whiteboard).	0	5	4.51	.841
The furniture (e.g., desks, shelves, tables) is...	0	5	4.20	1.021
The desks and chairs in this classroom are...	0	5	3.77	1.294

Supplementary Table 6. Descriptive statistics for the Spatial Layout Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
When I find on the walls the work done by students in language classes, I think this is...	0	5	4.19	1.044
When I find posters or prints on the walls with information about some linguistic structures of the language of our course, I think it is...	0	5	4.36	.901
The fact that there are posters or prints with information about the class, events of the language department of my university on the walls seems to me...	0	5	4.39	.941
The fact that there are posters or prints with cultural data of the country(ies) where the language of our course is spoken seems to me...	0	5	4.39	.929

Supplementary Table 7. Descriptive statistics for the Functionality Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
I learn cooperatively with classmates and teachers during language class.	0	5	3.21	1.130
The proximity (physical space) between my classmates, my teacher and I is adequate to benefit from each participation that happens in the classroom.	0	5	3.16	1.133
Everyone (students and teacher) in this class knows each other well enough through interaction in the classroom	0	5	2.87	1.269
Students in this class pay attention to what others say.	0	5	2.95	1.150
I am comfortable with the size of this class (number of people)	0	5	3.21	1.171

Supplementary Table 8. Descriptive statistics for the Social Environment Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
I like the idea of learning a language in a class like this, i.e., the one I have this semester.	0	4	3.39	1.086
My learning experience in this course is positive.	0	4	3.31	1.131
Overall, I am satisfied with the course.	0	4	3.36	1.101
Learning a language in a class like this is enjoyable.	0	4	3.40	1.105
As a whole, the course is effective for my learning.	0	4	3.36	1.141
So far, my language course has met all my expectations.	0	4	3.19	1.150
I would recommend my language course at the university to my friends and relatives.	0	4	3.23	1.205
Learning a language by taking a course like this is a good idea.	0	4	3.37	1.126

Supplementary Table 9. Descriptive statistics for the Satisfaction Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
In Mexico, people think that it is important/good to speak the language that I am learning.	0	4	2.89	1.274
I would like to learn this language in order to get to know/understand its speakers better.	0	4	3.43	1.078
Learning to speak this language would help me get better job opportunities or a good job.	0	4	3.45	1.109
If I learn this language very well, I will have many opportunities to use it.	0	4	3.35	1.147
I would like to meet people whose mother tongue is the one I am currently learning.	0	4	3.45	1.111

Supplementary Table 10. Descriptive statistics for the Language Learning Expectations Scale. n = 455; \bar{x} = mean; σ = standard deviation.

<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
Children find it easier to learn a language than adults.	0	4	3.30	1.116
Mexicans are good at learning foreign languages.	0	4	2.63	1.052
For someone who already speaks a foreign language it is easier to learn another.	0	4	3.00	1.108
People who are good at math or science are not good at learning languages.	0	4	1.68	1.403
I have an aptitude for the language I am studying. I mean, I have the ability to learn it.	0	4	3.27	1.052
People who speak more than one language well are very intelligent.	0	4	2.69	1.212
Everyone can learn to speak/use a foreign language.	0	4	3.40	1.056

Supplementary Table 11. Descriptive statistics for the Foreign Language Aptitude Scale. n = 455; \bar{x} = mean; σ = standard deviation.

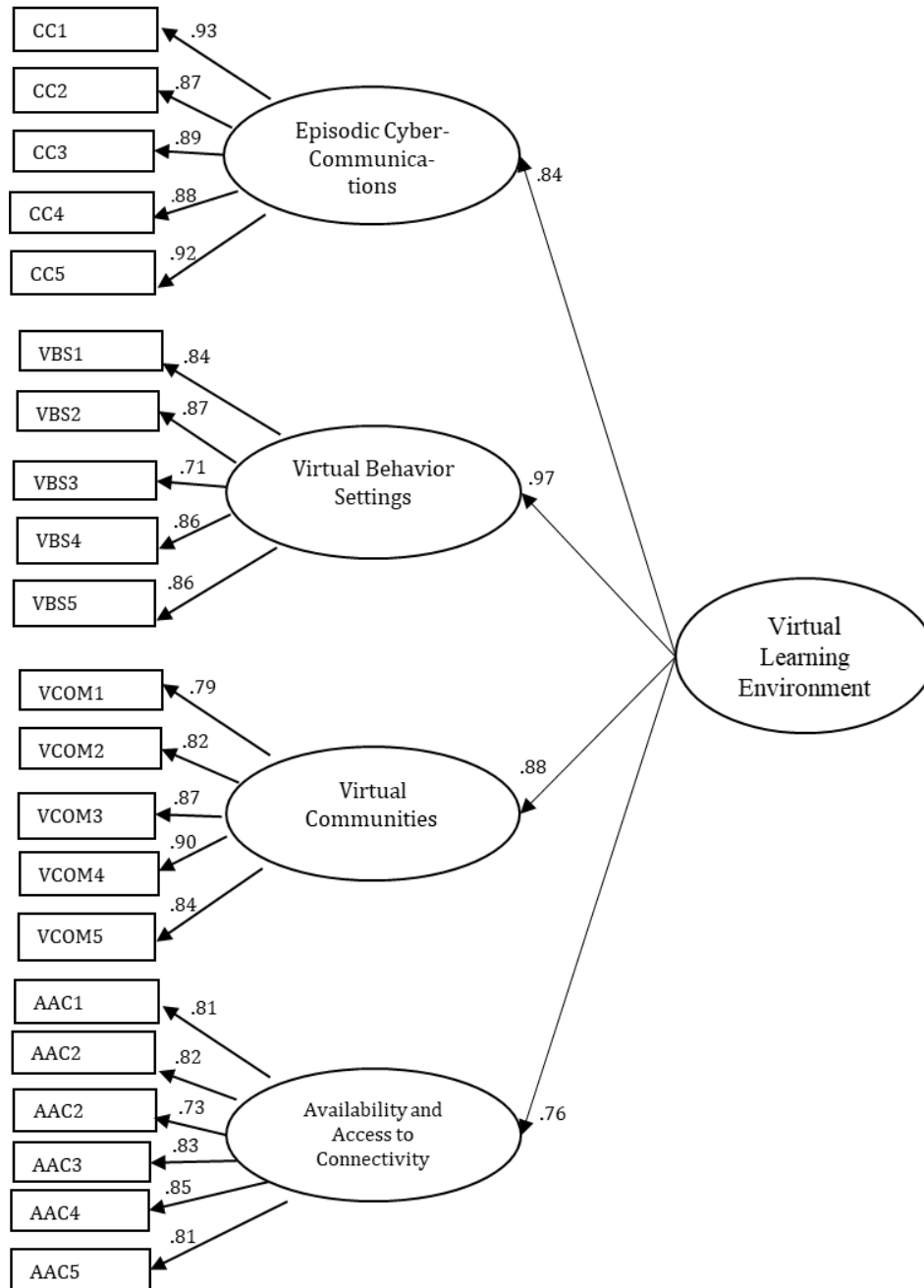
<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
I am willing to role-play in front of my language class (for example, ordering food in a restaurant).	0	4	2.86	1.213
I am willing to give a short presentation in front of my classmates and language teacher, in the foreign language of my class, without using notes.	0	4	2.83	1.182
I am willing to give a short speech (e.g., about my hometown) in the foreign language of my class, using my notes.	0	4	3.02	1.115
I am willing to translate for my group a spoken statement from my native language into the foreign language we share.	0	4	3.10	1.110
I am willing to ask the teacher (in the foreign language that I share with my group) to repeat what he just said because I did not understand it.	0	4	3.31	.988
I am willing to role-play in English at my desk with my partner (for example, ordering food in a restaurant).	0	4	3.15	1.080

Supplementary Table 12. Descriptive statistics for the Meaning Focused Willingness to Communicate Scale. n = 455; \bar{x} = mean; σ = standard deviation.

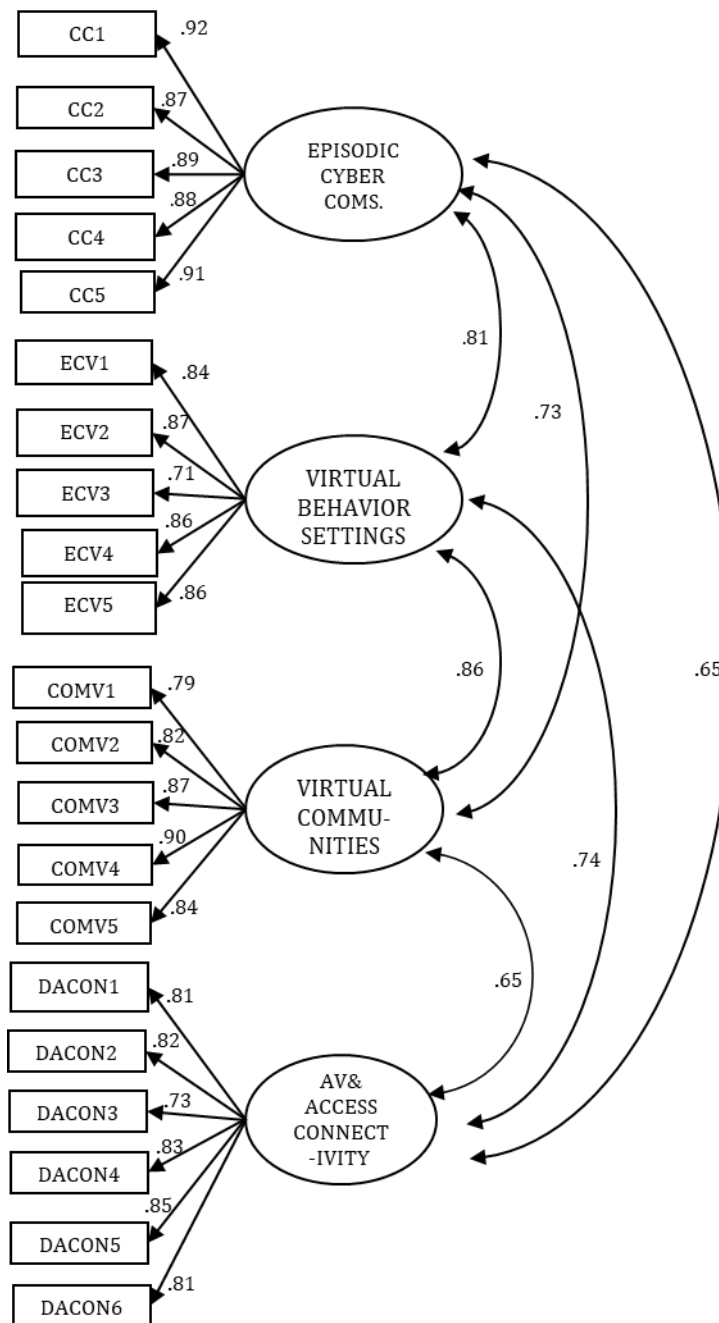
<i>Items</i>	<i>Min</i>	<i>Max</i>	\bar{x}	σ
I am willing to ask a partner sitting next to me the meaning of a word in the foreign language we share.	0	4	3.47	.826
I am willing to ask my groupmates (using our foreign language) the meaning of the word I don't know.	0	4	3.38	.909
I am willing to ask my classmates how to pronounce a word of the language we are learning.	0	4	3.40	.928
Estoy dispuesto a preguntarle a un compañero sentado a mi lado cómo decir (construir, expresar) una frase en nuestra lengua extranjera para expresar lo que estoy pensando.	0	4	3.46	.863

Supplementary Table 13. Descriptive statistics for the Form Focused Willingness to Communicate Scale. n = 455; \bar{x} = mean; σ = standard deviation.

