

Influence of Learning Style Preferences on Written Communication Skills in a Blended Learning Environment

Gustavo Zurita-Alarcón, Claudio Álvarez-Gómez

Recommended Citation:

Zurita-Alarcón, Gustavo; Álvarez-Gómez, Claudio (2024). "Influence of Learning Style Preferences on Written Communication Skills in a Blended Learning Environment". *Profesional de la información*, v. 33, n. 1, e330001.

<https://doi.org/10.3145/epi.2024.0001>

Article received on March 6th 2023

Approved on December 4th 2023



Gustavo Zurita-Alarcón

<https://orcid.org/0000-0003-0757-1247>

Universidad de Chile, Facultad de Economía y Negocios
Departamento de Control de Gestión y Sistemas de Información
Av. Diagonal Paraguay 257
8330015 Santiago, Chile
gzurita@fen.uchile.cl



Claudio Álvarez-Gómez ✉

<https://orcid.org/0000-0002-5442-2140>

Universidad de los Andes
Facultad de Ingeniería y Ciencias Aplicadas
Av. Monseñor Álvaro del Portillo 12455
7620001 las Condes, Chile
calvarez@uandes.cl

Abstract

Written communication is an essential skill for information professionals. Therefore, it is common to implement writing tasks to develop this skill in higher education. However, it is known that students' learning style preferences can influence improved written communication skills unequally among students, considering practice with writing tasks. This study examined how learning style preferences can influence the improvement of written communication skills in a blended learning environment for university students in information and management control engineering. Over seven semesters, 215 students participated in writing tasks supported by a discussion forum, and their learning style preferences were measured and analyzed using the Honey and Mumford model. Student performance on the online forum was repeatedly measured to determine the variation in written communication skills according to different learning style preferences and to identify which students benefited most from the intervention. The results indicate that although students' primary learning style preference influences their performance in written communication, these skills improve regardless of the learning style preference. Students with a primary "reflector" learning style preference were the most numerous and achieved the greatest learning gains. Students with a "theorist" learning style preference demonstrated medium-sized improvements in spelling and writing, and students with an "activist" learning style preference had small but significant increases in the quality of their justification and argumentation. Overall, the results suggest that learning style preferences are a relevant individual characteristic for personalizing electronic or hybrid learning environments in writing tasks.

Keywords

Written Communication, Information Professionals, Higher Education, Discussion Forum, B-learning, Blended Learning, Learning Styles, Cognitive Styles, Skill Improvement, Comparative Study.

1. Introduction

Given the rapid economic, social, and technological changes the world is experiencing, many industries worldwide are fundamentally based on information and digitization. Regardless of the economic sector or industry, organizations



nowadays require leaders and managers who can master a wide array of skills and intellectual capabilities, such as being creative, innovative, ethical, technologically literate, proficient critical thinkers, problem solvers, capable decision-makers, effective collaborators and communicators (**Hart Research Associates**, 2018; **AACSB**, 2020; **Suerta et al.**, 2017; **Manyika et al.**, 2020). These skills are known as “21st century skills” (**Care et al.**, 2012; **González-Pérez; Ramírez-Montoya**, 2022), given their relevance in contemporary society and the workplace. It has been acknowledged that people’s display of these skills predicts job success in organizations (**Hanushek et al.**, 2016).

Over two decades of research confirms that writing skills are instrumental in achieving various educational and graduate employment outcomes (**Jackson**, 2014; **Calma et al.**, 2022). Universities are increasingly responsible for graduate employment outcomes and ensuring that learning outcomes align with industry expectations. For instance, written communication was included as a generic skill expected of all students in the Assessment of Higher Education Learning Outcomes (AHELO) project, an effort to evaluate general learning outcomes of college students across nations, which is sponsored by the Organisation for Economic Co-operation and Development (**OECD Indicators**, 2012). Writing effectively based on writing standards is particularly important in higher education, where proficiency in written communication is considered a critical student learning outcome (**Sparks et al.**, 2014; **González-Pérez; Ramírez-Montoya**, 2022). Although written communication is defined differently among various sources, it is involved with the ability to effectively convey multiple types of messages, in multiple forms, to varying audiences through a written medium (**Markle et al.**, 2013). Written communication is part of an array of transferable skills considered part of the 21st century graduate in business education (**Smith; Paton**, 2014). In economics and business schools, developing 21st century skills, including written communication skills, is overseen by established accreditation standards (**AACSB**, 2020; **Carraher**, 2009), which implies that curricula must comprise learning goals that address them. **Mainga et al.** (2022) explored the perceptions of 189 business students - with a response rate of 47.6% - regarding their employability skills upon graduation, using an exploratory descriptive methodology. The results highlighted communication, self-learning skills, problem-solving, and teamwork as the essential skills for hiring in initial positions. To fulfill such learning goals, effective pedagogy and assessment are required. One of these pedagogical practices is the growing and increasingly used Blended Learning teaching method (**Arbaugh et al.**, 2009; **Chen; Jones**, 2007; **Güzer; Caner**, 2014; **Heilporn et al.**, 2021).

Blended learning (BL) combines pedagogical practices and advantages of face-to-face learning inside the classroom and online learning through the internet and the web (**Garrison; Kanuka**, 2004; **Graham**, 2006). Authors such as (**Maulida et al.**, 2022; **Garrison; Kanuka**, 2004; **Zhao; Breslow**, 2013) posit that the blend of traditional classroom learning and digital learning can enhance the learning of several skills, such as oral and written communication, critical thinking, problem solving and collaboration, among others. Particularly, (**Care et al.**, 2012) argue that BL environments can enhance the development of “21st century skills” in student populations, with their implementation becoming more frequent in higher education courses (**Güzer; Caner**, 2014) and especially in economics and business schools (**Allen et al.**, 2007; **Arbaugh et al.**, 2009). **Mueller and Wulf** (2022) highlighted the relevance of designing BL environments to enhance learning and student performance, indicating that promoting flexibility and interaction improves learning outcomes. We believe that in a BL environment, active knowledge construction through discussion forums and written assignments, similar to those designed (**Mueller; Wulf**, 2022), can improve written communication skills.

According to **Nurmalisa et al.** (2023), a review of 154 articles from 2000 to 2020 revealed that 25 of them discussed the relationship between “digital media” and students’ “learning styles,” underscoring the importance of BL in accommodating diverse learning styles. It is advocated that “digital learning media” should be created with students’ “learning styles” in mind. The findings emphasize educators’ need to understand their students’ learning styles to effectively tailor learning experiences. Following (**Nurmalisa et al.**, 2023), one key objective is to design digital media that align with students’ learning style preferences to meet their learning needs effectively. This tailored approach is crucial for optimizing the benefits of digital media in modern education, (**Nurmalisa et al.**, 2023). The article also stresses the need for further research on how educational interventions, whether digital technology or writing tasks within a BL environment, can be designed to suit diverse learning styles and, thus, improve critical skills like written communication. Consequently, we posit that further research is paramount to elucidate how BL environments can nurture the development of “21st century skills,” cognizant of students’ varied learning style preferences.

Learning styles consider habits and preferences for learning, (**Felder**, 2020). Results of different investigations suggest that students modify their learning style preferences to adapt to the learning needs they encounter as they come closer to the professional practice (**Nulty; Barrett**, 1996; **Fleming et al.**, 2011). Nulty & Barrett (1996) indicate that upon entering higher education, novice students do not present statistically significant differences in learning styles, even across different majors (**Nulty; Barrett**, 1996). Moreover, there is evidence that students in different educational institutions but in the same major will have similar learning styles (**Bitran et al.**, 2003). However, according to **Nulty and Barrett** (1996), learning styles can change over time according to the progression of subjects in curricula. Such evidence has led to classifying professional disciplines according to students’ dominant learning style preferences. According to **Cullen et al.** (1994) and **Nulty and Barrett** (1996), five clusters group study areas about students’ preferred learning styles. However, the business has not been fitted into a specific cluster. Instead, applied economics, which is close, has been found under the ‘abstract and reflective’ learning cluster.

In this research, we implemented a learning environment based on BL to foster written communication skills. The environment was implemented for seven consecutive semesters in a compulsory course that enrolled students from two undergraduate, business-related majors at University of Chile. A total of 215 students participated in this study. Data on students' learning styles and performance in written communication assignments were collected each semester to respond to the following two research questions driving this research: 1) Which is the dominant learning style among students in the studied cohorts in the field of business? 2) How do measurements of students' written communication skills evolve considering the beginning and end of the course, and what are the learning gains of students with different learning style preferences?

In this research, we implemented a learning environment based on blended learning to foster written communication skills

In the following sections, the theoretical foundations underpinning this research are presented (section 2), followed by method (section 3), results (section 4), a discussion on findings and their relations to pre-existing results and theory (section 5), research limitations (section 6), and lastly, conclusions and future research avenues (section 7).

2. Theoretical Framework

2.1. Blended Learning (BL)

According to **Hrastinski** (2019), different definitions and conceptualizations of BL have emerged in the past decade. The two most cited definitions in the literature are those from **Garrison and Kanuka** (2004) and **Graham** (2006). According to the former:

"BL is the thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (Garrison & Kanuka, 2004, p. 96). On the other hand, **Graham** (2006) defines BL as follows: *"Blended learning systems combine face-to-face instruction with computer-mediated instruction."* (p. 5).

The different conceptualizations of BL are based on criteria such as inclusion, quality, quantity, synchronicity (i.e., among both campus and online learners), and classroom digitalization, among others (**Hrastinski**, 2019).

In accordance with **Ismail** (2018), BL moves the emphasis from teaching to learning, thus enabling students to become more involved in the learning process and more enthused and, consequently, improves their perseverance and commitment. In addition, BL offers flexibility for students and lecturer, improved personalization, improved student outcomes, encourages the growth of autonomy and self-directed learning, creates prospects for professional learning, reduced cost proficiencies, increases communication between students and lecturer, and among students (**So; Brush**, 2008; **Spring et al.**, 2016). In accordance with **Poon** (2014), BL is likely to be developed as the leading teaching approach for the future as one of the top ten educational trends to occur in the twenty-first century, thus questions about BL should be aligned to the practice that should be included for its successful implementation. According to **Heilporn et al.** (2021) it is essential fully exploit and integrate synchronous and asynchronous modes of BL. In **Alenezi** (2023), the significant changes in higher education institutions are discussed, driven by online courses and the use of BL-type technologies that are increasingly integrated into teaching to facilitate students' learning. It is also suggested that additional research is needed to understand how higher education institutions can adapt to digital tools, such as BL environments.

According to **Graham** (2006), pedagogical activities in BL environments can be designed closer to a traditional class or a computer-mediated learning experience. Four aspects can shape the design of the learning activities in BL: 1) space, that is, the physical environment in which the activity occurs, which can be face-to-face, online (virtual), or mixed; 2) time, referring to the period during which the activities take place, which can be live, synchronous or asynchronous; 3) fidelity, which refers to learners' sensory experience, can go from high, medium, to low; and 4) the nature of human contact, which can range from highly human or face-to-face in-person interaction, to non-human or machine-only interaction.

Furthermore, **Graham** (2006) also categorizes BL interventions according to their pedagogical intent. Interventions aimed at facilitating or improving access for students, as is the case in courses in which most of the learning activities are conducted online, fall into the category of "enabling blended". BL interventions intended to generate moderate changes in traditional pedagogy by leveraging online environments but without radically changing students' learning experiences are denoted as "enhancing blends". Lastly, interventions introducing major pedagogical innovation and profound changes in teaching and learning are considered "transforming blends."

In the past decades, there has been cumulative evidence in the literature supporting the benefits of BL, such as improvements in academic performance (**Chen et al.**, 2010; **Day; Foley**, 2006; **Lewis; Harrison**, 2012; **López-Pérez et al.**, 2011; **Riffell; Sibley**, 2005; **Hasanah; Malik**, 2020; **Anthony Jnr**, 2022), decrease in attrition (**López-Pérez et al.**, 2011; **Zhao; Breslow**, 2013), enhanced students' perception and understanding of how they are instructed (**Zhao; Breslow**, 2013; **Ashraf et al.**, 2022), and an improvement in problem-solving ability (**Mason et al.**, 2013). A meta-analysis by **Bernard et al.** (2014) indicates that BL conditions exceed classroom instruction conditions by about one-third of a standard deviation ($g^* = 0.334$, $p < .001$) and that

the kind of computer support used (i.e., cognitive support vs. content/presentational support) and the presence of one or more interaction treatments (e.g., student–student/–teacher/–content interaction) serve to enhance student achievement. A more recent meta-analysis conducted by **Vo et al.** (2017) reports that BL has a similar small summary effect to the one found by Bernard *et al.* (2014) ($g^+ = 0.385, p < 0.001$). Notably, a significantly higher mean effect size was found in STEM disciplines ($g^+ = 0.496$) than in non-STEM disciplines ($g^+ = 0.210$). **Anthony et al.** (2022) conducted a theoretical and systematic review on BL and drew methodological implications for higher education. They envision that for universities and academicians, BL serves as a substitute for learning and teaching from the traditional perspective to enhance students' quality of teaching and learning in achieving better performance.