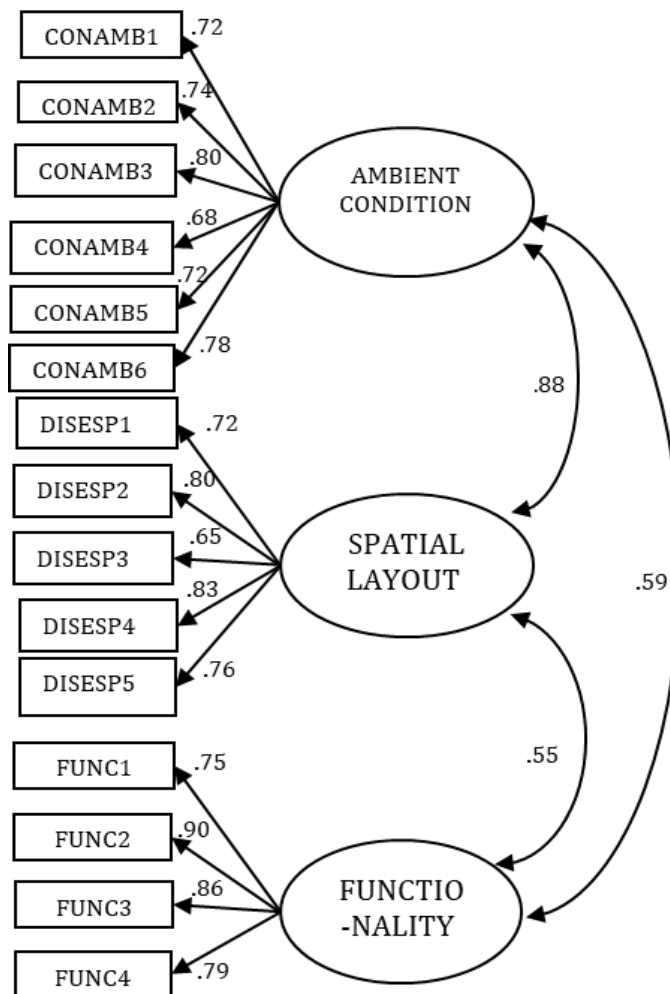
Annex 2: Supplementary figures



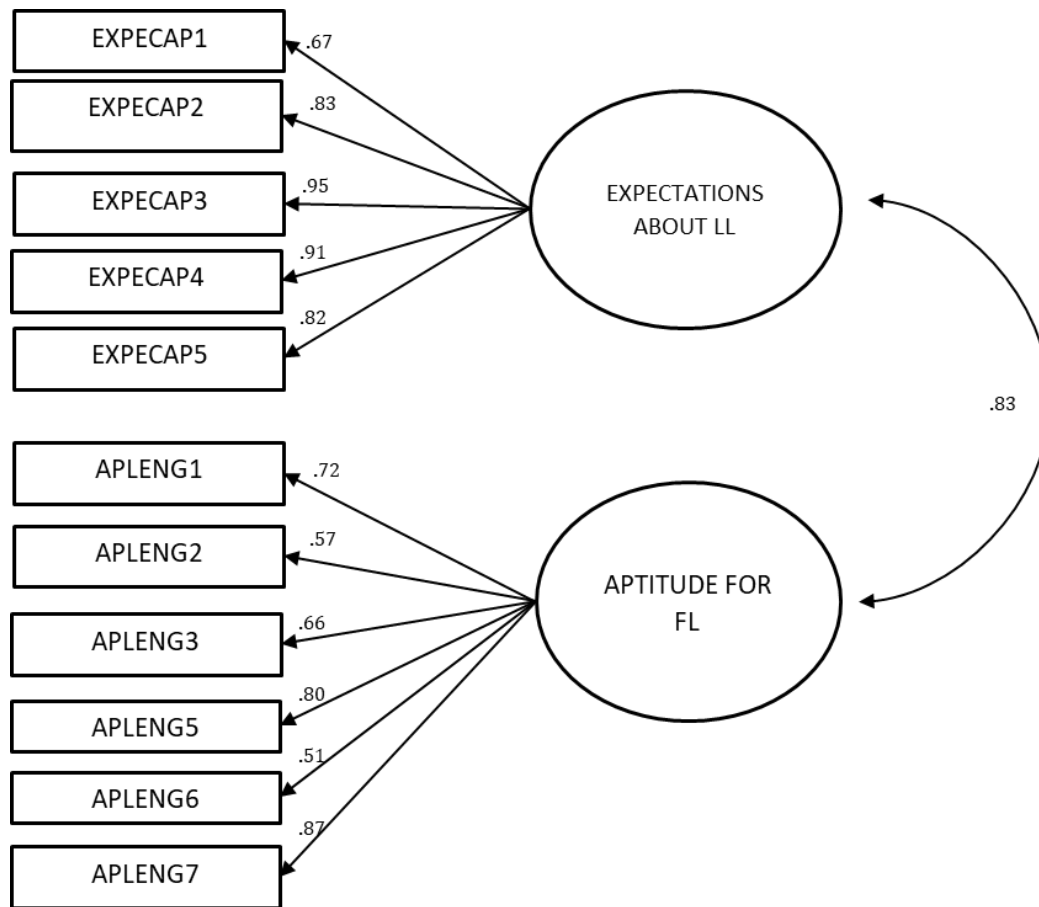
Supplementary Figure 1. Structural equation model of second order factor *Virtual Learning Environment* with four first-order factors. All factor loadings and are significant ($p < .05$). Values of errors are not reported. Goodness of fit: $\chi^2 = 669.84$ (179 *df*), $p = .000$; $BBNFI = .92$, $BBNNFI = .93$, $CFI = .94$; $RMSEA = .08$.



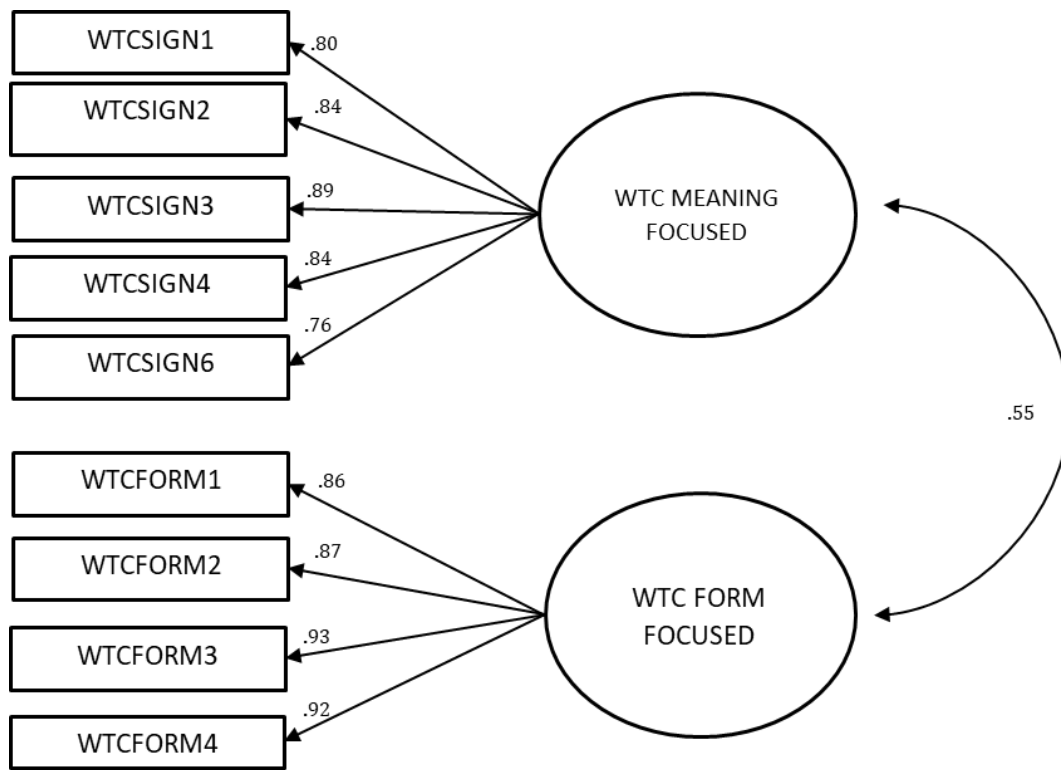
Supplementary Figure 2. Confirmatory factor analysis of Virtual Learning Environment. All factor loadings and covariances between factors are significant ($p < .05$). Values of errors are not reported. Goodness of fit: $\chi^2 = 668.04$ (179 *df*), $p = .000$; $BBNFI = .92$, $BBNNFI = .93$, $CFI = .94$; $RMSEA = .08$.



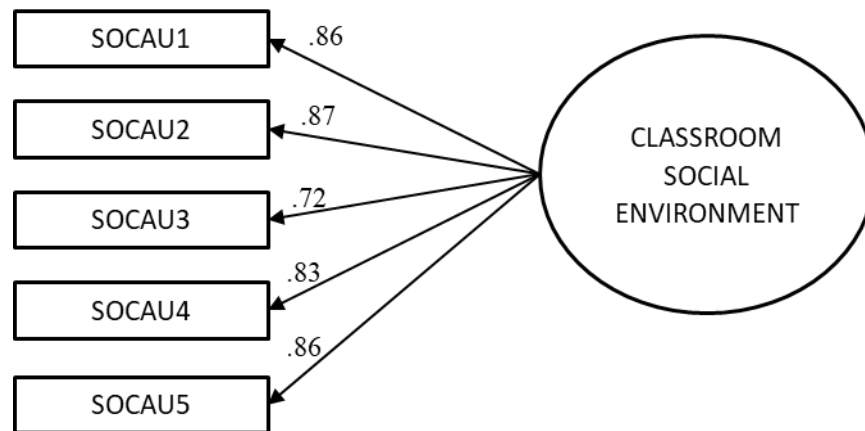
Supplementary Figure 3. Confirmatory factor analysis of Physical Environment of the Classroom. All factor loadings and covariances between factors are significant ($p < .05$). Values of errors are not reported. Goodness of fit: $\chi^2 = 368.26$ (81 *df*), $p = .000$; $BBNFI = .91$, $BBNNFI = .91$, $CFI = .93$; $RMSEA = .09$.