2.2. Written Communication Skills in 21st Century Business Education

A general conception of twenty-first-century skills originates from the widespread belief shared by academics, educational researchers, politicians, and employers that post-industrial societies and digital economies demand a workforce with skills and competencies different from those required in previous historic periods (**Ananiadou; Claro, 2009; Dede, 2007; Trilling; Fadel, 2009; National Research Council, 2013**). This is supported by studies such as those conducted by **Levy and Murnane (2007)** and **Trilling and Fadel (2009)** early in this century, which reported that hundreds of hiring executives from large corporations considered that graduate students lacked preparation for professional work. Such a meager appraisal was based on weaknesses in skills such as oral and written communication, critical thinking, problem-solving, teamwork and collaboration, effective use of technology, leadership and project management, and knowledge and awareness of ethical standards and issues. Labor markets worldwide have been increasingly searching for these skills in a wide range of careers (**Binkley et al., 2012; Rose, 2012**). The authors in **Rotherham and Willingham (2009)** argue that the success of the “21st century skills” movement depends on curricula in educational systems being updated effectively and accordingly. This view can be complemented by the fact that new generations’ mastery of “21st century skills” requires that educational systems at different levels can deliver teaching and learning experiences that align with these goals (**Rose, 2012; Care et al., 2012; González-Pérez; Ramírez-Montoya, 2022**).

The “Knowledge, Skills, Attitudes, Values & Ethics” (KSAVE) framework was proposed by **Care et al.** (2012), which identifies relevant “21st century skills”, and groups them into four categories, namely: 1) ‘Ways of Thinking’, which includes creativity and innovation, critical thinking, problem-solving, decision making, learning to learn and metacognition; 2) ‘Ways of Working’, which comprises communication and collaboration; 3) ‘Tools for Working’ – which includes information literacy as well as information technology literacy; and 4) ‘Living in the World,’ composed of citizenship, life and career, and personal and social responsibility, including cultural awareness and competence. The definition of communication skill in terms of KSAVE constituent components, i.e., knowledge, skills and abilities/values/ethics, is shown in the leftmost column of Table 1.

Table 1: The Communication Skills of the KSAVE Model, with Relevant Aspects and Indicators Considered in this Research.

Communication Knowledge. Skills. Attitude, Value, Ethics (KSAVE)			Aspect	Rubric
Knowledge	First language competency.	Solid knowledge of basic vocabulary, functional grammar and style, and language functions	Spelling and Writing (SW)	The student writes their text in a technical, correct and clear way, allowing the audience to fully understand its content.
		Awareness of various types of verbal interaction (conversations, interviews, debates, etc.) and the main characteristics of the different styles and registers in spoken language.	Internal Coherence (IC)	The student writes text based on coherent content, thus promoting the correct reception of meaning by the audience.
	Competency in other language	Understand the main characteristics of written language (formal, informal, scientific, journalistic, colloquial, etc.)		
Skills	Competency in first language and in additional languages	Solid knowledge of basic vocabulary, functional grammar and style, and language functions.		
		Understand the paralinguistic characteristics of communication (voice quality characteristics, facial expressions, postural and gestural systems)		
		Awareness of social conventions and cultural aspects and the variability of language in different geographical, social and communication environments.		
		Ability to communicate, in written or oral form, and understand, or make others understand, various messages in a variety of situations and for different purposes.	Topic Pertinence (TP)	The student associates specific contents to the topics worked on, written and/or oral speech, applying technical concepts with relevance.
		Communication includes the ability to listen to and understand various spoken messages in a variety of communicative situations, and to speak concisely and clearly.		
Attitudes/values/ethics	First language competency	Ability to read and understand different texts, adopting strategies appropriate to various reading purposes (reading for information, to study or for pleasure) and for various types of texts.		
		Ability to write different types of texts for various purposes and to control the writing process from writing to proofreading.		
		Ability to formulate one’s own arguments, in writing or spoken, convincingly and fully take into account other points of view, whether expressed orally or in writing.	Justification (JU)	The student elaborates text that presents itself as relevant, and that is able to deliver a meaningful judgement about an issue.
		Skills necessary to use aids (such as notes, diagrams, maps) to produce, present or understand complex texts in written or oral form (speeches, conversations, instructions, interviews, debates).		
Other language	Other language	Development of a positive attitude towards the first language, recognizing themselves as a potential source of personal and cultural enrichment.	Personal Perspective (PP)	The student formulates their own judgment on a fictitious problem occurring at the workplace, and provides a solution based on clear concepts and ideas.
		Willingness to approach the opinions and arguments of others with an open mind, and to engage in constructive and critical dialogue.	Argumentation (AR)	The student justifies the choice of sources relevant to the process of building their claims.
		Confidence when speaking in public		
		Willingness to strive for aesthetic quality in expression beyond the technical correctness of a word/phrase.		
		Developing love for literature.		
		Development of a positive attitude towards intercultural communication.		
		Sensitivity to cultural differences and resistance to stereotypes.		

According to the Association to Advance Collegiate Schools of Business (AACSB, 2020), communication skills, both verbal and written, along with the use of IT are particularly relevant to economics and business schools, because of surging demand for professionals apt for interdisciplinary work in business contexts that occur within and among global companies. For this reason, the AACSB has established these two competencies, along with others, as part of the curricular standards for schools in business and economics: 1) communication, defined as the ability to communicate effectively both verbally and in writing; and 2) use of Information Technology, which refers to the ability to ‘use current technologies in business and management contexts’ (AACSB, 2020).

As indicated before, BL involves effectively integrating face-to-face learning experiences in a classroom with asynchronous online pedagogical experiences carried out through the Internet. A fundamental aspect to consider is written communication. Written communication in the online environment can be used as an effective form of communication that supports diverse pedagogical learning practices by carefully integrating fast-paced, spontaneous verbal communication dynamics in a face-to-face learning environment (Garrison; Kanuka, 2004). Written communication in an online environment can be used as an indicator of student growth and learning; where a teacher can look at the student's progress in developing their ideas and understanding, as well as observe their weaknesses and improvement (Robles; Braathen, 2002; Maulida et al., 2022).

2.3. Learning Styles and Measurement Instruments

Learning styles are common patterns of student preferences for certain forms of instruction and student attributes associated with each pattern. Learning style preferences vary in strength and change with time and instructional context (Felder, 2020). There are different theories and questionnaires to conceptualize and identify students' preferred learning styles (Felder; Silverman, 1988; Graf et al., 2007; Honey; Mumford, 2000; Kolb; Kolb, 2005). However, the use of learning styles in traditional education has been criticized for several reasons, including the lack of a unified explanatory framework (An; Carr, 2017), lack of validity of self-reported learning style measurement and diagnosis (Kirschner; van Merriënboer, 2013), and the fact that learning styles have failed to predict academic achievement (Coffield et al., 2004; She, 2005). In spite of criticism, recent investigations into online learning provide evidence that consideration of learning styles in the design of learning environments can enhance learner motivation and reduce attrition (Hassan et al., 2021). A systematic review on the association of learning styles with different e-learning problems was conducted by Khamparia and Pandey (2020). They conclude that when adaptive and dynamic learning is blended with different learning styles and problems, learners' performance and knowledge are enhanced compared to traditional learning. This is consistent with Felder's view on the use of learning styles (Felder, 2020), as he asserts that:

Written communication in an online environment can be used as an indicator of student growth and learning; where a teacher can look at the student's progress in developing their ideas and understanding, as well as observe their weaknesses and improvement.

...the optimal teaching approach for a course is to balance the preferences of students with different learning styles rather than strongly favoring some preferences over their opposites.”, p. 11; and also adds that “When a good balance is achieved, all students are taught sometimes in their preferred manner so they are not too uncomfortable to learn, and sometimes in their less preferred manner so they are forced to stretch and grow, building important skills that they might never develop if their preferences were exclusively catered to. (p. 11)

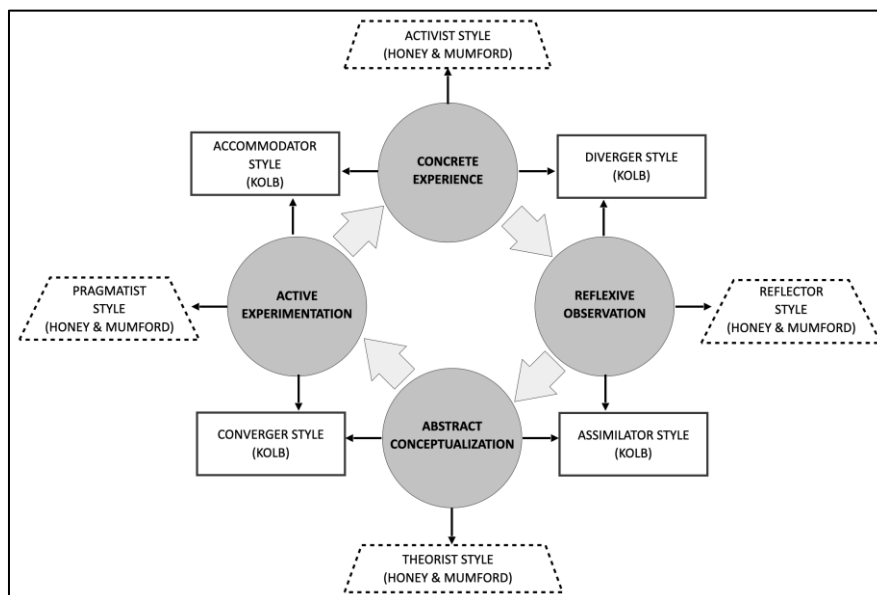


Figure 1: Learning Cycle and Styles According to Kolb (2014) and Honey and Mumford (2000).

According to **Kolb** (2014), a learning style preference describes the unique way in which a learner can transit through the phases of the 'experiential learning cycle'. The four phases of the experiential learning cycle are: 1) concrete experience, 2) reflective observation, 3) abstract conceptualization, and 4) active experimentation. The cycle and learners' path preferences along it yield four learning styles: 1) accommodating style, 2) divergent style, 3) assimilating style, and 4) convergent style. Each style relates to two phases of the experiential learning cycle (**Kolb**, 1984) as seen in Figure 1. Consequently, **Kolb** (2014) proposed the Learning Style Inventory (LSI), a self-reported questionnaire intended to ask learners how they learn. The LSI was developed deductively and in educational contexts. Because **Honey and Mumford** (2000) encountered low face validity of LSI with samples in management, entrepreneurial, and business fields, they developed the Learning Style Questionnaire (LSQ) in the context of business fields (**Muñoz-Seca; Sánchez**, 2001). The LSQ probes general behavioral tendencies, and it was developed inductively along with the LSQ, **Honey and Mumford** (2000) proposed another conceptualization of learning styles, which includes "Activist", "Reflector", "Theorist", and "Pragmatist" categories (see Figure 1).

Learning styles proposed by (**Honey; Mumford**, 2000) and (**Kolb**, 2014) are based on the four phases of the experiential learning cycle (**Kolb; Kolb**, 2005). The models differ in that (**Kolb**, 2014) links each style to two phases of the learning cycle, whereas in **Honey and Mumford** (2000) model, each learning style is associated to a single phase of the learning cycle (**Muñoz-Seca; Sánchez**, 2001). Figure 1 presents the links between phases in the experiential learning cycle and learning styles considered by both models. It can be seen, for example, that Kolb's convergent style arises from the combination between active experimentation and abstract conceptualization phases, while in Honey & Mumford's model, the "Theorist" learning style relates to the abstract conceptualization phase, and the "Pragmatic" learning style is linked to the active experimentation phase. Description of learning styles as considered in **Honey and Mumford** (2000) model is as follows:

1. **"Activist"**: Learn by doing. They like to involve themselves in new experiences, and will "try anything once." They tend to act first and consider the consequences afterwards.
2. **"Reflector"**: Learn by observing and thinking about what happened. They spend time listening and observing and tend to be cautious and thoughtful. They like to consider all the possible angles and implications before coming to a considered opinion.
3. **"Theorist"**: Like to understand the theory behind their actions. They like to analyze and synthesize and feel uncomfortable with subjective judgments. They need models, concepts, and facts in order to learn.
4. **"Pragmatist"**: They are keen about trying things out. They look for new ideas that can be applied to the problem. They like to get on with things and, tend to be impatient with open-ended discussions, are practical, and are down-to-earth people.

This research is based on **Honey and Mumford** (2000) model of learning styles and the LSQ questionnaire, as the studied cohorts belong to the field of business. The version of LSQ used in this research is in Spanish language, comprises 80 dichotomic items, and is known as CHAEA. The researchers in (**Alonso García**, 1991; **Alonso; Gallego**, 2000) point out that one of the characteristics of reflective students is their preference for written communication, through deliverables such as reports or statements. This characteristic does not apply to any of the other learning styles. For this reason, we believe that the learning environment presented in this research will be best suited for "Reflector" students.

2.3.1. Use of Kolb's and Honey & Mumford's Questionnaires

Kolb's LSI questionnaire has been utilized in university contexts, mostly with undergraduate students (**Kolb**, 2014). The variation of learning style preferences among different disciplines, such as Business, Computer Science, Chemistry and the Japanese language was studied by **Nulty and Barrett** (1996). They did so from a longitudinal perspective, considering from the first to the third year of studies, with students from three different universities in Brisbane, Australia. Business students shifted from a preference for reflective observation to one more geared toward active experimentation and concrete experience. Computer science students shifted from a preference closer to reflective observation and abstract conceptualization to a preference for active experimentation and abstract conceptualization. Chemistry students shifted from a reflexive observation preference to active experimentation. Finally, the Japanese students changed from a marked orientation towards reflective observation to one much closer to concrete experience. Based on the statistically significant differences found the authors and concluded that students adapt their learning styles according to the skills and abilities that are required in the discipline they study. Likewise, **Smith** (2010) studied the learning styles of nursing students from online programs at Southeastern University, USA. It concluded that the students of this discipline prefer the accommodating style primarily. Kolb's questionnaire was applied by **Bitran et al.** (2003) to novice students at the medical school of Pontificia Universidad Católica de Chile, Chile, in different years, and the results showed that students were primarily assimilators. According to the authors, their results are consistent with similar studies conducted at medical schools in other South American institutions.