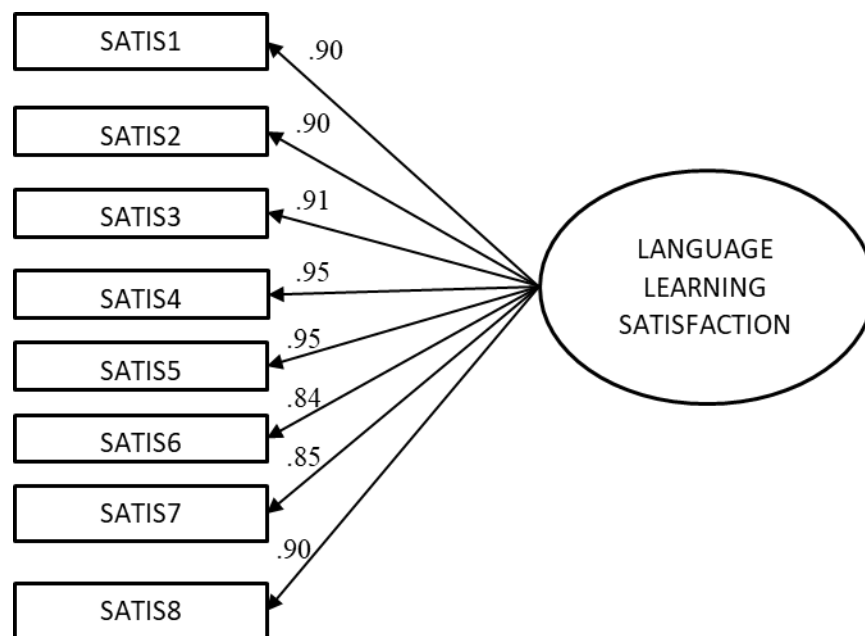
Supplementary Figure 4. Confirmatory factor analysis of Beliefs About Language Learning. All factor loadings and covariances between factors are significant ($p < .05$). Values of errors are not reported. Goodness of fit: $\chi^2 = 188.70$ (39 *df*), $p = .000$; $BBNFI = .94$, $BBNNFI = .94$, $CFI = .96$; $RMSEA = .09$.



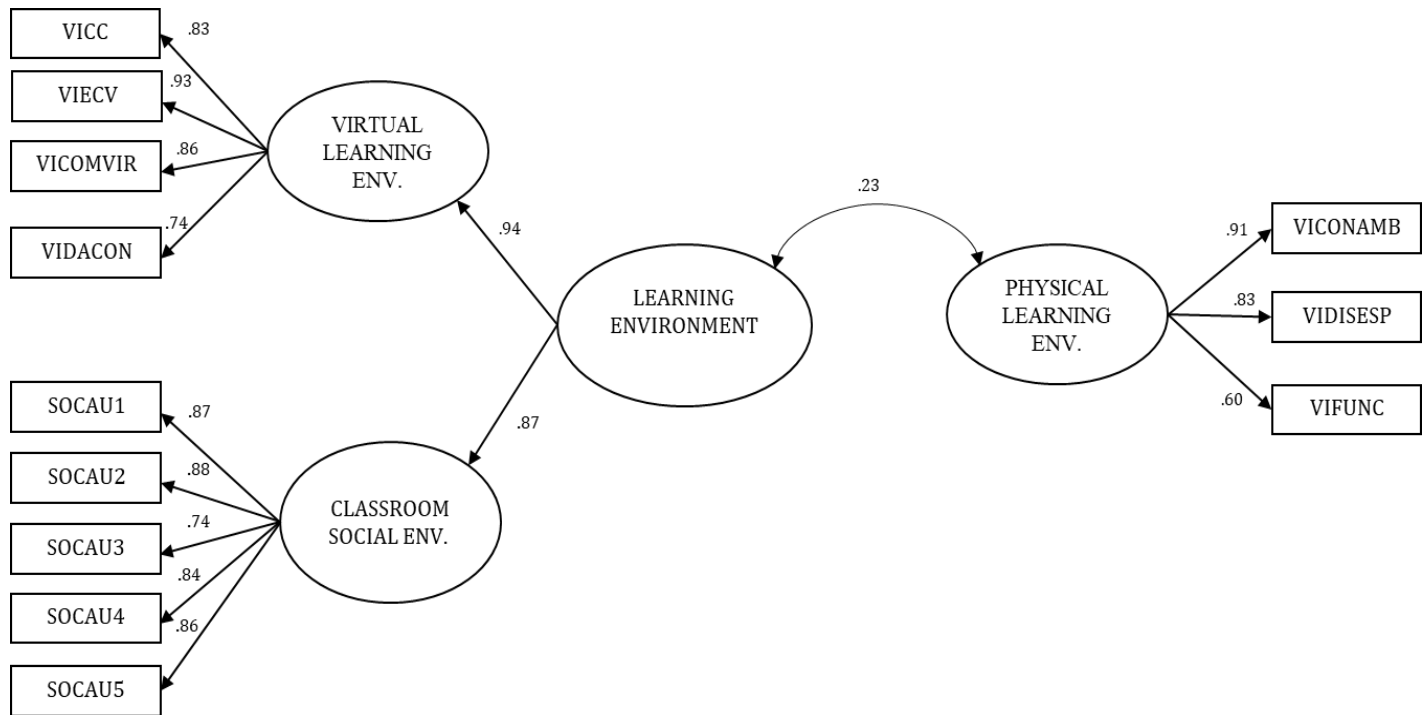
Supplementary Figure 5. Confirmatory factor analysis of Willingness to Communicate in a Foreign Language. All factor loadings and covariances between factors are significant ($p < .05$). Values of errors are not reported. Goodness of fit: $\chi^2 = 120.01$ (24 *df*), $p = .000$; $BBNFI = .96$, $BBNNFI = .95$, $CFI = .97$; $RMSEA = .09$.



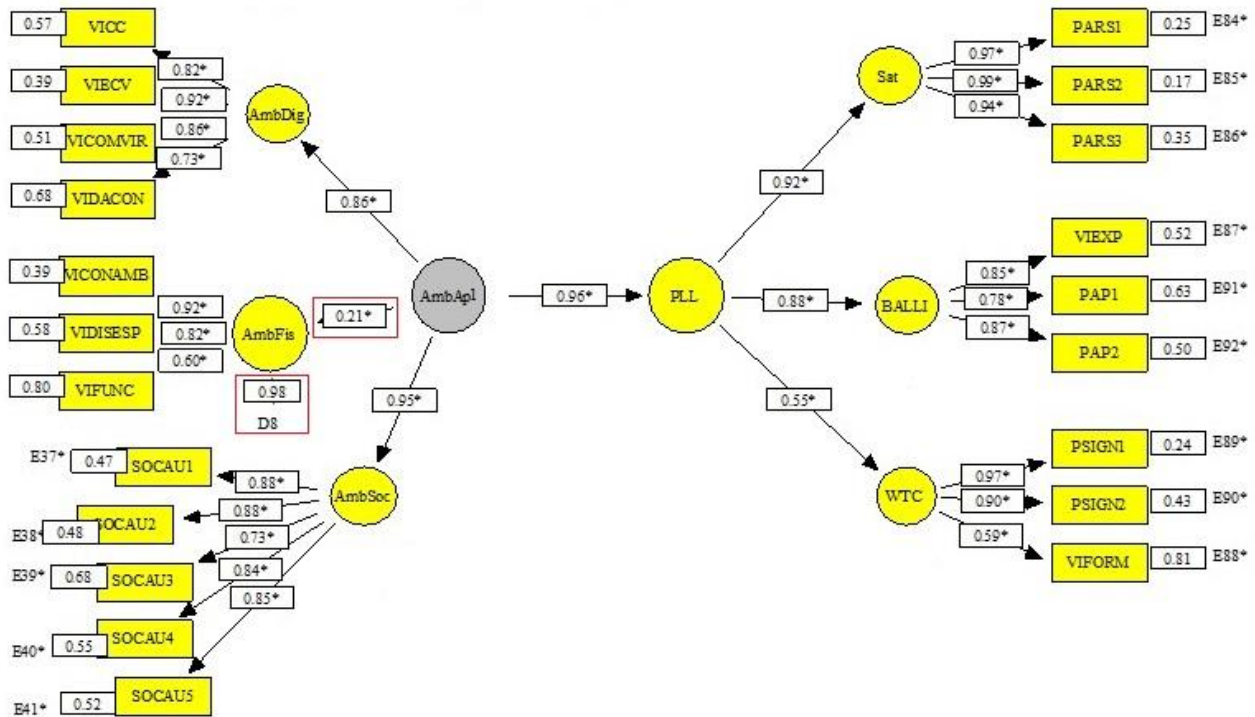
Supplementary Figure 6. Measurement Model of Classroom Social Environment. All factor loadings are significant ($p < .05$). Values of errors are not reported. Goodness of fit: $\chi^2 = 7.60$ (4 *df*), $p = .100$; $BBNFI = .99$, $BBNNFI = .98$, $CFI = .99$; $RMSEA = .04$.



Supplementary Figure 7. Measurement Model of Language Learning Satisfaction. All factor loadings are significant ($p < .05$). Values of errors are not reported. Goodness of fit: $\chi^2 = 82.29$ (16 *df*), $p = .00$; $BBNFI = .98$, $BBNNFI = .97$, $CFI = .98$; $RMSEA = .09$.



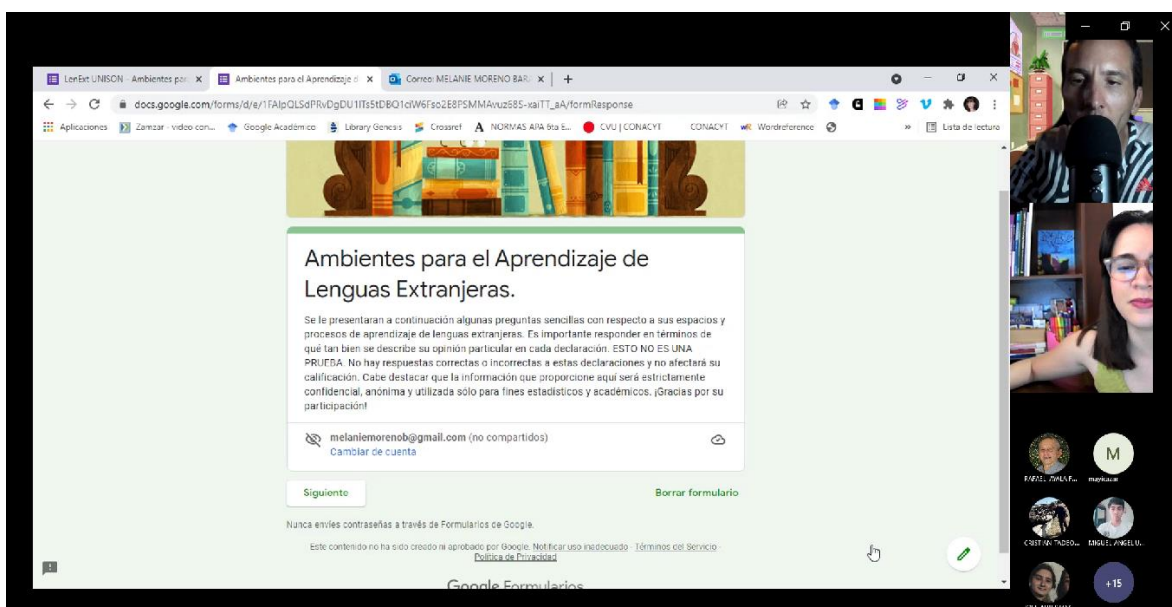
Supplementary Figure 9. Latent variable model of Learning Environment and covariance with Physical Environment. Errors for observed variables are not reported. $n = 455$. All factor loadings and the covariance between exogenous factors are significant ($p < .05$). Goodness of fit: $\chi^2 = 223.59$ (50 df), $p = .000$; $BBNFI = .94$, $BBNNFI = .94$, $CFI = .95$; $RMSEA = .08$.



Supplementary Figure 10. Raw Output of initial analysis for full latent variable model of Propensities in Language Learning predicted by Learning Environment (including physical classroom environment). Disturbance reported for Physical classroom environment factor ($D = .98$). $n = 455$. All factor loadings and the covariance between exogenous factors are significant ($p < .05$). Goodness of fit: $\chi^2 = 555.94$ (174 *df*), $p = .000$; $BBNFI = .93$, $BBNNFI = .94$, $CFI = .95$; $RMSEA = .07$. Propensities in Language Learning $R^2 = .95$.



Supplementary Figure 11. Cover of the virtual questionnaire (Google Forms) titled “Foreign Language Learning Environments”. Questionnaire available at: <https://forms.gle/nEo7ZNFZ6vT7rDT3A>.



Supplementary Figure 12. Screenshot taken on October 22nd, 2021, during a videocall with French Language students from UNISON who were volunteering for the last phase of the study.

Annex 3: Original Instrumentation employed in this study

Escala Ambientes digitales de aprendizaje

Instrucciones:

Por favor indique que tan de acuerdo se encuentra con las afirmaciones aquí enlistadas. Considere cada una de las afirmaciones en relación con la materia o contenido que se encuentra aprendiendo en este momento. Es importante que **no adivine**, si no que de un estimado realista sobre su opinión. No es una prueba, no hay respuestas correctas. Por favor **marque solo un número** por cada afirmación. **¡Gracias!**

Escala de Ciber comunicaciones episódicas

Esta sección refiere al uso de e-mail, mensajes de texto como **WhatsApp, Facebook Messenger, Direct Message de Instagram o Twitter, comunicaciones de videoconferencia como FaceTime, Skype o Zoom en sus prácticas cotidianas de aprendizaje** (ya sea en casa, la escuela, tus clases o cualquier otro lugar).

Para cada enunciado marque o encierre la respuesta que mejor representa su grado de acuerdo.					
0. Totalmente en desacuerdo 1. Parcialmente en desacuerdo 2. Ni de acuerdo ni en desacuerdo 3. Parcialmente de acuerdo 4. Totalmente de acuerdo					
1-Utilizo las ciber comunicaciones porque pienso que son eficientes (ej. Puedo comunicarme con un compañero de clase de manera rápida y sin complicaciones).	0	1	2	3	4
2-Hago uso de las ciber comunicaciones porque pienso que brindan una amplia gama de experiencias diferentes para mi aprendizaje.	0	1	2	3	4
3- Utilizo las ciber comunicaciones porque pienso que son una manera de estar activo en la interacción con otros.	0	1	2	3	4
4- Empleo las ciber comunicaciones porque pienso que resultan útiles para la distribución y adquisición de recursos/materiales para el aprendizaje (ej. Compartir mis notas o apuntes de clase).	0	1	2	3	4
5- Utilizo las ciber comunicaciones porque pienso que ayudan a ponerme en contacto con otros en el lugar o sitio donde me encuentre desde mi dispositivo habitual.	0	1	2	3	4

Escala de Escenarios de Conducta Virtuales

Esta sección refiere al uso de **perfiles personales en Facebook, Twitter, Instagram, bibliotecas en línea, páginas de juegos didácticos, Blogs o páginas web en sus prácticas cotidianas de aprendizaje** (ya sea en casa, la escuela, tus clases o cualquier otro lugar).

<p>Para cada enunciado marque o encierre la respuesta que mejor representa su grado de acuerdo.</p> <p style="text-align: center;">0. Totalmente en desacuerdo 1. Parcialmente en desacuerdo 2. Ni de acuerdo ni en desacuerdo 3. Parcialmente de acuerdo 4. Totalmente de acuerdo</p>					
6- En estos espacios virtuales la obtención de información es rápida y eficaz.	0	1	2	3	4
7- Recorro a estos espacios virtuales porque son diversos y variados (ej. Puedo encontrar diferentes formas de aprender y practicar como visitando un blog o una página web).	0	1	2	3	4
8- Frecuento estos espacios virtuales porque dan un sentido de presencia al interactuar con otras personas.	0	1	2	3	4
9- Recorro a estos espacios virtuales porque a través de ellos se puede crear, adquirir y distribuir materiales para mi aprendizaje (ej. Compartir con compañeros un libro que descargue en una biblioteca digital).	0	1	2	3	4
10- En estos espacios virtuales la información es accesible en cualquier momento y lugar desde mi dispositivo habitual (ej. Buscar información en una página web especializada desde donde me encuentre).	0	1	2	3	4

Escala de Comunidades Virtuales

Esta sección refiere al uso de grupos de apoyo en línea, foros con preguntas o comentarios sobre algún tema, comunidades especializadas como grupos en Facebook y/o Juegos en comunidades en sus prácticas cotidianas de aprendizaje (ya sea en casa, la escuela, tus clases o cualquier otro lugar).

<p>Para cada enunciado marque o encierre la respuesta que mejor representa su grado de acuerdo.</p> <p style="text-align: center;">0. Totalmente en desacuerdo 1. Parcialmente en desacuerdo 2. Ni de acuerdo ni en desacuerdo 3. Parcialmente de acuerdo 4. Totalmente de acuerdo</p>					
11- Las comunidades virtuales brindan información bien organizada y fácil de encontrar.	0	1	2	3	4
12- Acudo a comunidades virtuales porque ofrecen variabilidad de experiencias de aprendizaje (ej. consultar páginas de “fans” /foros para saber más sobre un tema, leer críticas de usuarios).	0	1	2	3	4
13- Acudo a comunidades virtuales porque son una manera de estar presente y activo/a en una comunidad o grupo del que puedo aprender.	0	1	2	3	4
14- Recorro a comunidades virtuales porque en ellas es sencillo crear, encontrar y compartir con otros los materiales que podrían contribuir a nuestro aprendizaje.	0	1	2	3	4
15- Las comunidades virtuales me pueden proporcionar información en el momento que se requiera desde mi dispositivo habitual (ej. Realizar una pregunta o consulta en un grupo mientras me dirijo a casa en el autobús).	0	1	2	3	4

Escala de Disponibilidad y Acceso a la Conectividad

Esta sección refiere a la disponibilidad de equipos y servicios para la conectividad en tu campus (Hardware, Software o programas, conexión a internet, etc.) que se emplean en prácticas cotidianas de aprendizaje.

<p>Para cada enunciado marque o encierre la respuesta que mejor representa su grado de acuerdo.</p> <p>0. Totalmente en desacuerdo 1. Parcialmente en desacuerdo 2. Ni de acuerdo ni en desacuerdo 3. Parcialmente de acuerdo 4. Totalmente de acuerdo</p>					
16- Mi escuela/universidad provee de infraestructura suficiente y medios eficientes para la conectividad en el campus (acceso a internet).	0	1	2	3	4
17- En mi escuela/universidad se dispone de servicios o plataformas de escolarización virtual que permiten ampliar las oportunidades de estudio de los alumnos.	0	1	2	3	4
18- Mi escuela/universidad cuenta con Un programa de capacitación/cursos/materia de orientación sobre manejo de tecnologías y plataformas virtuales de aprendizaje.	0	1	2	3	4
19- Mi escuela/universidad facilita el acceso a computadoras y su software asociado que brindan a los estudiantes las herramientas para trabajar en sus deberes académicos.	0	1	2	3	4
20- Mi escuela/universidad brinda acceso a una base de información (bases de datos, repositorios, bibliotecas digitales, etc.) que se encuentra en constante expansión a través de Internet.	0	1	2	3	4
21- Mi escuela/universidad proporciona acceso a una variedad de software gratuito que permite a los estudiantes realizar diferentes tipos de trabajos.	0	1	2	3	4

Cuestionario sobre Ambiente físico del Aula

Instrucciones:

Lea cada una de las preguntas y afirmaciones aquí enlistadas sobre las condiciones de su aula y exprese su opinión marcando con una cruz en el número correspondiente. Es importante que **no adivine**, si no que dé un estimado realista sobre su opinión. Utilice la escala de 0-5, basándose en los adjetivos situados en los extremos de cada opción de respuesta.

Por favor **marque solo un número** por cada afirmación. **¡Gracias!**

• **Condiciones ambientales**

- 1- ¿La calidad del aire y ventilación en el aula es adecuada? (Ventanas y flujo de aire fresco del exterior).

Inadecuada 0 1 2 3 4 5 *Adecuada*

- 2- ¿La temperatura dentro del aula es agradable?

No agradable 0 1 2 3 4 5 *Agradable*

- 3- En general, el olor en este salón de clases es...

Inaceptable 0 1 2 3 4 5 *Aceptable*

- 4- La iluminación en esta aula es... (hay demasiada o muy poca luz, limita o dificulta la visión).

Incómoda 0 1 2 3 4 5 *Cómoda*

- 5- En general, el nivel de ruido en el aula es... (Sin interferencia de ruido del exterior, alejada de fuentes de alto ruido)

Inaceptable 0 1 2 3 4 5 *Aceptable*

- 6- Regularmente, el interior del aula está...

Sucio 0 1 2 3 4 5 *Limpio*

• **Disposición espacial**

- 7- Los espacios entre asientos y muebles en esta aula son...

Estrechos 0 1 2 3 4 5 *Espaciosos*

- 8- Las instalaciones eléctricas y equipo electrónico en esta aula generalmente son...

Defectuosas 0 1 2 3 4 5 *Funcionales*

- 9- ¿El aula cuenta con comodidades básicas para la educación? (por ejemplo, proyector, pantalla, sistema de audio, pizarra).

Poco equipada 0 1 2 3 4 5 *Bien equipada*

- 10- Los muebles del aula (por ejemplo, escritorios, sillas, mesas) están en...

Mal estado 0 1 2 3 4 5 *Buen estado*

- 11- Los pupitres y las sillas de esta aula son...

Incómodos 0 1 2 3 4 5 *Cómodos*

- **Funcionalidad**

12- Cuando encuentro en las paredes el trabajo realizado por los estudiantes en clase de idiomas, pienso que esto es...