The LSQ instrument has also been applied in university contexts (**Honey; Mumford**, 2000). One such example is the study by **Penger** (2009) with 63 management students from the Faculty of Economics at the University of Ljubljana, Slovenia. The authors developed a questionnaire that investigated the learning styles of the students, based on the theories of Honey and Mumford (**Van Waes et al.**, 2014) and a model of learning styles proposed by **Dunn and Dunn** (1979b), which conceptualizes

learning styles based on sensory experience; namely, Visual, Auditory and Kinaesthetic, known as the VAK theory of learning styles (Penger, 2009). In Penger (2009), two groups of variables were considered concerning theoretical models by Honey and Mumford (2000) and Dunn and Dunn (1979a) theoretical models. Factor analysis proved the existence of four latent factors matching (Honey; Mumford, 2000) model, and other three variables corresponding to the VAK model.

A study by Fleming *et al.* (2011) supports the idea that students adapt their learning styles. They conducted a longitudinal study in nursing to observe variations in learning styles with measurements in the first and last years of the curriculum. The dominant style of the students in the first year was “Reflector”; however, the percentage of students with this style decreased towards the last year of the degree, from 69% to 57%. Although those students adapted their learning styles, it was impossible to explain academic achievement based on them.

2.3.2. The Relationship among Learning Styles and Blended Learning Environments

According to the literature, students may perceive a given BL environment or activity differently depending on their learning style preferences. For example, (Akkoyunlu; Soylu, 2008) analysed thirty-four undergraduate students enrolled in educational technology curricula and found that their cohort split almost evenly among diverger and assimilator students, according to Kolb’s model (Kolb, 1984). The authors found no significant difference in students’ academic performance in a BL environment when comparing students with different learning style preferences. However, their results show that students classified as assimilators evaluated the environment more positively.

According to the literature, students may perceive a given BL environment or activity differently depending on their learning style preferences.

Uğur *et al.* (2011) found that students’ highest valuation towards their BL implementation came from accommodator students, i.e., students who learn through concrete hands-on experiences and active experimentation (Uğur *et al.*, 2011). Their findings are based on an examination of 31 senior students’ views on a BL method and its use in relation to their individual learning styles based on Kolb’s model (Kolb, 1984).

According to Halbert *et al.* (2011), students with active and/or intuitive learning styles tend to consume online study material. They conducting a study involving 270 first-year students of medicine. The students were able to access study material online, which consisted of class summaries and diagrams. Accessing the online material was optional and no extrinsic incentives were offered to the students to encourage this. The Index of Learning Styles (Felder; Silverman, 1988) questionnaire was administered to the cohort. The authors conclude that the online material was more appealing to active and/or intuitive students, as they feel most comfortable in control of their learning experience. The result could have also been related to the online content format.

Marantika (2022) investigated the challenge of determining appropriate strategies to enhance learning outcomes in heterogeneous classes. Through a descriptive study involving 30 German students, the author identified learning styles from a gender perspective and described related strategies. The results showed a correlation between learning styles, gender, and outcomes, concluding that both factors can influence the students’ language skills.

A study conducted by Van Waes *et al.* (2014) suggests that writers with different learning styles deal with learning material differently, often in line with the preferences that characterize their learning styles. Their study analyzed the effect of learning styles on an online writing task, including the student’s approach to the writing task and the product of the process. Reflective learners were likelier to focus on theory than active ones (i.e., accommodators or convergers). However, no effect of learning style on text quality was found.

Students tend to participate in ways that suit their individual learning styles. A study with 78 undergraduate students in a general education course was conducted by Cheng and Chau (2016). The students were offered four types of online activities after class. The authors found that sensing learners (i.e., according to the Index of Learning Styles model (Felder; Silverman, 1988) were more likely to participate in three activities, while reflective learners were more predisposed to only one kind of activity.

The design of adaptive e-learning systems should consider the combined use of different models, such as Kolb (2014) and Mumford (1995). A review on the association of learning styles with e-learning problems was published by Khamparia and Pandey (2020), showing that systems supporting online education and BL benefit from using students’ learning style profiles to provide a higher level of personalization in learning experiences. In these contexts, the most frequently used model of learning styles for adaptive learning has been that of Felder and Silverman (1988). The authors also emphasize the possibility of improving performance of online learning systems in blended learning by means of introducing more advanced and hybrid classification techniques for learner’s differences and learning style preferences.

The reviewed background lead us to expect that business students’ learning style preferences, according to Honey and Mumford (2000) model will have a meaningful effect on their written communication skills in a blended learning environment. Considering Alonso and Gallego (2000) assertion that reflective students exhibit traits such as being

report and/or statement writers and argument elaborators, we expect that in the present study “Reflector” students will experience more significant learning gains in their written communication than their companions with other learning style preferences, that is, considering measurements at the start and end of the intervention.

3. Method

The following sections provide an overview of the research design (Section 3.1), the samples included in the study (Section 3.2), details about the educational context (Section 3.3), the design and implementation of interventions (Sections 3.4 and 3.5), the measurements performed (Section 3.6), and a description of the data analyses (Section 3.7).

3.1. Research Design

This study employs a quasi-experimental, ex post facto research design to explore the relationship between individual primary learning style preferences and various attributes of written communication. The research spans seven semestral cohorts from 2016 to 2019.

The primary learning style preference of each participant serves as the independent variable. It is measured using the CHAEA instrument (Alonso & Gallego, 2000), a model based on Honey & Mumford's (2000) learning styles, categorizing subjects into Active, Reflective, Pragmatic, and Theoretical preferences.

The dependent variables consist of six continuous attributes of written communication based on the KSAVE model from (Griffin *et al.*, 2012). These include "Spelling and Writing", "Internal Coherence", "Personal Perspective", "Topic Pertinence", "Justification", and "Argumentation". Also, the sum of scores of these variables is operationalized as the written communication score.

The main objective of this study is to attest the efficacy of a blended learning strategy, which is aimed at enhancing the written communication abilities of higher education cohorts within business and informatics-focused disciplines. This strategy involves participants engaging in written communication tasks within an online discussion forum over a semester. The central focus of this study is therefore to determine whether this pedagogical approach yields significant advancements in students' written communication skills, by comparing measurements acquired at the inception and conclusion

The central focus of this study is therefore to determine whether this pedagogical approach yields significant advancements in students' written communication skills, by comparing measurements acquired at the inception and conclusion of the intervention period and considering students' predominant learning style preferences.

of the intervention period and considering students' predominant learning style preferences. Accordingly, the specific research objectives are to: (1) validate the effectiveness of the proposed blended learning strategy in improving written communication skills across the entire sample population; (2) assess whether discernible variations exist in the advancements of written communication skills among groups with diverse primary learning preferences; and (3) evaluate whether there are significant differences in the enhancements of written communication skills between groups with varying primary learning preferences. Stemming from these objectives, the research hypotheses anchoring this study are as follows:

- H₁: There are no performance gains in written communication variables for the entire sample when contrasting initial and final measurements.
- H₂: For none of the groups with different primary learning preferences are there performance gains in written communication variables when contrasting initial and final measurements.
- H₃: There are no differences in performance gains in written communication score between groups with different primary learning preferences when contrasting initial and final measurements.

To validate these hypotheses, full sample (H₁), intra-group (H₂), and between-group contrasts (H₃) are conducted on the dependent variables. Either mean or median (non-parametric) comparison tests are utilized, depending on whether the data fulfill the normality assumption. Cases are separated by groups according to the conditions of the independent variable, focusing the contrasts between groups by primary learning style preferences. The analysis does not extend to inter-semester or inter-annual contrasts but is rather concentrated on contrasts between groups by primary learning style preferences. All analysis is conducted ex post facto, following the aggregation of data from all semestral cohorts.

3.2. Sample

The present study was conducted at the Faculty of Economics and Business at University of Chile. A total of 215 students participated in this study, of which 187 were enrolled in the degree in Information Engineering and Management Control, and another 28 in the Accountant Auditor program in the same institution. Fifty-six percent of the sample was composed of female students and 44% of male. The average age of the participants was 22 years. The study was conducted over seven semesters from 2016 to 2019, with samples of semester students shown in Table 2.

Table 2: Participants Per Semester-year.

Semester	II -2016	I-2017	II-2017	I-2018	II-2018	I-2019	II-2019	Total
Cohort size	17	40	33	42	18	26	39	215
%	7,9%	18,6%	15,3%	19,5%	8,4%	12,1%	18,1%	100%

Over 80% of the students in the samples participating in the current study gained admission to their respective programs through the university selection test (PSU) of the Chilean higher education system. Specifically, the language and communication test of this admission process is a standardized assessment consisting of 80 items, with a scoring scale ranging from 150 to 850, focusing on evaluating various skills in this area, including written communication ability. This assessment takes into account skills in lexicon selection and precise selection of expressions and terminology, along with the ability to organize ideas and present information (DEMRE, 2017).

Table 3: Descriptive Statistics of Language and Communications Test Scores for Corresponding Freshman Years.

Freshman Year	M*	SD†	MIN	MAX
2013	661.5	60.7	501	780
2014	643.8	53.0	554	807
2015	639.3	62.7	505	770
2016	642.2	58.4	521	785

*Weighted average based on the distributions of the two undergraduate programs in the study.
 †Combined standard deviation based on the distributions of the two programs.

Table 3 illustrates that the admission cohorts for the programs examined in this study have remained stable, displaying minimal variations from the years 2013 to 2016. In the ensuing years up to the present, the distribution of admission test scores for freshman cohorts within the institution and programs of study have sustained this stability, yielding results comparable to those depicted in Table 3.

3.3. Educational Context

The intervention conducted in this study was part of the Business with Information Technologies course (hereinafter, “Business with IT”), which is compulsory in both of the abovementioned programs. The main learning goal of the course is that students identify relevant IT systems and applications that can be leveraged according to needs of management and business. Students are expected to detect needs of companies at different levels of their organization, and propose traditional and/or innovative IT solutions to improve processes that align with organizational strategies. The course requires a dedication of eight weekly hours, including 4.5 hours of classes broken down into three hours of lecture, and an hour and a half of practical workshop. During the years 2016-19 the hours of classes were face-to-face, and the teacher, one of the authors of the present study, was the same every semester.

The “Business with IT” course was based on the following four learning outcomes that remained immutable during the period of the study: 1) Identify problems and/or business opportunities associated with the components of the value chain of organizations, which may be solved and/or supported through the use of IT, considering aspects associated with the problem/opportunity and the points of view of the clients and the organization. 2) Propose IT-based solutions to support various primary and secondary activities and information flows required by the implementation of an organization's strategy. 3) Analyse the feasibility and applicability of the proposed solution according to the organizational culture and society. 4) Analyse and justify if the proposed IT solution introduces competitive advantages in the organization.

3.4. Instructional Design

The instructional design of the “Business with IT” course was inspired by a constructivist approach to learning, and by the use of BL to organize and synergize activities inside and outside the classroom (Graham, 2006; Morphey, 2002; Anthony *et al.*, 2022). For the purposes of the present study, a relevant learning objective of the course was that the students developed the written communication competence, presenting an opinion and personal perspective on matters relevant to their future careers as business professionals.

The means to achieve the above were based on students using an online forum to develop publications and comments on the use of IT in business. Participation in the forum is mandatory for all students, as it is part of the teaching methodology and the course evaluation system. Prior to each weekly lecture, the students are tasked with posting news about the use of IT in business on the forum, along with a personal comment regarding the news posted, with a minimum length of 300 words. In addition, they have to post short comments on the news of their classmates with a minimum length of 100 words. All students’ publications, including news, personal comments, and short comments are posted anonymously on the discussion forum. In the face-to-face class, the teacher reviews the news and comments published by the students, gives feedback with regard to content and form, and generates discussion with the students.

3.5. Discussion Forum Implementation

The discussion forum was implemented with the content management system WordPress (Cabot, 2018). The

implementation included functions commonly found in discussion forums, such as post listings, an entry editor, and the possibility to comment on entries. The forum home page displayed the most recent posts, and in a side section, a cloud of categories, along with recent posts and comments. When posting a new article, the students could categorize their publications according to predefined categories (see Figures 2 and 3). In addition, the forum had a search function, to find posts referring to a particular category.

3.6. Procedure

In each of the seven semesters in which this study was conducted, each student was asked to publish at least nine news items on the use of IT in national and international contexts, along with the corresponding personal comment per each news item. The news could be extracted by the students from various digital sources, such as newspapers, specialized IT magazines, other IT forums, etc. The comment had to meet one of the four learning outcomes of the course. In addition, students were required to post nine “short comments” of at least 100 words each on news stories posted by their peers.

Each student was asked to publish at least nine news items on the use of IT in national and international contexts, along with the corresponding personal comment per each news item.



Figure 2: A List of Search Results is Shown for News Publications with the 'Augmented Reality' theme. Word Clouds Show the Most Frequent Categories in Publications.



Figure 3: The Screenshot on the Left Shows a News Item Entitled “Augmented Reality Based on Education” Followed of a “Personal Comment” Published by a Student Anonymously. The Screenshot on the Right Shows Comments Posted by Other Students to this News, along with a form to Add New Comments.

Considering course duration of 18 weeks in every semester, evaluation of students’ publications and comments in the forum was carried out chronologically, in three periods: Period I (henceforth ‘initial measurement’), which ran from the beginning of the semester to the sixth week; Period II, from the sixth to the eleventh week; and Period III (henceforth ‘final measurement’), from the eleventh week to the sixteenth week. To complete a minimum of nine news postings and personal comments in the semester, the students were asked to generate three of them in each period, along with three brief comments on their classmates’ news postings. It was required that students published news that related to the content seen in class at the time of posting.

3.7. Measurements

Two kinds of measurement were conducted in this research; namely, an assessment of students’ personal comments in the forum, and administration of a learning styles questionnaire at the end of the semester.

The rubric utilized to assess students' personal comments is shown in Table 4. At the start of each semester, the rubric was shown to the students and fully explained by the teacher, with examples. Rubric indicators were defined based on the description of the communication abilities comprised in the KSAVE model from **Care et al.** (2012), see Table 1, in relation to knowledge, skills and attitudes/values/ethics. The evaluation rubric is composed of six dimensions: 1) Spelling and Writing (SW), 2) Internal Coherence (IC), 3) Personal Perspective (PP), 4) Topic Pertinence (TP), 5) Justification (JU), and 6) Argumentation (AR). Aspects of the KSAVE model irrelevant to the activity were omitted in the rubric, such as communication in a second language or the inclusion of different types of text. For each of the dimensions of the rubric, a discrete score was given to the student's personal comment according to the observed level of achievement. The rubric defines a scale with a maximum score of 38 points.

Two kinds of measurement were conducted in this research; namely, an assessment of students’ personal comments in the forum, and administration of a learning styles questionnaire at the end of the semester.

To identify the learning styles of the students, the CHAEA (Alonso; Gallego, 2000) learning styles questionnaire was administered to each cohort at the end of every semester. The overall response rate for this instrument, considering all the semester cohorts, was 87%.

Table 4: Rubric Utilized for Evaluating Students’ Personal Comments in Forum News Postings.

		Rubric			
Aspect	Indicator	Level 1	Level 2	Level 3	Level 4
Spelling and Writing (SW)	The student writes their text in a technical, correct and clear way, allowing the audience to fully understand its content.	The text presents spelling errors, such as grammatical or diacritical accents, homophone words, capital letters, literal spelling, typing problems errors and/or does not use correctly a vocabulary according to the topic. Its paragraphs contain sentences of inadequate length, and it presents punctuation problems. The length of each paragraph is also inappropriate; paragraphs fail to aim at the conclusion or develop a single central idea.	The text presents vocabulary according to the topic it addresses, but presents minimal spelling mistakes, such as sporadic errors in diacritical accents and homophone words. Its paragraphs contain sentences of adequate length, with correct punctuation. However, the length of each paragraph is inadequate; paragraphs fail to aim at the conclusion or develop a single central idea.	The text presents good spelling and uses vocabulary according to the topic it addresses. Its paragraphs contain sentences of adequate length, with correct punctuation. The length of each paragraph is appropriate. However, the text does not strategically aim at a conclusion or develop a single central idea.	The text presents good spelling and uses vocabulary according to the topic it addresses. Its paragraphs contain sentences of adequate length (i.e., not more than 25 words), with correct punctuation. The length of each paragraph is appropriate (i.e., between 5 and 15 lines). Each paragraph strategically aims at the conclusion and develops a single central idea.
	Score:	0	2	4	6
Internal Coherence (IC)	The student builds a coherent text in its constituent and content elements, thus promoting the correct reception of their proposals by their audience.	The text is organized based on one or two introductory paragraphs, a development and a brief conclusion. However, the central idea that structures its contents is unclear. The results, or the content that is presented in the conclusion, do not effectively demonstrate whether the idea is valid or not. The order of the text does not follow a logical line, and fails to direct reflection towards the conclusion.	The text is organized based on one or two introductory paragraphs, a development and a brief conclusion. Content is structured based on an identifiable central idea. However, the results, or the content that is presented in the conclusion does not effectively demonstrate whether the idea presented is valid or not. The order of the text does not follow a logical line, and fails to direct reflection towards the conclusion.	The text is organized based on one or two introductory paragraphs, a development and a brief conclusion. Content is structured based on an identifiable central idea. The results, or the content that are presented in the conclusion, do not effectively demonstrate whether the idea is valid. The order of work does not follow a logical line, and fails to direct reflection towards the conclusion.	The text is organized based on one or two introductory paragraphs, a development and a brief conclusion. Content is structured based on a central idea. The results presented in the conclusion show whether the central idea raised is valid or not. The order of work follows a logical line and directs the reflection towards the conclusion.
	Score:	2	4	6	8
Personal Perspective (PP)	The student formulates a judgment on a fictitious case of daily work using concepts and ideas as solutions.	The text presents a point of view based on reflective reading of a news source, but fails to achieve the necessary solidity. The text must present further reflection on contents, finding clearer relationships between what is proposed by the source and the author’s own perspective.	The text presents a point of view based on reflective reading of a news source. However, the text reveals weakness in its author’s ability to demonstrate understanding of course concepts. The text does not permit visualizing clear relationships between the source and the author’s own perspective.	The text presents a point of view based on reflective reading of a news source. However, the author’s understanding of the course concepts is weak and the relationships they visualize among the concepts and the news source are unclear.	The text presents a point of view based on reflective reading of a news source. The author understands the central concepts of the course and visualizes relationships among them and their ideas.
	Score:	2	4	6	8
Topic Pertinence (TP)	The student associates specific contents to the topics worked on, written and / or oral speeches, applying technical concepts with relevance.	The text develops a topic that is pertinent to professional practice. However, it does not present consistent relationships that account for the author’s correct understanding of course contents. The text lacks examples related to the course contents and/or professional practice.	The text develops a topic that is pertinent to the course. However, it does not present consistent relationships that account for the author’s correct understanding of course contents. The text lacks examples related to course contents .	The text develops a topic that is pertinent to the course. It succeeds at presenting consistent relationships that account for the author’s correct understanding of the concepts. However, the text still lacks examples related to the course contents.	The text develops a relevant topic with the contents of the course, presenting consistent relationships that account for the correct understanding of the concepts. Use examples according to course contents.
	Score:	1	2	3	4
Justification (JU)	The student prepares a text that presents himself as relevant, capable of delivering a valuable judgment on a contingent problem.	The text presents itself as relevant, however, it fails to invite reading. He does not mention enough information to assess the contribution of the work; it does not manage to explain the use or application of technology in a specific aspect, nor does it point out how said application facilitates development of daily tasks.	The text presents itself as relevant and encourages reading. However, it does not provide sufficient background information to assess the contribution of the work. It does not manage to explain the use or application of technology in a specific aspect, nor does it point out how such application facilitates development of daily tasks.	The text presents itself as relevant and encourages reading. It provides the necessary background to assess the contribution of the work. It explains the use or application of technology in a specific aspect. However, it does not indicate how such application facilitates development of daily tasks.	The text presents itself as relevant and encourages reading. It provides the necessary background to assess the contribution of the work. It explains the use or application of technology in a specific aspect. It indicates how such application facilitates development of daily tasks.
	Score:	1	2	3	4
Argumentation (AR)	The student justifies the choice of sources relevant to the process of construction of their presentations.	A clear relationship is established between what is stated in the news and some content of the course. However, the text does not identify nor explain how the technological proposal can be transferred to other areas of use. Examples are used in argumentation, however, the text does not highlight contributions to any component of the value chain of an organization. The text does not associate the contents of the news with subjects seen in previous or current lectures.	There is a clear relationship between what is stated in the news and the course content, identifying and explaining how the technological proposal can be transferred to other areas of use. The text provides examples, however, it does not highlight contributions to any component of the value chain of an organization. It fails to associate the contents of the news with subjects seen in previous or current lectures.	The text explains how the technological proposal can be transferred to other areas of use. It uses examples for its argumentation, highlighting contribution to any component of the value chain of an organization. However, the text does not associate the contents of the news with subjects seen in lectures, including past or current lectures.	A clear relationship is established between what is stated in the news and the course content. The text identifies and explains how the technological proposal can be transferred to other areas of use. It uses examples for its argumentation, highlighting contribution to any component of the value chain of an organization. There is association among the content of the news with subjects seen in past or current lectures.
	Score:	2	4	6	8

3.8. Data Analyses

Data analyses were conducted considering the research questions of this study: 1) which is the dominant learning style among students in the studied cohorts in the field of business? and 2) how do measurements of students’ written communication skills evolve considering the beginning and end of the course, and what are the outcomes for students

with different learning style preferences? Analyses were conducted in R (R Development Core Team, 2017).

With regard to the first research question, the results of the CHAEA instrument were tabulated (Alonso; Gallego, 2000), considering the data from the seven semesters in which the study was carried out. Only complete responses to the instrument were considered.

To analyse the consistency of the evaluation process of students' comments in the online forum, correlations among dependent variables (i.e., evaluation rubric criteria defined in

Table 4) and Principal Components Analyses – PCA (Schumacker, 2015) were computed for data collected in periods I and III, henceforth also referred to as initial and final measurements, respectively. Also, Cronbach's alpha was computed for data in both measurements.

To inquire about the second research question, students' average scores in forum tasks according to the six dependent variables defined in the evaluation rubric (i.e., SW, IC, PP, TP, JU and AR as shown in Table 4) were computed for periods I and III, henceforth also referred to as initial and final measurements, respectively. Partial scores per dependent variable were linearly scaled to a 0-1 range, thus the total score was transformed to a 0-6 scale.

To validate hypothesis H₁, the Kolmogorov-Smirnov statistic was employed to determine whether the assumption of normality holds for the pre and post measurements data of the complete sample, and Levene's test for equality of variances between said pre and post measurements was also conducted. Based on these results, it was determined that all variables are highly non-normal, along with the equality of variances for the pre and post measurements of each variable. It was deemed that the non-parametric Wilcoxon test for related samples of equal variances is the suitable method to contrast H₁.

To contrast hypotheses H₂ and H₃, four groups were established based on the students' primary learning style preference (refer to Table 5). Out of the 188 students with complete initial and final measurements of the dependent variables, 15 did not exhibit a distinct preference for a specific primary learning style. Consequently, only 173 students were allocated to the contrast groups. These groups were designated according to the subjects' primary learning preference as the "Activist", "Reflector", "Theorist", and "Pragmatist" groups.

In relation to H₂, all groups yielded pre-post measurements with homogeneous variances according to Levene's test as per each of the six dependent variables in the evaluation rubric (see Table 4). Data normality assumptions were analyzed as follows: The Kolmogorov-Smirnov statistic was used to test normality of the complete sample as well as the "Theorist", "Reflector" and "Activist" contrast groups, as these had 30 or more cases. For the group of "Pragmatist" students, the Shapiro-Wilk statistic was used, since this group had less than 20 cases.

Most variables in pre-post measurements were found non-normal, thus, in these cases the non-parametric Wilcoxon rank sum test was computed to compare pre-post measurements of dependent variables per group (see Table 5). Otherwise, Student's t-test for paired samples with equal variances was computed for normally distributed variables. In addition, Cohen's d was calculated to obtain the effect size per each dependent variable and group.

Table 5: Univariate Mean Comparison Tests Utilized for Initial and Final Measurements of Each Dependent Variable and Contrast Group, in Relation to Hypothesis H₂.

Dependent Variable	Contrast Groups*				
	All (N=173)	"Theorist" (N _T =38)	"Reflector" (N _R =85)	"Pragmatist" (N _P =15)	"Activist" (N _A =35)
SW	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon
IC	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon	Student's t-test
PP	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon	Student's t-test
TP	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon
JU	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon
AR	Wilcoxon	Wilcoxon	Wilcoxon	Wilcoxon	Student's t-test
SCORE	Wilcoxon	Wilcoxon	Student's t-test	Wilcoxon	Student's t-test

SW = Spelling and Writing, IC = Internal Coherence, PP = Personal Perspective, TP = Topic Pertinence, JU = Justification, AR = Argumentation, SCORE = Sum of rubric partial scores
 *As per subjects' primary learning style preference.

To validate H₃, given the non-normality of the pre and post written communication scores in all the contrast groups, the non-parametric Kruskal-Wallis test was preferred.

4. Results

4.1. Dominant Learning Style Preference

Of the 215 students who participated in this study, 55.3% were reflectors, 23.3% theorists, 14.4% pragmatists, and 23.3% preferred an active learning style (see Figure 4). It should be noted that students may prefer more than one style, which is why the percentages do not add up to 100%.

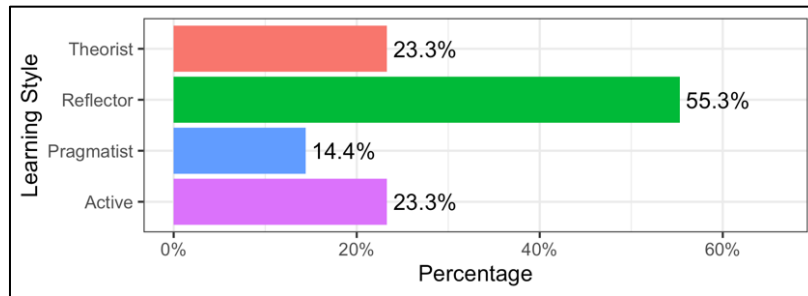


Figure 4: Learning Style Preferences in the Sample.