Inútil 0 1 2 3 4 5 *Útil*

13- Cuando encuentro en las paredes *posters* o impresiones con información sobre algunas estructuras lingüísticas del idioma de nuestro curso, pienso que son...

Desfavorables 0 1 2 3 4 5 *Favorables*

14- El que haya *posters* o impresiones con información sobre la clase, eventos del departamento de idiomas de mi universidad en las paredes me parece...

Inconveniente 0 1 2 3 4 5 *Conveniente*

15- El que haya *posters* o impresiones con datos culturales del país(es) donde se habla el idioma de nuestro curso en las paredes me parece...

Poco importante 0 1 2 3 4 5 *Importante*

Escala de Ambiente Social del Aula

Instrucciones:

Por favor indique que tan de acuerdo se encuentra con las afirmaciones aquí enlistadas. Considere cada una de las afirmaciones en relación con el aula y grupo en el que se encuentra en este momento. Es importante que **no adivine**, si no que de un estimado realista sobre su opinión. Por favor utilice la siguiente escala:

- 0) Totalmente en desacuerdo**
- 1) Parcialmente en desacuerdo**
- 2) Ni de acuerdo ni en desacuerdo**
- 3) Parcialmente de acuerdo**
- 4) Totalmente de acuerdo**

Por favor **marque solo un número** por cada afirmación. **¡Gracias!**

- 1- Aprendo cooperativamente con compañeros y maestros durante la clase de idiomas.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo**
 - 2) Ni de acuerdo ni en desacuerdo 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**

- 2- La proximidad (espacio físico) entre mis compañeros, mi profesor y yo es adecuado para beneficiarios cada participación que sucede en el aula.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo**
 - 2) Ni de acuerdo ni en desacuerdo 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**

- 3- Todos (alumnos y profesor) en esta clase se conocen bien a través de la interacción en el aula
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo**
 - 2) Ni de acuerdo ni en desacuerdo 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**

- 4- Los estudiantes en esta clase prestan atención a lo que otros dicen.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo**
 - 2) Ni de acuerdo ni en desacuerdo 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**

- 5- Me siento cómodo/a con el tamaño de esta clase (cantidad de personas)
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo**
 - 2) Ni de acuerdo ni en desacuerdo 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**

Escala de Satisfacción con el aprendizaje de idiomas

Instrucciones:

Por favor indique que tan de acuerdo se encuentra con las afirmaciones aquí enlistadas. Tiene usted 30 segundos para considerar cada una de las afirmaciones en relación con la clase de idiomas en las que se encuentra en este momento. Es importante que **no adivine**, si no que de un estimado realista sobre su opinión. Por favor utilice la siguiente escala:

- 0) Totalmente en desacuerdo**
- 1) Parcialmente en desacuerdo**
- 2) Ni de acuerdo ni en desacuerdo**
- 3) Parcialmente de acuerdo**
- 4) Totalmente de acuerdo**

Por favor **marque solo un número** por cada afirmación. **¡Gracias!**

- 1- . Me gusta la idea de aprender un idioma en una clase como esta; es decir, la que tengo este semestre.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo 2) Ni de acuerdo ni en desacuerdo**
 - 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**
- 2- Considero que mi experiencia de aprendizaje en este curso es positiva.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo 2) Ni de acuerdo ni en desacuerdo**
 - 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**
- 3- En general, estoy satisfecho/a con el curso.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo 2) Ni de acuerdo ni en desacuerdo**
 - 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**
- 4- Aprender un idioma en una clase como esta es agradable.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo 2) Ni de acuerdo ni en desacuerdo**
 - 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**
- 5- En general, pienso que este curso es efectivo para mi aprendizaje.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo 2) Ni de acuerdo ni en desacuerdo**
 - 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**
- 6- Hasta ahora, mi curso de idiomas ha cumplido todas mis expectativas.
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo 2) Ni de acuerdo ni en desacuerdo**
 - 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**
- 7- Recomendaría mi curso de idiomas en la universidad a mis amigos
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo 2) Ni de acuerdo ni en desacuerdo**
 - 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**
- 8- Mi elección de tomar este curso de idiomas fue una buena decisión
 - 0) Totalmente en desacuerdo 1) Parcialmente en desacuerdo 2) Ni de acuerdo ni en desacuerdo**
 - 3) Parcialmente de acuerdo 4) Totalmente de acuerdo**

Inventario de Creencias sobre el Aprendizaje del lenguaje (BALLI - *Beliefs about Language Learning*).

Instrucciones:

Lea cada declaración en las siguientes páginas. Responda a las declaraciones tomando como referencia la **lengua extranjera que usted se encuentra aprendiendo en este momento**. Decida su grado de acuerdo con cada declaración. Es importante que **no adivine**, si no que de un estimado realista sobre su opinión. Intente no cambiar sus respuestas después de elegir las. Por favor responda todas las preguntas y marque **solo una casilla** por cada afirmación. Esto no es una prueba, no hay respuestas correctas y no se encuentra relacionado a su calificación. **¡Gracias por su participación!**

Las opciones de respuesta en este cuestionario están abreviadas.

Por ejemplo, si usted está totalmente de acuerdo con el enunciado, marque la casilla correspondiente a “TA” de la siguiente manera:

Totalmente Desacuerdo (TD)	Desacuerdo (D)	Ni de acuerdo, ni desacuerdo (I)	Acuerdo (A)	Totalmente de Acuerdo (TA)
				X

Dimensión 1. Expectativas sobre el aprendizaje de idiomas.

Para cada enunciado marque la respuesta que mejor representa su opinión o grado de acuerdo.

	TD	D	I	A	TA
5- En México la gente piensa que es importante hablar el idioma que estoy aprendiendo.					
6- Me gustaría aprender este idioma para poder conocer/comprender mejor a sus hablantes.					
7- Aprender a hablar este idioma, me ayudaría a conseguir mejores oportunidades de trabajo o un buen empleo.					
8- Si aprendo muy bien este idioma, tendré muchas oportunidades para usarlo.					
9- Me gustaría conocer personas cuya lengua materna es la que estoy aprendiendo.					

Dimensión 2. Aptitud para las lenguas extranjeras

Para cada enunciado marque la respuesta que mejor representa su opinión o grado de acuerdo.

	TD	D	I	A	TA
10- A los niños les resulta más fácil aprender una lengua que a los adultos.					
11- Los mexicanos son buenos para aprender lenguas extranjeras.					
12- Para alguien que ya habla una lengua extranjera es más fácil aprender otra.					
13- Las personas que son buenas en matemáticas o ciencias no son buenas para aprender idiomas.					
14- Tengo aptitud para el idioma que estoy estudiando. Es decir, tengo la capacidad de aprenderlo.					
15- Las personas que hablan bien más de un idioma son muy inteligentes					
16- Todos pueden aprender a hablar/usar una lengua extranjera.					

Inventario sobre la Disposición para Comunicarse en una Lengua Extranjera

Folio _____ Idioma _____ Nivel _____

Instrucciones: Suponga que se le ha pedido que realice las siguientes tareas en **la lengua extranjera que se encuentra aprendiendo en este momento**. Por favor indique que tan dispuesto estaría a realizar las tareas enlistadas si estas fueran una actividad de clase (**No tiene que ejecutar/hacer cada tarea**). Es importante que **no adivine**, si no que de un estimado realista sobre su disposición a realizar la tarea correctamente. Por favor utilice la siguiente escala marcando la casilla correspondiente.

1. **“No dispuesto”**. Significa que no estaría para nada dispuesto a realizar la actividad.
2. **“No realmente dispuesto”**. Significa que su respuesta se inclina más a no estar dispuesto, pero no en su totalidad.
3. **“Ni dispuesto ni No dispuesto”**. Indica una neutralidad en su disposición a realizar la tarea.
4. **“Algo dispuesto”**. Significa que se encuentra dispuesto a realizar la actividad, pero no en su totalidad.
5. **“Dispuesto”**. Significa que se encuentra totalmente dispuesto a realizar la actividad.

Es importante responder en términos de qué tan bien describe cada declaración lo que usted piensa, NO en términos de lo que cree que debería pensar, o lo que otras personas piensan. ESTO NO ES UNA PRUEBA. No hay respuestas correctas o incorrectas a estas declaraciones. El puntaje que obtenga no afectará su calificación. Dependiendo de su experiencia y preferencias en cuanto al aprendizaje de idiomas, puede usted estar de acuerdo o no con realizar diferentes actividades. *Cabe destacar que la información que proporcione aquí será estrictamente confidencial, anónima y utilizada sólo para fines estadísticos y académicos.* Por favor **marque solo un número** por cada tarea. **¡Gracias por su participación!**

Para cada enunciado marque o encierre la respuesta que mejor representa su disposición para realizar cada actividad.					
	1.No Dispuesto	2. No realmente dispuesto	3. Ni dispuesto ni No dispuesto	4. Algo dispuesto	5. Dispuesto
1. Estoy dispuesto a hacer un juego de roles frente a mi clase de idiomas (por ejemplo, pedir comida en un restaurante).	1	2	3	4	5
2. Estoy dispuesto a dar una breve presentación frente a mis compañeros y maestro de idiomas, en la lengua extranjera de mi clase, sin emplear notas.	1	2	3	4	5
3. Estoy dispuesto a dar un breve discurso (Ej. sobre mi ciudad natal) en la lengua extranjera de mi clase, usando mis notas.	1	2	3	4	5
4. Estoy dispuesto a traducir para mi grupo un enunciado hablado de mi lengua materna a la lengua extranjera que compartimos.	1	2	3	4	5
5. Estoy dispuesto a pedirle al profesor (en la lengua extranjera que comparto con mi grupo) que repita lo que acaba de decir porque no lo entendí.	1	2	3	4	5
6. Estoy dispuesto a hacer un juego de roles en inglés en mi escritorio, con mi compañero (por ejemplo, pedir comida en un restaurante).	1	2	3	4	5

Para cada enunciado marque o encierre la respuesta que mejor representa su disposición para realizar cada actividad.

**1.No Dispuesto 2. No realmente dispuesto 3. Ni dispuesto ni No dispuesto
4. Algo dispuesto 5. Dispuesto**

7. Estoy dispuesto a preguntarle a mi compañero sentado a mi lado en inglés el significado de una palabra en la lengua extranjera que compartimos.	1	2	3	4	5
8. Estoy dispuesto a preguntarle a mis compañeros de grupo (empleando nuestro idioma extranjero) el significado de la palabra que no sé.	1	2	3	4	5
9. Estoy dispuesto a preguntar a mis compañeros de grupo cómo pronunciar una palabra del idioma que estamos aprendiendo.	1	2	3	4	5
10. Estoy dispuesto a preguntarle a un compañero sentado a mi lado cómo decir (construir, expresar) una frase en nuestra lengua extranjera para expresar lo que estoy pensando	1	2	3	4	5

VARIABLES DEMOGRÁFICAS

Edad _____ *Identidad de Genero* _____

Grado escolar:

Preparatoria: I II III IV V VI

Licenciatura: I II III IV V VI VII VIII IX X

Maestría: I II III IV V VI

Doctorado: I II III IV V VI VII VIII IX X

Le recordamos que la información que usted proporcione aquí es estrictamente confidencial y protegida por estándares éticos que garantizan su anonimato. La información solo será utilizada para fines de la investigación científica que aquí se conlleva. Todos los datos serán recopilados y analizados como un conjunto. Por favor marque la casilla que se encuentra debajo de este enunciado para informarnos sobre su disposición de participar en este estudio de manera voluntaria.