Table 6 considers the data from subjects with a clearly differentiated primary learning style preference, that is, without ties in primary preferences. This table displays a breakdown of subgroups according to the primary preference by year. In addition, the results of chi-square trend tests for proportions are presented to check for the existence of any systematic interannual evolution trend of the primary preferences. Based on these tests, all of them with non-significant chi-square statistic, it can be determined that within the years in which this study was conducted, the representativeness of the various primary preferences of learning styles is not affected by any systematic interannual upward or downward trend.

Table 6: Primary Learning Style Preference Trends in the Cohorts Under Study.

Learning Style Preference	Year	Group Size	Cohort Size	Proportion	$\chi^2(1)$	<i>p</i>
Theorist	2016	5	19	0.263	0.413	<i>n.s</i>
	2017	21	69	0.304		
	2018	4	38	0.105		
	2019	10	53	0.189		
Reflector	2016	10	19	0.526	2.363	<i>n.s</i>
	2017	24	69	0.348		
	2018	21	38	0.553		
	2019	29	53	0.547		
Pragmatist	2016	1	19	0.053	2.531	<i>n.s</i>
	2017	8	69	0.116		
	2018	3	38	0.079		
	2019	1	53	0.019		
Active	2016	3	19	0.158	2.107	<i>n.s</i>
	2017	16	69	0.232		
	2018	10	38	0.263		
	2019	13	53	0.245		

4.2. Rubric Analysis

Correlograms based on Spearman bivariate correlation for the first and second measurements comprising the six written communication variables in the evaluation rubric (see

Table 4) are shown in Figure 5. All correlations were found significant at the 0.05 level. Justification (JU) and Argumentation (AR) variables have the highest correlation in both measurements (i.e., 0.83 and 0.85, respectively), and AR, JU, Topic Pertinence (TP) and Personal Perspective (PP) variables have correlations above 0.6 with each other.

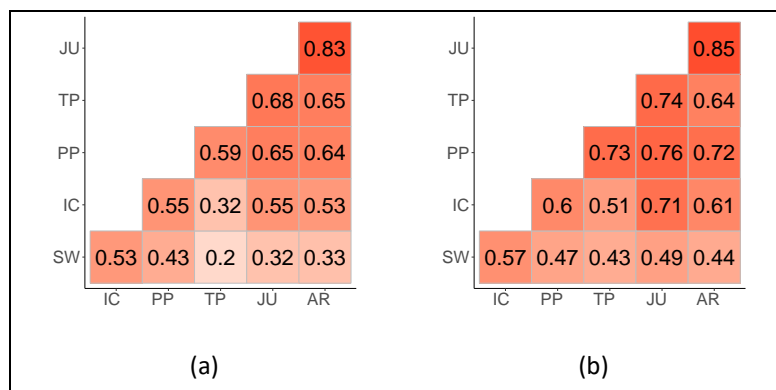


Figure 5: Correlograms for Dependent Variables in Initial (a) and Final (b) measurements. All Bivariate Spearman Correlation Coefficients are Significant at the 0.05 Level.

Separate Principal Components Analysis (PCA) procedures with varimax rotation were conducted for each measurement utilizing the psych package (Revelle, 2016; Schumacker, 2015). PCA procedures included the six

dependent variables considered. Two-component models were generated for each measurement, see Figure 6. Conditions for the PCA procedure were satisfied by the data collected in both measurements, including the KMO test ($KMO_i=0.82$; $KMO_f=0.86$), Bartlett's test for equal variances ($\chi^2=634.99$, $df=15$, $p<0.0001$; $\chi^2=765.93$, $df=15$, $p<0.0001$), and positive determinant of the correlation matrix ($\Delta_i=0.0318$; $\Delta_f=0.0136$). Cronbach's alpha reliability coefficient indicates high internal consistency of responses in both measurements ($\alpha_i=0.86$; $\alpha_f=0.91$).

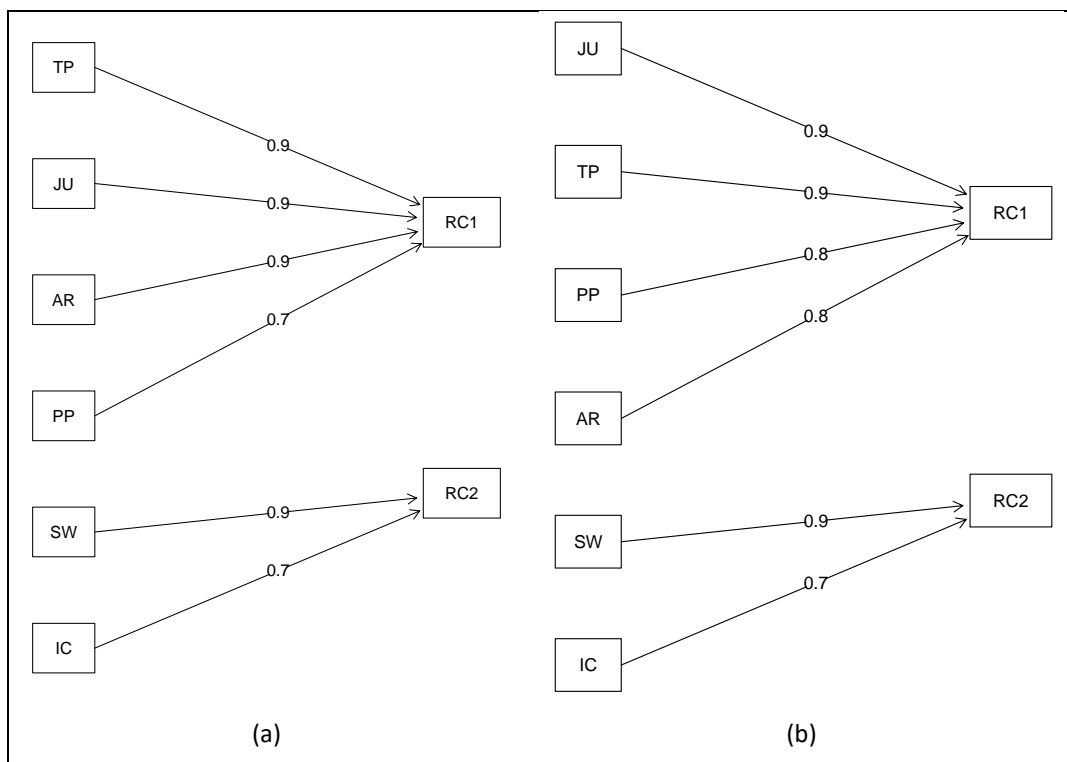


Figure 6: Plots of Principal Component Models for Initial (a) and Final (b) Measurements.

The models obtained are similar with component loadings 0.7 and above for each of the variables. It is observed that one of the components (i.e., RC2 in Figure 6) groups criteria related with form and structure of students' personal comments (i.e., SW and IC), while the other component (i.e., RC1) groups variables that are related with content (i.e., PP, TP, AR, and JU). These results show that with the evaluation rubric it was possible to generate consistent results across measurements. However, high correlation among some of the rubric criteria provides indication that the rubric could be simplified by reducing its criteria, especially with regard to evaluation of content.

4.3. Results of Forum Activity

4.3.1. Aggregate Results

Only 188 out of 215 total students generated complete data for both initial and final measurements, considering listwise deletion. The mean score in the initial measurement was 3.27/6.00 ($SD=1.29$). In the final measurement the mean score was 3.65/6.00 ($SD=1.45$). This difference was found highly significant ($p<0.01$). Score distributions for both measurements are shown in Figure 7.

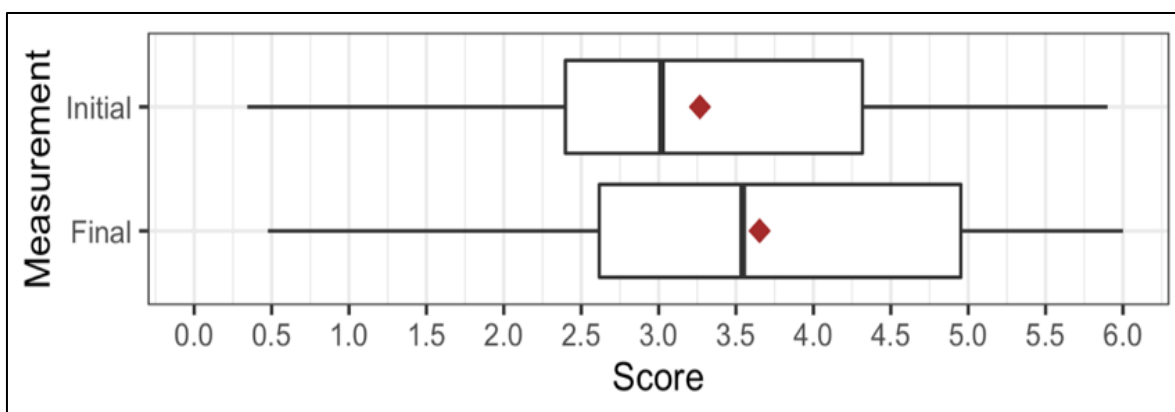


Figure 7: Distributions of Scores in Initial and Final Measurements.

Figure 8 shows the scores obtained by the students in each measurement. Significant differences were observed in all variables, with the sole exception of Justification (JU).

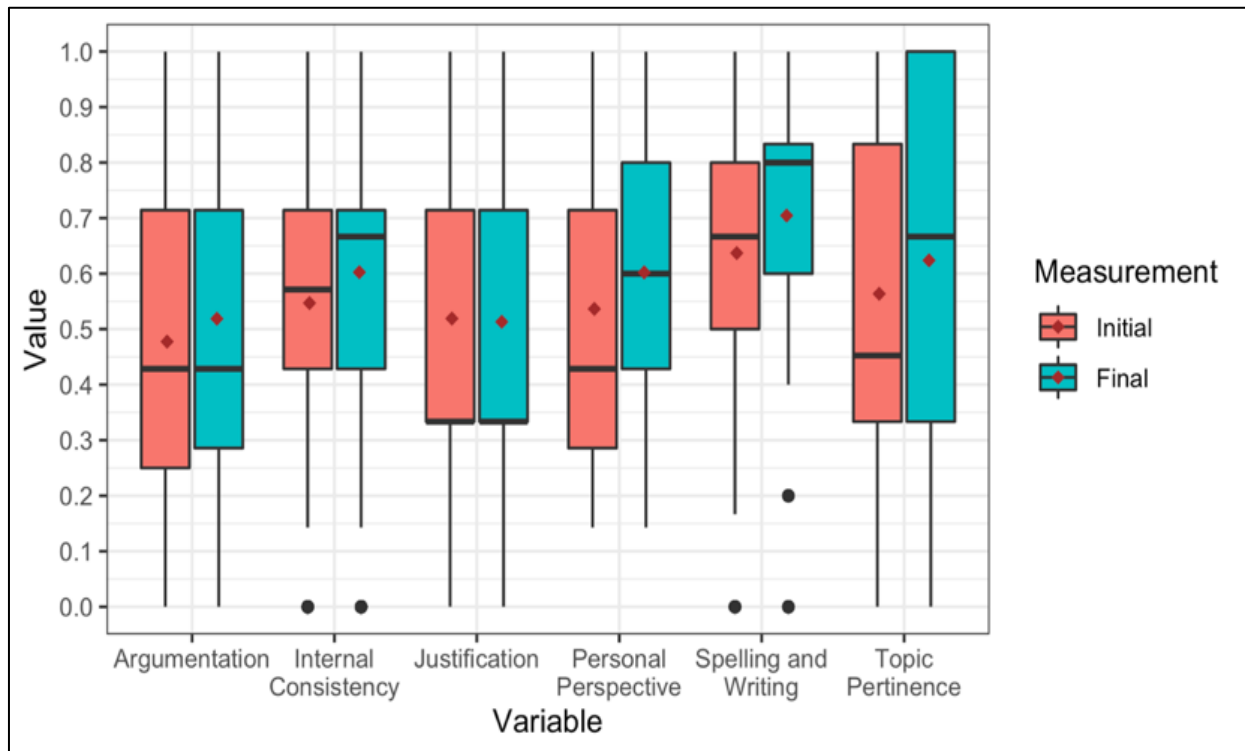


Figure 8: Distribution of Forum Comment Scores Per Rubric Criteria.

The aggregated results allow for the rejection of H_1 , as a significant improvement in written communication score has been observed, along with significant enhancements in five out of six attributes of written communication competency assessment (see Table 7). The effect sizes of the differences range from small to medium.

Table 7: Descriptive Statistics, Means Comparison Test p-value, and Cohen’s d Per Each Written Communication Variable and Total Score.

Variable	Measurement				Means comparison p-value	Cohen’s d
	Initial		Final			
	M	SD	M	SD		
SW	0.631	0.252	0.708	0.253	0.000	0.330
IC	0.545	0.266	0.614	0.275	0.000	0.287
PP	0.544	0.260	0.617	0.268	0.000	0.296
TP	0.563	0.306	0.638	0.296	0.001	0.249
JU	0.534	0.328	0.544	0.351	0.420	0.056
AR	0.484	0.308	0.539	0.312	0.009	0.174
Score	3.27	1.29	3.65	1.45	0.000	0.280

4.3.2. Results Per Learning Style

With regard to the written communication performance as considered in the evaluation rubric, different learning gains were observed per dependent variable and group (see Figure 9 and Table 8). The “Reflector” group improved significantly in three of the written communication criteria (i.e., IC, PP and TP variables), and a medium effect size ($d=0.404$) was observed in the Internal Coherence (IC) criterion. The “Theorist” group improved the Spelling and Writing skill (SW) significantly, with medium effect size ($d=0.512$). The “Activist” group improved significantly in three variables (i.e., PP, JU and AR) with small effect sizes. Lastly, despite that in the “Pragmatist” group improvements in SW and IC variables were found with medium effect size, these were not significant. A small and non-significant negative effect size was observed in the JU variable in this group. Other negative effect sizes found in “Theorist” and “Pragmatist” groups were negligible and non-significant.