¡Muchas gracias!



"El saber de mis hijos
hará mi grandeza"

UNIVERSIDAD DE SONORA

División de Ciencias Sociales

Doctorado en Psicología

Hermosillo, Sonora, México a 9 de Agosto de 2021

Estimada Mtra. Karin Neudecker de Rosas

Coordinación de Otros Idiomas – Departamento de Lenguas Extranjeras.

Agradecemos su apoyo y participación en el proceso de levantamiento de datos de nuestra alumna, la Mtra. en Psic. Melanie Moreno Barahona, quien se encuentra realizando su tesis doctoral titulada "La influencia del ambiente educativo en el aprendizaje de un segundo idioma". Con el propósito de reafirmar nuestro compromiso ante la atención y tratamiento de la información conferida por los alumnos de su institución, presentamos aquí el acuerdo de confidencialidad celebrado por el Doctorado en Psicología de la Universidad de Sonora.

-La información que se nos proporcione es estrictamente confidencial y protegida por altos estándares éticos que garantizan su anonimato. La información solo será utilizada para fines de la investigación científica que en el trabajo de tesis mencionado se conllevan. Todos los datos serán recopilados y analizados como un conjunto en un software estadístico.

-Se ha solicitado esta información únicamente para la finalidad exclusiva de la realización de actividades profesionales y de investigación bajo el entendido de guardar secreto profesional respecto a todos los datos de carácter personal y a los que se tenga acceso durante la realización de este procedimiento. Igualmente, obligados a custodiar e impedir el acceso a los datos de carácter personal a cualquier tercero que no acredite la necesidad de su acceso a dicha información.

-Solamente se revelará dicha información a los empleados acreditados en su institución, que tengan necesidad expresa de conocerla en relación con el desarrollo de su actividad laboral o profesional (Directivos, coordinadores, administrativos).

ATENTAMENTE

"El saber de mis hijos hará mi grandeza"



El saber de mis hijos
hará mi grandeza
**DOCTORADO
EN PSICOLOGÍA**

Dra. Blanca Silvia Fraijo Sing
Universidad de Sonora
Tutora nacional

Dr. Cesar Tapia Fonllem
Universidad de Sonora
Coordinador de Posgrado en Psicología

Mtra. Melanie Moreno Barahona
Universidad de Sonora
Tesisista



"El saber de mis hijos
hará mi grandeza"

UNIVERSIDAD DE SONORA

División de Ciencias Sociales Doctorado en Psicología

Hermosillo, Sonora, México a 23 de abril de 2021

Estimado Mtro. Rodolfo Eduardo Ramírez Hernández.
Coordinación de Lenguas Extranjeras – Instituto Tecnológico de Hermosillo

Por medio de la presente, nos es grato dirigirnos a usted y extenderle un cordial saludo, en ocasión de presentar a usted con nuestra alumna de 5to semestre del Doctorado en Psicología, la **Mtra. en Psic. Melanie Moreno Barahona**, quien se encuentra realizando labor de campo y levantamiento de datos para la implementación de una fase de investigación en el marco de su tesis doctoral titulada "*La influencia del ambiente educativo en el aprendizaje de un segundo idioma*". Dicho trabajo se desarrolla actualmente en cotutela por nuestra Universidad de Sonora y la Université de Nantes en Francia.

Nuestra fase de investigación conlleva los siguientes pasos:

- Solicitud de aprobación y permisos por parte de la coordinación de lenguas extranjeras.
- Distribución de un enlace a un cuestionario en línea (Formato amigable de Google Forms, tiempo aproximado de respuesta de 15 min.) entre los estudiantes de lenguas extranjeras en su institución (alumnos de cualquier idioma y nivel).

Cabe aclarar que la información recabada por los cuestionarios será manejada con toda confidencialidad y solo será utilizada para fines de investigación científica, tratada por altos estándares éticos. De contar con su amable aprobación y apoyo, los días que contemplamos para el desarrollo de las acciones descritas contemplan los últimos días del mes de abril o la primera quincena de mayo en Hermosillo, Sonora.

Agradeciendo su atención a esta solicitud y su consideración

A T E N T A M E N T E

"El saber de mis hijos hará mi grandeza"



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EN PSICOLOGÍA**

Dra. Blanca Silvia Fraijo Sing
Universidad de Sonora
Tutora nacional

Dr. Cesar Tapia Fonllem
Universidad de Sonora
Coordinador de Posgrado en Psicología

Dr. Oscar Navarro Carrascal
Université de Nantes
Co-tutor internacional

UNIVERSITE DE NANTES
Laboratoire de Psychologie
Des Pays de la Loire
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"El saber de mis hijos
hará mi grandeza"

UNIVERSIDAD DE SONORA

División de Ciencias Sociales Doctorado en Psicología

Hermosillo, Sonora, México a 23 de abril de 2021

Estimada Mtra. Carmen Virginia García Acosta
Coordinación de Idiomas, Universidad del Valle de México (Campus Hermosillo)

Por medio de la presente, nos es grato dirigirnos a usted y extenderle un cordial saludo, en ocasión de presentar a usted con nuestra alumna de 5to semestre del Doctorado en Psicología, la **Mtra. en Psic. Melanie Moreno Barahona**, quien se encuentra realizando labor de campo y levantamiento de datos para la implementación de una fase de investigación en el marco de su tesis doctoral titulada "*La influencia del ambiente educativo en el aprendizaje de un segundo idioma*". Dicho trabajo se desarrolla actualmente en cotutela por nuestra Universidad de Sonora y la Université de Nantes en Francia.

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Cabe aclarar que la información recabada por los cuestionarios será manejada con toda confidencialidad y solo será utilizada para fines de investigación científica, tratada por altos estándares éticos. De contar con su amable aprobación y apoyo, los días que contemplamos para el desarrollo de las acciones descritas contemplan los últimos días del mes de abril o la primera quincena de mayo en Hermosillo, Sonora.

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UNIVERSIDAD DE SONORA

División de Ciencias Sociales Doctorado en Psicología

Hermosillo, Sonora, México a 03 de mayo de 2021

Lic. Mariana Macías Roaro
Universidad Tecnológica de Hermosillo.

Por medio de la presente, nos es grato dirigirnos a usted y extenderle un cordial saludo, en ocasión de presentar a usted con nuestra alumna de 5to semestre del Doctorado en Psicología, la **Mtra. en Psic. Melanie Moreno Barahona**, quien se encuentra realizando labor de campo y levantamiento de datos para la implementación de una fase de investigación en el marco de su tesis doctoral titulada "*La influencia del ambiente educativo en el aprendizaje de un segundo idioma*". Dicho trabajo se desarrolla actualmente en cotutela por nuestra Universidad de Sonora y la Université de Nantes en Francia.

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Conceptual Integration and Empirical Validation of a Unified Taxonomy: Quantitative Data Analysis for Virtual Learning Environments

Melanie Moreno-Barahona^{1,2}, Blanca Fraijo-Sing^{1*}, Ghazlane Fleury-Bahi², Oscar Navarro-Carrascal^{2,3} and Cesar Tapia-Fonllem¹

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Specific classes of cyberspaces emphasize different types of digital transactions given the user's context, thus making it essential to take into account what these environments can afford. In this way, we can portray the niches of technological use as ecologies of particular possibilities and compare how they differ between distinct spheres of human life. The present research is focused on describing the conceptual integration of a taxonomic crossover between Virtual Learning Environments and Educational Affordances of Technology, while also performing empirical testing and determining the psychometric properties in a scale regarding the aforementioned taxonomy. The study sample consisted of 320 students in the departments of foreign languages from three different universities in Sonora (northwestern region of Mexico). Students were given a questionnaire of 21 items organized into four subscales with a Likert-type response option to measure the notions concerning their usage of Virtual Learning Environments. Internal consistency procedures and confirmatory factor analysis by means of Cronbach's alpha and Structural modeling support the derived factorial structure, which contains Cyber-Communications, Virtual Behavior Settings, Virtual Communities, and Availability and Access to Connectivity. This structure traces the environmental properties perceived by learners in a virtual environment. Results sustain the initial conceptual construction regarding the proposed taxonomy, conclude that the 'Virtual Learning Environments Questionnaire' demonstrates adequate psychometric properties, and validate it as a fitting measure to assess the perceived psychological experience of students in a digital educational setting.

Keywords: educational affordances, taxonomic crossover, psychometrics, empirical validation, virtual learning environments (VLE)

INTRODUCTION

Categories and classifications are linked to everything humans do, ranging from the worlds where events happen to their complexities and the relationships between them. Categories as material or symbolic tools affect society in several ways: they are assigned, can become labels chosen for different events, and, in turn, can become statistical artifacts (Bowker and Leigh-Star, 2000).

Without a classification, there would be no advanced conceptualization, reasoning, or data analysis. Classifications as taxonomies may refer to both the process and the result. Thus, the term taxonomy is reserved for a theoretical classification of empirical entities. Taxonomical methods, in general, begin with a set of observed data that are measured in a string of variables. Afterward, various techniques, which are traditionally quantitative, are used to group cases on their general resemblance (Bailey, 1994). The present research seeks to develop an exhaustive taxonomy and take it, with an empirical proof, to the operational or indicator level (Bailey, 1984, 1990) by an integration and junction of the concepts that shape each of the selected taxonomies. In this manner, we intend to characterize the main bodies of information and specify the methods that achieve this taxonomic cross.

Numerous concepts and constructs describing virtual learning environments, as well as their corresponding measures, have been proposed in the literature. Research on this topic has evolved to include several instruments designed to evaluate different learning environments by measuring variables such as the efficacy of learners and teachers that engage in them (Chard, 2006); Intrinsic Motivation in virtual learning environments (Firat et al., 2017); the perceived quality of educational services provided by virtual learning environments (Martínez-Argüelles et al., 2013); scales developed to measure users' engagement in specific virtual environments (Lee et al., 2019; Olivetti et al., 2020; Rojabi, 2020) and The perception of students about pedagogical models and standards in virtual learning environments (Barari et al., 2020; Torres Martín et al., 2021). While these contributions remain to be very significant to the field, they do not provide a general view on virtual learning environments as they focus on the environment's isolated qualities. The taxonomy and corresponding scale presented here differ from prior research because it is sustained by both the educational affordances and spatial qualities of the components of cyberspace, therefore testing the integration of existing taxonomies. This integration will allow to capture the information more completely and to better evaluate virtual learning environments' spatiotemporal qualities and the psychological experience of learners traversing them through their learning process.

The conceptual integration as proposed in this study is focused on describing different components of the cyberspaces or virtual environments, given their potential in learning processes. These components reference the capacity of the Internet and the cyberspace to bring sources of information closer to electronically simulated "virtual" places that are physically distant (Stokols and Montero, 2002). A virtual environment is defined as the experience of being surrounded by an environment synthesized by a computer, mobile device, or cyberspace, which might allow us to state that these types of environments move beyond a three-dimensional context, unlike physical spaces (Stokols, 2018a). In light of their ease of use on mobile devices, virtual environments allow for an interaction with the content and other users without regarding such a device as a computer, but rather

as a space and an extension of their habitual daily practices (Lindaman and Nolan, 2015).

Therefore, we agree with the categorization of different components of cyberspace as conceived by Stokols (2018a), where distinct units of cyberspace emphasize different types of digital transactions. This categorization comprises Episodic Cyber Communications, that refer to conversations or exchanges in relatively short or designated time periods that are not as immersive as more extensive online interactions (e.g., E-mail, WhatsApp, Facebook Messenger, Instagram, Skype, and Zoom); Virtual Behavior Settings, meaning sites that stay online during longer periods of time and develop a symbolic sense of "space" or "place." These are frequently built around particular goals or activities (e.g., Blogs or web pages of some particular theme, virtual libraries, different learning management systems such as Moodle and Schoology); and Virtual Communities, the most socially immersive kind of these cyberspaces, which makes reference to groups that involve recurring interactions between participants, who develop a shared identity and a virtual sense of camaraderie. Said cyberspaces often depict members of a community whose interactions and encounters are portrayed on an interface or screen (e.g., Classcraft, learning communities and support groups on Facebook, forums for questions, tutorials, and guides, or sites to make comments and receive feedback on a specific topic).

Other authors have mentioned that, by using taxonomies about virtual environments, we must, in turn, consider what these environments may afford us. Thusly, we may portray the niches of technological use as ecologies of particular possibilities and compare how they differ between specific contexts (Mitev and De Vaujany, 2013). On the topic of what technologies or digital environments afford us in an educational setting, we selected several categories from existing research that explore the *Educational Affordances of wearable technologies* and *Affordances of Information and Communication Technologies*. In this article, we have retrieved mutual components to conceive a category that integrates the affordances of Accessibility, Diversity, Communication, Presence, and Distribution (Boyle and Cook, 2004; Conole and Dyke, 2004; Bower and Sturman, 2015).

Finally, when contemplating cyberspace categories and what they afford us in regard to education, it is pertinent to comment on the material and physical possibility of the availability and access to the connectivity that students have in their places of study. This concept refers to the availability of equipment and services for connectivity in the learning environment, such as Hardware, Software, Internet connection (broadband, wireless, or mobile data), and Educational platforms that are used in everyday learning practices, since the access and usage of these resources in education improves quality, enhances creative thought, is associated to productivity and efficiency of educational results, and facilitates both the teaching and learning process (Siddiquah and Salim, 2017).

The taxonomy comprised by the aforementioned variables may be illustrated in the following manner (see **Figure 1**).

METHODOLOGY

Participants

The study sample consisted of 320 students (Adults ≥ 18 years, $M = 19.4$) in the departments of foreign languages from Universidad del Valle de Mexico, Instituto Tecnológico de Hermosillo, and Universidad de Sonora. This sample included 115 male students and 205 female students, all of them located in the city of Hermosillo, Sonora in Northwestern Mexico. All participants were invited and then volunteered to partake in the online study. Participants also completed several other questionnaires related to language learning variables as part of a broader online study regarding language learning environments.

Instrument and Measures

A questionnaire, called the Virtual Learning Environment Questionnaire (VLEQ), was based on the Taxonomy for Virtual Learning Environments, and developed specifically for its use in this study. It contained 21 items with a closed-ended Likert five-point scale response option (ranging from 0 – strongly disagree, to 5 – strongly agree). The VLEQ comprised four main sections: (1) Episodic Cyber Communications, (2) Virtual Behavior Settings, (3) Virtual Communities, and (4) Availability and Access to Connectivity. Regarding the first three scales, each one of them aimed to assess the suitability of the environmental quality perceived from each of these types of digital spaces dedicated to learning. As for the fourth scale, it was designed to gather information about the students’ availability of equipment and services for connectivity.

Procedure

The VLEQ Questionnaire development procedure began in November 2020, based on a literature review and structuration of the taxonomic cross in this study. This was carried out with a review of major studies in the area, regarding virtual environments and the affordances of information technologies. Review evolved as ensued by peer feedback, followed by the technique proposed by Bailey (1994), where the planned selection and precise combination of a set of criteria with empirical referents served as a foundation for the taxonomy, and as a result obtaining the 21 Item pool which was to be proved through factor analysis, in order to identify the underlying relationships between measured variables.

The questionnaire was written in Spanish, and it was made available to students from March to April 2021. The recruitment process was tailored to ensure that the learners received the questionnaire via a link shared by their teachers, and then answered during their online classes. The VLEQ link provided also contained the informed consent clause which was signed by all participants.

Data Analysis

The classic strategy is one of the most prevalent practices in social research, which first consists in specifying the concepts or constructs and then measuring empirical cases of them. This strategy alludes to a basic type of indicator classification

TABLE 1 | Internal consistency of the scales.

Scale	Cronbach's alpha (α)
Virtual Learning Environment Questionnaire	
Episodic Cyber Communications	0.94
Virtual Communities	0.91
Virtual Behavior Settings	0.93
Availability and Access to Connectivity	0.91

TABLE 2 | Pearson's correlation coefficients between the scales contained in the Virtual Learning Environments Questionnaire.

	CC	VBS	Vir. C	AAC
CC	1			
VBS	0.789**	1		
Vir. C	0.702**	0.800**	1	
AAC	0.582**	0.648**	0.617**	1

** $p < 0.01$; $n = 320$.

CC, Cyber Communications; VBS, Virtual Behavior Settings; Vir. C, Virtual Communities; AAC, Availability and Access to Connectivity.

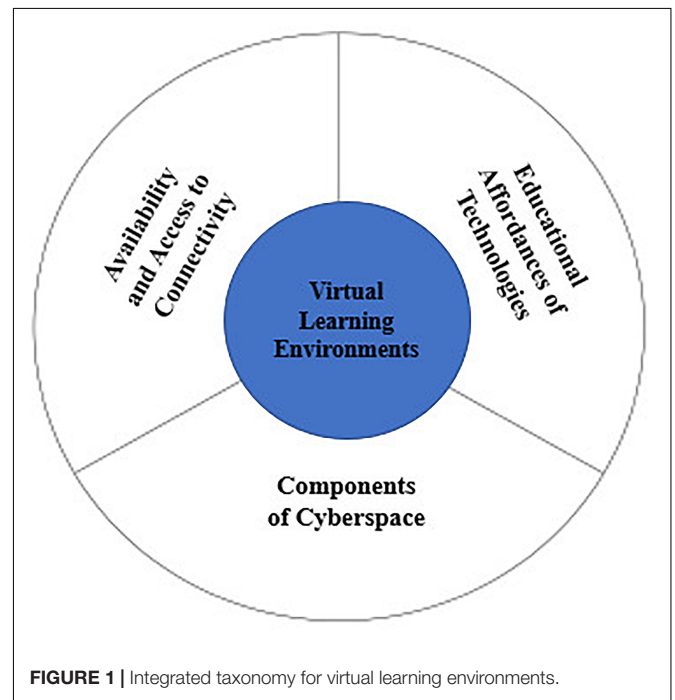


FIGURE 1 | Integrated taxonomy for virtual learning environments.

called a “three-level measurement model,” where we find the concept, the corresponding empirical occurrence of the concept, and the indicator of both the concept and the empirical occurrence (Bailey, 1984). In these cases, typologies of a conceptual or empiric nature can only be abstracted through a measurement process which objectively identifies empirical cases for each conceptual category by measuring their correspondence (Bailey, 1994).

The main form of data analysis to be presented here is the results of the analysis from structural modeling procedures used to determine the taxonomy’s empirical validity and therefore

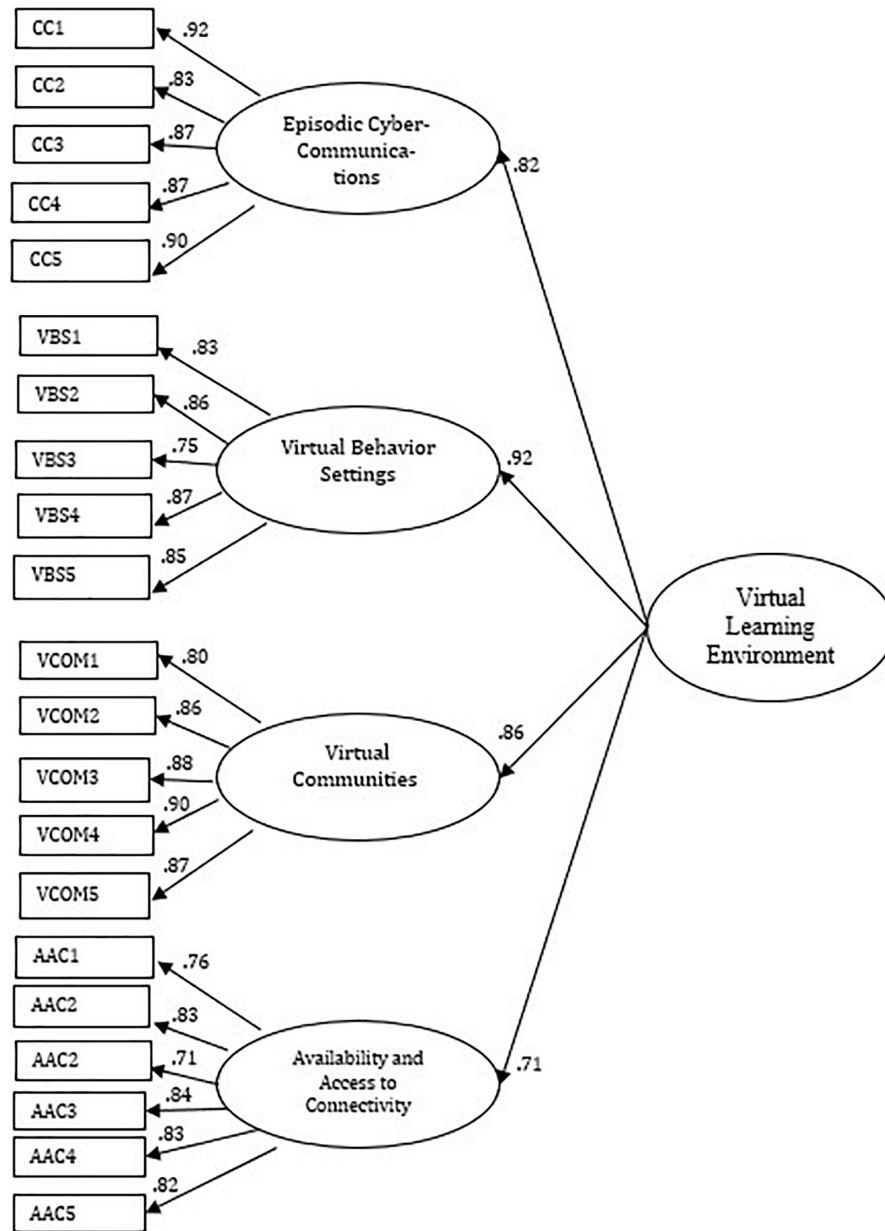


FIGURE 2 | Structural equation model of second-order factor virtual learning environment with four first-order factors. All factor loadings are significant ($p < 0.05$). Values of errors are not reported. Goodness of fit: $\chi^2 = 668.04$ ($df = 179$), $p = 0.000$; BBNFI = 0.92, BBNFI = 0.93, CFI = 0.94; RMSEA = 0.08. Circles indicate latent variables, and boxes indicate the number of the item.