The results obtained provide evidence that allows for the rejection of H_2 for the groups of students with primary learning preferences of “Activist”, “Reflector”, and “Theorist”, as significant differences in the written communication score are observed considering initial and final measurements. For each of these groups, specific significant differences related to certain attributes of written communication have also been found, as described above.

Table 8: Descriptive Statistics, Means Comparison Test p-value, and Cohen’s d Per Each Written Communication Variable and Group.

Group	Variable	Measurement				Means comparison p-value	Cohen’s d
		Initial		Final			
		M	SD	M	SD		
“Activist”	SW	0.679	0.180	0.722	0.240	0.313	0.438
	IC	0.598	0.273	0.607	0.286	0.600	0.002
	PP	0.571	0.263	0.654	0.265	0.041	0.283
	TP	0.574	0.328	0.577	0.274	0.824	0.091
	JU	0.482	0.367	0.582	0.337	0.047	0.251
	AR	0.467	0.325	0.584	0.328	0.010	0.367
	Score	3.372	1.400	3.725	1.489	0.033	0.265
“Reflector”	SW	0.669	0.235	0.727	0.243	0.083	0.280
	IC	0.541	0.271	0.636	0.273	0.001	0.404
	PP	0.554	0.271	0.629	0.277	0.011	0.356
	TP	0.561	0.306	0.652	0.305	0.012	0.395
	JU	0.536	0.324	0.552	0.359	0.769	0.077
	AR	0.503	0.315	0.529	0.307	0.311	0.135
	Score	3.364	1.350	3.724	1.466	0.008	0.331
“Theorist”	SW	0.569	0.247	0.714	0.256	0.003	0.512
	IC	0.495	0.257	0.561	0.294	0.232	0.259
	PP	0.482	0.251	0.559	0.272	0.080	0.293
	TP	0.520	0.308	0.613	0.315	0.096	0.203
	JU	0.467	0.310	0.411	0.341	0.082	-0.088
	AR	0.417	0.292	0.451	0.321	0.443	0.132
	Score	2.951	1.194	3.309	1.427	0.023	0.263
“Pragmatist”	SW	0.520	0.275	0.580	0.284	0.558	0.586
	IC	0.486	0.222	0.498	0.253	0.953	0.491
	PP	0.438	0.227	0.438	0.177	0.664	0.188
	TP	0.546	0.258	0.511	0.278	0.527	0.219
	JU	0.463	0.293	0.343	0.313	0.412	-0.244
	AR	0.438	0.312	0.438	0.322	1.000	-0.018
	Score	2.891	1.206	2.809	1.336	0.816	0.240

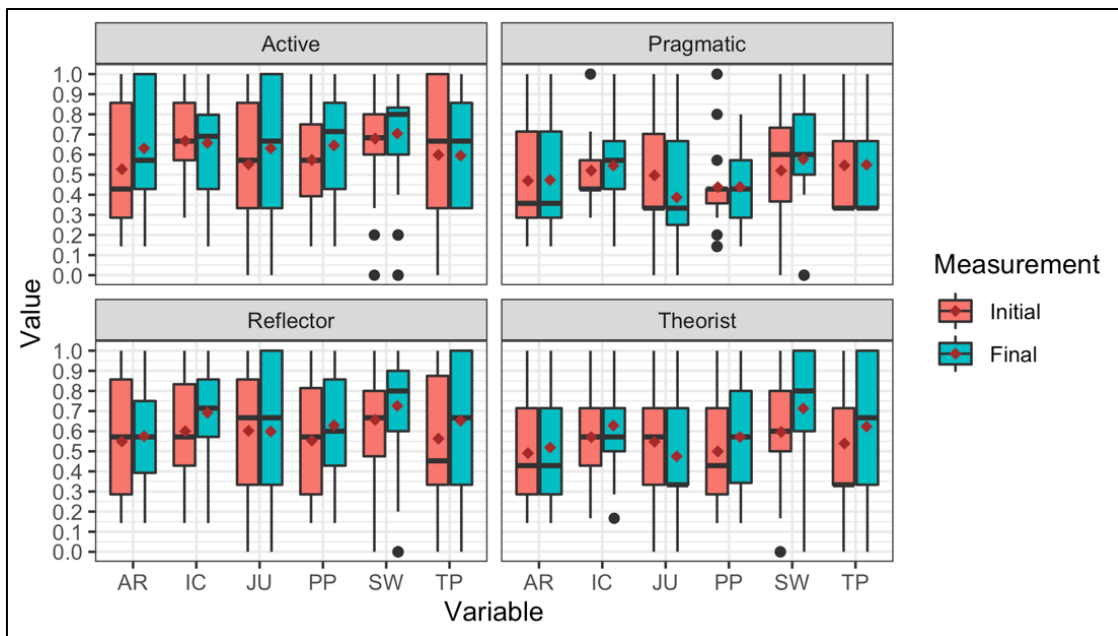


Figure 9: Distributions of Scores Per Each Learning Style and Written Communication Variable.

In all groups but the “Pragmatist”, an improvement in total scores between the initial and final measurements was attained (see Figure 10 and Table 8). The “Reflector” group had the highest increase in total score, with an effect size of 0.331, followed by “Activist”, “Theorist” and “Pragmatist” groups (see Table 8). To validate H₃ considering students’ written communication score, Kruskal-Wallis tests were conducted in initial and final measurements to attest whether significant score differences could be established among the different contrast groups. As for the initial measurement, no significant differences were found in average scores among different

Under the conditions of the present study some of the groups according to primary learning style preference did benefit more than others.

groups. In the final measurement, differences were found to be marginally significant ($H(3) = 7.59, p=0.055$). Thus, the results do not provide sufficient evidence to reject hypothesis H_3 , but do provide indication that under the conditions of the present study some of the groups according to primary learning style preference did benefit more than others.

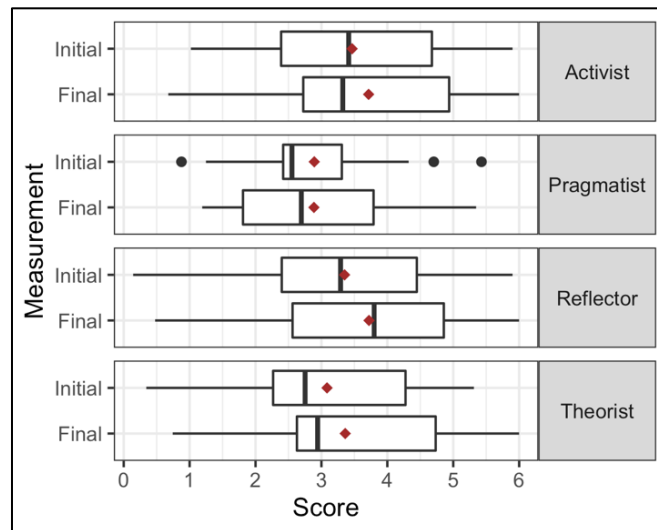


Figure 10: Total Score Distributions Per Group and Measurement. Means are Displayed as Diamond Shapes.

5. Discussion

(Nulty; Barrett, 1996) found that students in different curricula had similar learning style preferences in their first year of studies, and these were inclined towards reflective observation in Kolb's model (1984). In the third year of studies, business students had modified their learning style preference towards active experimentation. Strikingly, findings in this study are inconsistent with Nulty and Barrett (1996), that is, considering learning style preferences adopted by senior students. Cohorts that participated in this study enrolled students in the last year of their undergraduate studies in business-related majors, and slightly more than half of the students were found to be "Reflectors"s, while about two-fifths split evenly among "Activist" and "Theorist" learning style preferences. Students who preferred a "Pragmatist" learning style were no more than fifteen percent of the total cohort. Arguably, cultural differences in student populations and epistemic or pedagogical differences in courses and curricula could explain these differences. Still, more research is required to determine whether first-year students' learning style preferences in the studied population are similar to those reported by Nulty and Barrett (1996).

Considering results reported by Bitran *et al.* (2003) it is likely that learning style preferences found in the cohorts studied here are similar to those of students in other national and international institutions with culturally akin student populations, and in similar higher education programs. Thus, it is possible that "Reflector" students consistently hold a majority proportion and that "Pragmatists" are a minority group across different business programs in Latin America. From a pedagogical standpoint, it is possible that this study's findings reflect students' learning experiences being based mainly on traditional classroom instruction, with sporadic active learning episodes based on methodologies that prompt for reflective thinking, such as case-based learning. Based on the hypothesis that students adapt their learning style to the nature of pedagogy and discourse that they encounter in their higher education studies (Fleming *et al.*, 2011), greater adoption of active learning strategies in business schools, demanding that students engage in highly social and interactive learning environments prompting for active experimentation and substantial experience, such as engaging with modelling and simulation tools, could lead students to adopt learning behaviors and preferences to adapt to such requirements, and thus adopt learning preferences different to the ones observed here.

With regard to the first specific objective of this research, the learning design and environment proposed resulted in improved written communication skills considering the complete sample of students under study, with effect sizes ranging from 0.17 to 0.33 in the six written communication variables considered. However, different levels of improvement were observed in written communication variables depending on each group, which relates to the second research objective of this research. Improvements in spelling and writing skills were found in every group. However, these only were statistically significant in the "Theorist" group, with medium effect size of 0.512. The internal consistency criterion, which relates to the organization of the text and how content is structured around a central idea, had its greatest statistically significant improvement with "Reflector" students, with medium effect size of 0.404. The other content-related criteria which were found to be highly correlated, including expression of personal perspective, topic relevance, argumentation, and justification, experienced less of an improvement among different groups. "Reflector" students experienced slight to medium statistically significant learning gains in personal perspective and topic pertinence variables, while justification and argumentation criteria had small gains. "Activist" students attained

the most remarkable statistically significant improvement in justification and argumentation skills. Contrastingly, the “Pragmatist” group worsened their performance in these variables, comparing initial and final measurements with negative effect sizes. The “Theorist” group experienced small, slightly non-significant improvements in personal perspective and topic pertinence, and did not improve in the justification criterion, with a close-to-null effect size.

Regarding the third specific objective of this research, that is, determine between-group differences in written communication performance gains, the results obtained provide indication that under the conditions in which the present study was conducted, the “Reflector” group attained the biggest improvement in total score, thus comprises the students who most benefited from the written communication activities in the learning environment.

As expected based on theoretical references (Alonso; Gallego, 2000; Mumford, 1995), “Reflector” students are those who present the greatest performance improvements in activities designed to develop written communication skills. “Reflector” students’ behavioral features include observing and analyzing a situation from different perspectives and collecting information before elaborating conclusions. On the other hand, Alonso and Gallego (2000) state that “Reflector” students also have a distinct preference for report writing, which, not being the same as writing a personal comment in an online forum, shares some of the characteristics of this activity, such as organizing ideas, and analyzing the situation before presenting conclusions. Both activities require applying written communication competence.

Although the “Reflector” learning style appears dominant in the cohorts observed, course design following a BL scheme allows the inclusion of different kinds of activities that can be well-suited to learners with other learning style preferences (Thorne, 2003; Singh; Reed, 2001). This is consistent with Felder (2020) observations on how learning styles should be considered for the design of learning environments, that is, by fostering the integration of a diversity of learning activities that can jointly suit most learners’ primary style preferences. Therefore, a question arises on what variations in the learning design and environment proposed here could be beneficial for students with different learning style preferences. Tools for supporting written communication, such as those found in Argumentation-Based Computer Supported Collaborative Learning (ABCSCCL) applications, including argument maps, scaffolding, and personalized feedback, could be helpful for suiting the behavioural traits and learning style preferences of “Active” and “Pragmatic” students (Jeong; Lee, 2008). Also, teacher-facing analytics, including automated text analysis capabilities can support teachers in noting common issues in students’ written deliverables, and thus facilitating teachers’ provision of formative feedback to students, (Alvarez *et al.*, 2021).

6. Research Limitations

This study supports the hypothesis that performance gains in a written communication learning activity are influenced by the main learning style preference of the student, that is, considering (Honey; Mumford, 2000) theory of learning styles. However, results must be taken with caution as three evident research limitations exist. Firstly, groups in this study are unbalanced. Thus results based on comparison of learning gains between groups are only approximate. Secondly, every semester a single teaching assistant graded all assignments under study, and a different teaching assistant served in the course every year. Evidently, this could have resulted in biased assessments of students’ performance. However, no inter-term comparisons were conducted in this study, while it is certain that the same teaching assistant graded all written communication tasks in a given term. With regard to the evaluation rubric, which the present authors elaborated, yielded results in which some of the written communication variables strongly correlated (i.e., argumentation and justification criteria). Collinearity possibly resulted in unreliable total scores being computed, as an improvement in argumentation or justification will tend to have a more significant impact on the total score of a group compared to improvements in spelling and writing or internal coherence.