the VLEQ’s reliability and construct validity. Specifically, we aimed to provide the first test of the factorial structure, presented here in two stages. The first step was to execute an Internal consistency analysis by means of Cronbach’s alpha reliability coefficient employing SPSS software. This coefficient was chosen in accordance with the needs of the study, given that it refers to the degree that the items of a measurement altogether reflect a simple latent variable (Cohen et al., 2012). Secondly, we demonstrated the validity of the approach by performing a

confirmatory factor analysis by the means of structural equation modeling and a covariance analysis between the four factors developed with the proposed taxonomy. The modeling of latent variables provides convergent and discriminative evidence of the validity of the construct (Cohen and Swerdlick, 2006); the latter is assessed by examining the chi-square (χ^2) statistic and its degrees of freedom. Moreover, other indexes used to estimate model fit include the Normed Fit Index (NFI), Non-normed Fit Index (NNFI), Comparative Fit Index (CFI), and Root-Mean-Square

Error Approximation (RMSEA); all of which can be computed in EQS software.

RESULTS

Reliability and Internal Consistency

All scales in this study were individually tested. Since, for the most part, tests are not always assumed to be homogeneous; but rather, it is sought that each of its scales, separately, measures a set of traits or characteristics different from those measured by the other scales included in the test (Cohen and Swerdlick, 2006). **Table 1** shows the internal consistency of the scales used in the study. We can observe that all round, scale coefficients are both statistically significant and strongly correlated (see **Table 2**), presenting high Cronbach's alpha values ($\alpha \geq 0.75$), hence, demonstrating an excellent internal consistency and reliability coefficient of the questionnaire.

Confirmatory Factor Analysis and Model Fit

With regards to model fit and its interpretation, **Figure 2** shows the obtained model for the Virtual Learning Environments Taxonomy, which shows a second-order factor explained by four first-order factors. We employed absolute fit indexes such as chi-square statistic to assess the degree to which the proposed structure and the actual data variance compare (Bentler, 1995). By observing it, we can corroborate that the indicators of goodness of statistical adjustment were in this case significant ($\chi^2 = 668.04$, $df = 179$, $p = 0.000$). However, we may also remark that all factorial loads are equal to or greater than 0.70, and adjunct or practical goodness of fit indexes (NFI = 0.92, NNFI = 0.93, CFI = 0.94, RMSEA = 0.08) show that the model is well supported by the amount of observed data contained in our sample since fit index all values are equal to or greater than 0.90 and $RMSEA \leq 0.08$ (Bentler, 1990; Corral-Verdugo, 1995; Ullman and Bentler, 2012), thus, proving an adequate factorial structure and model fit regarding its practical indicators, which brought additional information about the value of the hypothesized model (Thompson, 2004; Shi et al., 2019; Park and Kim, 2021).

DISCUSSION

The results from this study point to the conclusion that the conceptual integration and empirical validation of the unified taxonomy for Virtual Learning Environments were solidly constructed and verified. Once indicators are classified into their designated groups, discriminant analysis works with all variables linearly to make a prediction as to the group to which the indicator belongs. This means that a collection of empirical cases assigned to groups and a set of continuously measured variables come to represent the conceptual-indicator-empirical structure obtained via discriminant analysis (Bailey, 1984).

Therefore, by acknowledging this model, this research is a first step toward a more profound understanding of virtual

learning environments and study of the scope and complexity of the cybersphere in educational settings. Literature on virtual or digital environments indicates we should consider the cybersphere as a broad domain of environmental influence and search for ways to assess the varied outcomes of virtual life in relation to people's contexts (Stokols, 2019a). Here, we explored some of the contextual relationships embedded in virtual learning environments, approaching the study of how technologies and virtual settings may afford a sense of ecological presence (Frielick, 2004). While touching on the impact of virtual environments in educational settings, we can also make an emphasis on how digital communications and the components of the cybersphere have an influence on a person's day-to-day activities (Stokols, 2019b). In this case, an influence on students' activities and the qualities they perceive from their digital environments. Moreover, the model in this study may shed a light on strategies for digitalized or remote learning and teaching, tactics for adapting to change within the transition to online learning, and the design of digital learning spaces (Abdelhafez, 2021; Lyu, 2021).

A key strength of this research lies within the fact that the newly proposed questionnaire (VLEQ) specializes in studying some of the perceived affordances in virtual learning environments solely based on the items derived from a taxonomic cross which included theoretical categories that had not been tested with empirical cases before. These indicators were subjected to empirical testing procedures in order to obtain and analyze the psychometric properties which determined the validity of the taxonomy portrayed in the questionnaire.

Even in light of the results obtained, a significant limitation in this study relates to generalization, since we worked with data from only 320 second language learning students at university level, therefore the results cannot be claimed to universally be the case for all learners and educational degrees. Furthermore, this work only offers limited aspects regarding each category for virtual learning environments, future directions may point to the improvement of several features of the taxonomy. These may be explored by further development of the questionnaire, such as adding more examples to better describe the different kinds of cyberspaces or including more items in order to describe other affordances of information technologies.

The obtained results justify further development of the method, several interesting aspects may be explored to a greater extent by adapting the instruments and methods of this study to the needs of other populations in different educational levels. Future works should include different kinds of students (including different areas and fields of knowledge), while also associating their virtual, physical, and social contexts in order to further detail the interconnection between these environments and its impact on variables related to learning processes.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Committee of Ethics in Research (Comité de Ética en Investigación) of the University of Sonora. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MM-B contributed to the conceptualization and design of the study, acquired the data, ran formal analysis, and organized the databases. BF-S and GF-B contributed to supervising the study, methodological tasks, and data interpretation. CT-F made substantial contributions by editing and revising the manuscript critically for important intellectual content. MM-B and ON-C provided the

writing of the original draft. All authors contributed to manuscript revision and read and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.814592/full#supplementary-material>

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Título: La Influencia del Ambiente de Aprendizaje en las Propensiones para el Aprendizaje de una Segunda Lengua

Palabras Clave: *Ambiente de Aprendizaje, Aprendizaje de Lenguas Extranjeras, Modelamiento Estructural, Psicología Ambiental.*

Resumen: Este estudio probó un modelo hipotético que integra el Ambiente de Aprendizaje y las Propensiones para el Aprendizaje de una Segunda Lengua, utilizando un modelo de ecuaciones estructurales. La población de análisis para este estudio comprendió una muestra de 455 estudiantes de idiomas de nivel universitario en Hermosillo, Sonora, México. Los participantes respondieron a un cuestionario virtual que consistía de una sección demográfica y seis escalas que medían variables relacionadas con su Entorno Virtual de Aprendizaje, Entorno Físico de Aprendizaje, Entorno Social de Aprendizaje, Satisfacción con el Aprendizaje de Idiomas, Creencias sobre el Aprendizaje de Idiomas y Disposición a Comunicarse en una Lengua Extranjera.

Los resultados muestran un efecto directo del Entorno de Aprendizaje (integrado únicamente por los factores de ambiente virtual y social) sobre la variable de propensiones, lo que implica que las cualidades percibidas en el entorno de aprendizaje predijeron con éxito las propensiones para el aprendizaje de una segunda lengua. El modelo demostró un ajuste adecuado a los datos ($\chi^2 = 417,94$ (123 df), $p = .000$; BBNFI = .95, BBNNFI = .95, CFI = .96; RMSEA=.07), lo que indica el potencial del abordaje de las diferencias individuales y variables contextuales para dar cuenta de procesos relacionados con el aprendizaje de idiomas.

Titre : L'influence de l'environnement d'apprentissage (numérique, physique et social) sur les propensions à l'apprentissage d'une langue étrangère.

Mots clés : Environnements d'apprentissage, apprentissage des langues étrangères, modélisation structurelle, psychologie environnementale.

Résumé : Cette étude a testé un modèle hypothétique qui intègre l'environnement d'apprentissage et les propensions à l'apprentissage d'une langue étrangère en utilisant la modélisation par équations structurelles. La population analysée pour cette étude comprenait un échantillon de 455 apprenants en langues de niveau universitaire à Hermosillo, Sonora, Mexique. Les participants ont répondu à un questionnaire en ligne comprenant une section démographique et six échelles mesurant des variables liées à leur environnement d'apprentissage virtuel ou numérique, leur environnement d'apprentissage physique, leur environnement d'apprentissage social, leur satisfaction à l'égard de l'apprentissage des langues, leurs croyances en matière d'apprentissage des langues et leur volonté de communiquer dans une langue étrangère.

Les résultats montrent un effet direct de l'environnement d'apprentissage (comprenant uniquement les facteurs d'environnement virtuel et social) sur la variable des propensions, ce qui implique que les qualités perçues de l'environnement d'apprentissage prédisent avec succès les propensions à l'apprentissage d'une deuxième langue. Le modèle a démontré un ajustement adéquat aux données ($\chi^2 = 417.94$ (123 df), $p = .000$; BBNFI = .95, BBNNFI = .95, CFI = .96 ; RMSEA=.07), indiquant le potentiel de la prise en compte des différences individuelles et des variables contextuelles pour expliquer les processus liés à l'apprentissage des langues.

Title : The Influence of the Learning Environment (Digital, Physical and Social) on Propensities for Second Language Learning.

Keywords : Learning Environments, Foreign Language Learning, Structural Modelling, Environmental Psychology.

Abstract : A hypothesized model integrating relationships between Learning Environment and Propensities for Second Language Learning was tested using structural equation modeling. The analysis population for this study comprised a sample of 455 university-level language learners in Hermosillo, Sonora, Mexico. Participants responded to a virtual questionnaire consisting of a demographic section and six scales, measuring variables regarding their Virtual Learning Environment, Physical Learning Environment, Social Learning Environment, Language Learning Satisfaction, Beliefs about Language Learning and Willingness to Communicate in a Foreign Language.

The results show a direct effect of learning environment (integrated only by its virtual and social spheres) on the propensities variable, implying that the perceived qualities of the learning environment successfully predicted propensities for second language learning. The model provides an adequate fit to the data ($\chi^2 = 417.94$ (123 df), $p = .000$; BBNFI = .95, BBNNFI = .95, CFI = .96; RMSEA=.07), indicating the potential to draw on individual differences and contextual variables to account for language learning related processes.