The data amassed in this study from 2016 to 2019 are dated; nevertheless, the present authors maintain that the study is highly reproducible, and its outcomes should not undergo significant variations if the intervention were replicated presently. On one hand, students’ learning style preferences have proven to be stable throughout the seven semesters in which the study was conducted, with no fluctuations or increasing or decreasing trends in their representation in the annual cohorts (see Table 6). Moreover, while there is some evidence in literature supporting that learning style preferences can vary throughout university education (Fleming *et al.*, 2011), the admission profile of the institution where this study was conducted has remained consistent in terms of academic variables, that is, considering university admissions test score distributions, and particularly, the language and communication admission test in the Chilean admissions system (see Table 3). On the other hand, the teaching methods employed by the institution have not significantly varied when comparing pre-pandemic to post-pandemic education. Teaching has reverted to being in-person, and the curricula have remained close to what they were until 2019. Hence, the representation of learning style preferences should continue to persist in the educational context of this study to the present day.

Finally, although the rubric used for measuring written communication competencies was utilized in this study by a different evaluator each semester, the analyses performed allow us to observe that there was regularity and consistency in the initial and final measurements (see Figure 6). The current authors believe there are no factors that

could alter this measurement consistency if the study were to be repeated at the present date.

7. Conclusions and Future Work

In this study, a learning environment based on blended learning was designed and implemented for fostering written communication skills among business students. The study was conducted for seven semesters with cohorts of final year students in a Latin American research university enrolled in business-related majors. A total of 216 students were categorized into four groups based on their primary learning style preference corresponding to **Honey and Mumford** (2000) theory of learning styles. Performance in written communication tasks about publishing personal comments in an online forum was assessed based on six criteria derived from the KSAVE framework of 21st century skills proposed by **Care et al.** (2012).

The findings have fulfilled the objectives of the current research and have significantly contrasted the first two working hypotheses; that is, the learning environment is effective in improving students' written communication competence, with observed differences having small to medium effect sizes considering students' primary learning style preferences. Regarding the third working hypothesis, the results indicate that under the conditions in which

“The learning environment is effective in improving students' written communication competence, with observed differences having small to medium effect sizes considering students' primary learning style preferences.”

the study was conducted, differences in written communication performance gains exist between the groups, with some groups benefiting more from the intervention than others. “Reflector” students, who were the most numerous (55.3%), benefited the most from the learning environment attaining the highest learning gains ($d=0.331$). All four groups improved spelling and writing skills, with “Theorist” students improving with medium effect size ($d=0.512$). “Activist” students had small but significant improvements in quality of content, including justification ($d=0.251$) and argumentation ($d=0.367$) criteria. No statistically significant differences were found in assessments of “Reflector” students; however, medium-sized improvements were found in spelling and writing and internal coherence of texts.

In the future, we will consider augmenting the learning environment with other written communication tasks and aids, such as the use of writing prompts and scaffolds, and the construction of argument maps, to attest whether students with “Activist” or “Reflector” learning styles can further improve their written communication skills, especially with regard to text organization and content. Also, we envision scaling up our research by involving cohorts from other institutions; firstly, to investigate the dominant learning styles of junior and senior students in business schools and the evolution of students' preference for learning styles.

8. Funding

This research was partially funded by project ANID/Fondecyt Regular 1161200 “Pedagogical practices to acquire ‘21st century ICT skills’ using microblogging and geo-collaboration supported by mobile applications”.

8.1 Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

8.2. Ethical Approval

This research has received ethical approval by an Ethics Committee at University of Chile.

8.3. Data availability statement

The data supporting this study's findings are publicly available at <http://doi.org/10.6084/m9.figshare.19383260>

References

- AACSB** (2020). "2020 Guiding Principles and Standards for AACSB Business Accreditation." <https://www.aacsb.edu/educators/accreditation/business-accreditation/aacsb-business-accreditation-standards>
- Akkoyunlu, Buket; Soyly, Meryem Yilmaz** (2008). "A study of student's perceptions in a blended learning environment based on different learning styles". *Journal of Educational Technology & Society*, v. 11, n. 1, pp. 183-193. <https://www.jstor.org/stable/jeductechsoci.11.1.183>
- Alenezi, Mamdouh** (2023). "Digital learning and digital institution in higher education". *Education Sciences*, v. 13, n. 1, pp. 88. <https://doi.org/10.3390/educsci13010088>
- Allen, I Elaine; Seaman, Jeff; Garrett, Richard** (2007). *Blending in: The extent and promise of blended education in the United States*. ERIC. <https://files.eric.ed.gov/fulltext/ED529930.pdf>

- Alonso, Catalina; Gallego, Domingo** (2000). "Cuestionario Honey-Alonso de estilos de aprendizaje CHAEA". https://www.cua.uam.mx/pdfs/coplavi/s_p/doc_ng/test-de-estilos-de-aprendizaje.pdf
- Alonso García, C. M.** (1991). "Análisis y diagnóstico de los estilos de aprendizaje en estudiantes universitarios". *Tesis Doctorales*, pp. 359/92. <https://dialnet.unirioja.es/servlet/tesis?codigo=132763>
- Alvarez, Claudio; Zurita, Gustavo; Carvallo, Andrés; Ramírez, Pablo; Bravo, Eugenio; Baloián, Nelson** (2021). "Automatic Content Analysis of Student Moral Discourse in a Collaborative Learning Activity." In: *Collaboration Technologies and Social Computing*. Hernández-Leo, Davinia; Hishiyama, Reiko; Zurita, Gustavo; Weyers, Benjamin; Nolte, Alexander; Ogata, Hiroaki (Eds.), pp. 3-19. Springer International Publishing. https://doi.org/10.1007/978-3-030-85071-5_1
- An, Donggun; Carr, Martha** (2017). "Learning styles theory fails to explain learning and achievement: Recommendations for alternative approaches". *Personality and Individual Differences*, v. 116, pp. 410-416. <https://doi.org/10.1016/j.paid.2017.04.050>
- Ananiadou, Katerina; Claro, Magdalen** (2009). *21st century skills and competences for new millennium learners in OECD countries*. OECD Publishing. <https://doi.org/10.1787/218525261154>
- Anthony, Bokolo; Kamaludin, Adzhar; Romli, Awanis; Raffei, Anis Farihan Mat; Phon, Danakorn Nincarean A. L. Eh; Abdullah, Aziman; Ming, Gan Leong** (2022). "Blended Learning Adoption and Implementation in Higher Education: A Theoretical and Systematic Review". *Technology, Knowledge and Learning*, v. 27, n. 2, pp. 531-578. <https://doi.org/10.1007/s10758-020-09477-z>
- Anthony Jnr, Bokolo** (2022). "An exploratory study on academic staff perception towards blended learning in higher education". *Education and Information Technologies*, v. 27, n. 3, pp. 3107-3133. <https://doi.org/10.1007/s10639-021-10705-x>
- Arbaugh, J Ben; Godfrey, Michael R; Johnson, Marianne; Pollack, Birgit Leisen; Niendorf, Bruce; Wresch, William** (2009). "Research in online and blended learning in the business disciplines: Key findings and possible future directions". *The Internet and Higher Education*, v. 12, n. 2, pp. 71-87. <https://doi.org/10.1016/j.iheduc.2009.06.006>
- Ashraf, Muhammad Azeem; Iqbal, Javed; Arif, Muhammad Irfan; Asghar, Muhammad Zaheer** (2022). "Fostering ICT competencies in blended learning: Role of curriculum content, material, and teaching strategies". *Frontiers in Psychology*, v. 13, pp. 758016. <https://doi.org/10.3389/fpsyg.2022.758016>
- Bernard, Robert M.; Borokhovski, Eugene; Schmid, Richard F.; Tamim, Rana M.; Abrami, Philip C.** (2014). "A meta-analysis of blended learning and technology use in higher education: from the general to the applied". *Journal of Computing in Higher Education*, v. 26, n. 1, pp. 87-122. <https://doi.org/10.1007/s12528-013-9077-3>
- Binkley, Marilyn; Erstad, Ola; Herman, Joan; Raizen, Senta; Ripley, Martin; Miller-Ricci, May; Rumble, Mike** (2012). "Defining Twenty-First Century Skills." In: *Assessment and Teaching of 21st Century Skills*. Griffin, Patrick; McGaw, Barry; Care, Esther (Eds.), pp. 17-66. Springer Netherlands. https://doi.org/10.1007/978-94-007-2324-5_2
- Bitran, Marcela; Zúñiga, Denisse; Lafuente, Montserrat; Viviani, Paola; Mena, Beltrán** (2003). "Tipos psicológicos y estilos de aprendizaje de los estudiantes que ingresan a Medicina en la Pontificia Universidad Católica de Chile". *Revista médica de Chile*, v. 131, n. 9, pp. 1067-1078. <https://doi.org/10.4067/S0034-98872003000900015>
- Cabot, Jordi** (2018). "WordPress: A content management system to democratize publishing". *IEEE Software*, v. 35, n. 3, pp. 89-92. <https://doi.org/10.1109/MS.2018.2141016>
- Calma, Angelito; Cotronei-Baird, Valeria; Chia, Austin** (2022). "Grammarly: An instructional intervention for writing enhancement in management education". *The International Journal of Management Education*, v. 20, n. 3, pp. 100704. <https://doi.org/10.1016/j.ijme.2022.100704>
- Care, Esther; Griffin, Patrick; McGaw, Barry** (2012). *Assessment and Teaching of 21st Century Skills*. Springer. <https://doi.org/10.1007/978-3-319-65368-6>
- Carraher, Shawn** (2009). "Business Education Accreditation and the Changing Global Marketplace: John Fernandes of AACSB". *Journal of Applied Management and Entrepreneurship*, v. 14, n. 1, pp. 128-138. <https://www.proquest.com/openview/88792bbf4fa746a7f5c51e6a4a2c0c96>
- Chen, Clement C; Jones, Keith T** (2007). "Blended Learning vs. Traditional Classroom Settings: Assessing Effectiveness and Student Perceptions in an MBA Accounting Course". *Journal of Educators Online*, v. 4, n. 1, pp. n1. <https://files.eric.ed.gov/fulltext/EJ907743.pdf>
- Chen, Zhongzhou; Stelzer, Timothy; Gladding, Gary** (2010). "Using multimedia modules to better prepare students for introductory physics lecture". *Physical Review Special Topics-Physics Education Research*, v. 6, n. 1, pp. 010108. <https://doi.org/10.1103/PhysRevSTPER.6.010108>

- Cheng, Gary; Chau, Juliana** (2016). "Exploring the relationships between learning styles, online participation, learning achievement and course satisfaction: An empirical study of a blended learning course". *British Journal of Educational Technology*, v. 47, n. 2, pp. 257-278. <https://doi.org/10.1111/bjet.12243>
- Coffield, Frank; Moseley, David; Hall, Elaine; Ecclestone, Kathryn; Coffield, Frank; Moseley, David; Hall, Elaine; Ecclestone, Kathryn** (2004). *Learning Styles and Pedagogy in Post-16 Learning: A Systematic and Critical Review*. Learning and Skills Research Centre. <http://www.hull.ac.uk/php/edskas/learning%20styles.pdf>
- Cullen, David J; Pearson, Margot; Saha, Lawrence J; Spear, R H** (1994). *Establishing effective PhD supervision: Evaluation and Investigations Report*. Higher Education Division, Department of Education, Employment and Training. Canberra, ACT, Australia: Australian Government Publishing Service. https://nccastaff.bournemouth.ac.uk/hncharif/MathsCGs/Desktop/PGCertificate/230_full.pdf
- Day, Jason A; Foley, James D** (2006). "Evaluating a Web Lecture Intervention in a Human-Computer Interaction Course". *IEEE Transactions on Education*, v. 49, n. 4, pp. 420-431. <https://doi.org/10.1109/TE.2006.879792>
- Dede, Chris** (2007). *Transforming Education for the 21st Century: New Pedagogies That Help All Students Attain Sophisticated Learning Outcomes*. Commissioned by the NCSU Friday Institute. http://www.gse.harvard.edu/~dedech/Dede_21stC-skills_semi-final.pdf
- Dunn, Rita S; Dunn, Kenneth J** (1979a). "Learning Styles/Teaching Styles: Should They... Can They... Be Matched?". *Educational Leadership*, v. 36, n. 4, pp. 238-44. https://files.ascd.org/staticfiles/ascd/pdf/journals/ed_lead/el_197901_dunn.pdf
- Dunn, Rita S; Dunn, Kenneth J** (1979b). "Using Learning Style Data to Develop Student Prescriptions." In: *Student Learning Styles Diagnosing and Prescribing Programs*. pp. 109-122. <https://eric.ed.gov/?id=ED182859>
- Felder, Richard M** (2020). "Opinion: Uses, misuses, and validity of learning styles". *Advances in Engineering Education*, v. 8, n. 1, pp. 1-16. <https://advances.asee.org/wp-content/uploads/vol08/issue01/Papers/AEE-Pathways-Felder.pdf>
- Felder, Richard M; Silverman, Linda K** (1988). "Learning and Teaching Styles in Engineering Education". *Engineering Education*, v. 78, n. 7, pp. 674-681. <https://www.cs.unc.edu/~anderson/teach/comp915/slides/FelderPaper.pdf>
- Fleming, Sandra; McKee, Gabrielle; Huntley-Moore, Sylvia** (2011). "Undergraduate nursing students' learning styles: A longitudinal study". *Nurse Education Today*, v. 31, n. 5, pp. 444-449. <https://doi.org/10.1016/j.nedt.2010.08.005>
- Garrison, D. Randy; Kanuka, Heather** (2004). "Blended learning: Uncovering its transformative potential in higher education". *The Internet and Higher Education*, v. 7, n. 2, pp. 95-105. <https://doi.org/10.1016/j.iheduc.2004.02.001>
- González-Pérez, Laura Icela; Ramírez-Montoya, María Soledad** (2022). "Components of Education 4.0 in 21st century skills frameworks: systematic review". *Sustainability*, v. 14, n. 3, pp. 1493. <https://doi.org/10.3390/su14031493>
- Graf, Sabine; Viola, Silvia Rita; Leo, Tommaso; Kinshuk** (2007). "In-depth analysis of the Felder-Silverman learning style dimensions". *Journal of Research on Technology in Education*, v. 40, n. 1, pp. 79-93. <https://doi.org/10.1080/15391523.2007.10782498>
- Graham, Charles R** (2006). "Blended Learning Systems." In: *The Handbook of Blended Learning: Global Perspectives, Local Designs*. Bonk, Curtis J.; Graham, Charles R. (Eds.), pp. 3-21. Pfeiffer Publishing. https://curtbonk.com/toc_section_intros2.pdf
- Güzer, Bayram; Caner, Hamit** (2014). "The Past, Present and Future of Blended Learning: An in Depth Analysis of Literature". *Procedia - Social and Behavioral Sciences*, v. 116, pp. 4596-4603. <https://doi.org/10.1016/j.sbspro.2014.01.992>
- Halbert, Caitlin; Kriebel, Richard; Cuzzolino, Robert; Coughlin, Patrick; Fresa-Dillon, Kerin** (2011). "Self-assessed learning style correlates to use of supplemental learning materials in an online course management system". *Medical Teacher*, v. 33, n. 4, pp. 331-333. <https://doi.org/10.3109/0142159X.2011.542209>
- Hanushek, Eric A.; Machin, Stephen J.; Woessmann, Ludger** (2016). *Handbook of the Economics of Education*. Elsevier. <https://shop.elsevier.com/books/handbook-of-the-economics-of-education/hanushek/978-0-444-63459-7>
- Hart Research Associates** (2018). "Fulfilling the American dream: Liberal education and the future of work. Selected findings from online surveys of business executives and hiring managers." Association of American Colleges and Universities Washington, DC. <https://www.aacu.org/research/2018-future-of-work>
- Hasanah, Hasanah; Malik, Muhammad Nasir** (2020). "Blended learning in improving students' critical thinking and communication skills at University". *Cypriot Journal of Educational Sciences*, v. 15, n. 5, pp. 1295-1306. <https://doi.org/10.18844/cjes.v15i5.5168>
- Hassan, Muhammad Awais; Habiba, Ume; Majeed, Fiaz; Shoaib, Muhammad** (2021). "Adaptive gamification in e-learning based on students' learning styles". *Interactive Learning Environments*, v. 29, n. 4, pp. 545-565. <https://doi.org/10.1080/10494820.2019.1588745>

- Heilporn, Géraldine; Lakhali, Sawsen; Bélisle, Marilou** (2021). "An examination of teachers' strategies to foster student engagement in blended learning in higher education". *International Journal of Educational Technology in Higher Education*, v. 18, n. 1, pp. 25. <https://doi.org/10.1186/s41239-021-00260-3>
- Honey, Peter; Mumford, Alan** (2000). *The Learning Styles Helper's Guide*. Peter Honey Publications. https://www.fwsolutions.net/wp-content/uploads/2021/01/learning-styles-helpers-guide_quickpeek.pdf
- Hrastinski, Stefan** (2019). "What Do We Mean by Blended Learning?". *TechTrends*, v. 63, n. 5, pp. 564-569. <https://doi.org/10.1007/s11528-019-00375-5>
- Ismail, Alajab Mohammed Alajab** (2018). "Empowering your students satisfaction with blended learning: A lesson from the Arabian Gulf University distance teaching and training program". *International Journal of Information and Education Technology*, v. 8, n. 2, pp. 81-94. <https://www.ijet.org/vol8/1019-T81.pdf>
- Jackson, Denise** (2014). "Business graduate performance in oral communication skills and strategies for improvement". *The International Journal of Management Education*, v. 12, n. 1, pp. 22-34. <https://doi.org/10.1016/j.ijme.2013.08.001>
- Jeong, Allan; Lee, JeongMin** (2008). "The effects of active versus reflective learning style on the processes of critical discourse in computer-supported collaborative argumentation". *British Journal of Educational Technology*, v. 39, n. 4, pp. 651-665. <https://doi.org/10.1111/j.1467-8535.2007.00762.x>
- Khamparia, Aditya; Pandey, Babita** (2020). "Association of learning styles with different e-learning problems: a systematic review and classification". *Education and Information Technologies*, v. 25, n. 2, pp. 1303-1331. <https://doi.org/10.1007/s10639-019-10028-y>
- Kirschner, Paul A.; van Merriënboer, Jeroen J. G.** (2013). "Do Learners Really Know Best? Urban Legends in Education". *Educational Psychologist*, v. 48, n. 3, pp. 169-183. <https://doi.org/10.1080/00461520.2013.804395>
- Kolb, Alice Y.; Kolb, David A.** (2005). "Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education". *Academy of Management Learning & Education*, v. 4, n. 2, pp. 193-212. <https://doi.org/10.5465/amle.2005.17268566>
- Kolb, David A** (1984). *Experience as the Source of Learning and Development*. Upper Saddle River: Prentice Hall.
- Kolb, David A** (2014). *Experiential Learning: Experience as the Source of Learning and Development*. FT Press.
- Levy, Frank; Murnane, Richard** (2007). "How Computerized Work and Globalization Shape Human Skill Demands." In: *Learning in the Global Era: International Perspectives on Globalization and Education*. Suarez-Orozco, Marcelo (Ed.), pp. 158-174. University of California Press. <https://doi.org/10.1525/9780520941496-011>
- Lewis, J Scott; Harrison, Marissa A** (2012). "Online Delivery as a Course Adjunct Promotes Active Learning and Student Success". *Teaching of Psychology*, v. 39, n. 1, pp. 72-76. <https://doi.org/10.1177/0098628311430641>
- López-Pérez, M. Victoria; Pérez-López, M. Carmen; Rodríguez-Ariza, Lázaro** (2011). "Blended learning in higher education: Students' perceptions and their relation to outcomes". *Computers & Education*, v. 56, n. 3, pp. 818-826. <https://doi.org/10.1016/j.compedu.2010.10.023>
- Mainga, Wise; Murphy-Braynen, Marlo B; Moxey, Remelda; Quddus, Syed Abdul** (2022). "Graduate Employability of Business Students". *Administrative Sciences*, v. 12, n. 3, pp. 72. <https://doi.org/10.3390/admsci12030072>
- Manyika, James; Madgavkar, Anu; Tacke, Tilman; Smit, Sven; Woetzel, Lola; Abdulaal, Abdulla** (2020). *The social contract in the 21st century*. McKinsey Global Institute. <https://www.mckinsey.com/industries/social-sector/our-insights/the-social-contract-in-the-21st-century>
- Marantika, Juliaans Eliezer Ruland** (2022). "The Relationship Between Learning Styles, Gender and Learning Outcomes". *Kıbrıslı Eğitim Bilimleri Dergisi*, v. 17, n. 1, pp. 56-67. <https://doi.org/10.18844/cjes.v17i1.6681>
- Markle, Ross; Breneman, Meghan; Jackson, Teresa; Burrus, Jeremy; Robbins, Steven** (2013). "Synthesizing Frameworks of Higher Education Student Learning Outcomes". *ETS Research Report Series*, v. 2013, n. 2, pp. i-37. <https://doi.org/10.1002/j.2333-8504.2013.tb02329.x>
- Mason, Gregory S; Shuman, Teodora Rutar; Cook, Kathleen E** (2013). "Comparing the Effectiveness of an Inverted Classroom to a Traditional Classroom in an Upper-division Engineering Course". *IEEE Transactions on Education*, v. 56, n. 4, pp. 430-435. <https://doi.org/10.1109/TE.2013.2249066>
- Maulida, Dewi Safira; Rahman, M Arinal; Handrianto, Ciptro; Rasool, Shahid** (2022). "A Review of the Blended Learning as the Model in Improving Studentsparagraph Writing Skills". *Abjadia: International Journal of Education*, v. 7, n. 1, pp. 59-72. <https://doi.org/10.18860/abj.v7i1.15901>
- Morphew, Valerie N.** (2002). "Web-Based Learning and Instruction: A Constructivist Approach." In: *Web-Based Instructional*

Learning. Mehdi Khosrow-Pour, D. B. A. (Ed.), pp. 1-14. IGI Global. <https://doi.org/10.4018/978-1-931777-04-9.ch001>

Mueller, Fabian Alexander; Wulf, Torsten (2022). "Blended learning environments and learning outcomes: The mediating role of flow experience". *The International Journal of Management Education*, v. 20, n. 3, pp. 100694. <https://doi.org/10.1016/j.ijme.2022.100694>

Mumford, Alan (1995). "Learning Styles and Mentoring". *Industrial and Commercial Training*, v. 27, n. 8, pp. 4-7. <https://doi.org/10.1108/00197859510097045>

Muñoz-Seca, Beatriz; Sánchez, Lorena (2001). "Los Estilos de Aprender". http://web.iese.edu/BMS/GESCO_02/Documentaci%F3n/4b_01978300.pdf

National Research Council (2013). *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. National Academies Press Washington, DC. <https://doi.org/10.17226/13398>

Nulty, Duncan D.; Barrett, Mary A. (1996). "Transitions in students' learning styles". *Studies in Higher Education*, v. 21, n. 3, pp. 333-345. <https://doi.org/10.1080/03075079612331381251>

Nurmalisa, Yunisca; Sunyono, Sunyono; Yulianti, Dwi (2023). "An integrative review: Application of digital learning media to developing learning styles preference". *International Journal of Information and Education Technology*, v. 13, n. 1, pp. 187-194. <http://repository.lppm.unila.ac.id/id/eprint/47632>

OECD Indicators (2012). "Education at a Glance 2016". *Editions OECD*, v. 90. <https://www.oecd.org/education/skills-beyond-school/EAG2016-Annex3.pdf>

Penger, Sandra (2009). "Testing Dunn & Dunn's and Honey & Mumford's learning style theories: The case of the Slovenian higher education system". *Management: Journal of Contemporary Management Issues*, v. 14, n. 2, pp. 1-20. <https://hrcak.srce.hr/48131>

Poon, Joanna (2014). "A cross-country comparison on the use of blended learning in property education". *Property Management*, v. 32, n. 2, pp. 154-175. <https://doi.org/10.1108/PM-04-2013-0026>

R Development Core Team (2017). *R: A Language and environment for statistical computing*, v. 3.5.1. The R Foundation for Statistical Computing, Vienna. <https://www.r-project.org/foundation>

Revelle, William (2016). *How To: Use the psych package for Factor Analysis and data reduction*. Evanston, IL: Northwestern University, Department of Psychology. <https://randilgarcia.github.io/smith-r-workshop/factor.pdf>

Riffell, Samuel; Sibley, Duncan (2005). "Using web-based instruction to improve large undergraduate biology courses: An evaluation of a hybrid course format". *Computers & Education*, v. 44, n. 3, pp. 217-235. <https://doi.org/10.1016/j.compedu.2004.01.005>

Robles, Marcel; Braathen, Sandy (2002). "Online Assessment Techniques". *Delta Pi Epsilon Journal*, v. 44, n. 1, pp. 39-49. <https://www.icci.edu.ky/wp-content/uploads/2016/02/online-assessment-techniques.pdf>

Rose, Pauline (2012). *Efa Global Monitoring Report 2012: Youth and Skills, Putting Education to Work*. UNESCO. <https://www.unesco.org/gem-report/en/youth-skills-putting-education-work>

Rotherham, Andrew J; Willingham, Daniel (2009). "21st Century". *Educational Leadership*, v. 67, n. 1, pp. 16-21. <http://cesa7ita2009.pbworks.com/f/21st+Century+Skills+Curriculum+Teachers+Assessment.pdf>

Schumacker, Randall E. (2015). *Using R with Multivariate Statistics*. Sage Publications. <https://study.sagepub.com/multivariatewithr>

She, Hsiao-Ching (2005). "Enhancing Eighth Grade Students' Learning of Buoyancy: The Interaction of Teachers' Instructional Approach and Students' Learning Preference Styles". *International Journal of Science and Mathematics Education*, v. 3, n. 4, pp. 609-624. <https://doi.org/10.1007/s10763-004-6113-9>

Singh, Harvi; Reed, Chris (2001). "A White Paper: Achieving Success With Blended Learning". *Centra Software*, v. 1, pp. 1-11. <https://facilitateadultlearning.pbworks.com/f/blendedlearning.pdf>

Smith, Anita (2010). "Learning styles of registered nurses enrolled in an online nursing program". *Journal of Professional Nursing*, v. 26, n. 1, pp. 49-53. <https://doi.org/10.1016/j.profnurs.2009.04.006>

Smith, Anne M. J.; Paton, Robert A. (2014). "Embedding enterprise education: A service based transferable skills framework". *The International Journal of Management Education*, v. 12, n. 3, pp. 550-560. <https://doi.org/10.1016/j.ijme.2014.02.002>

So, Hyo-Jeong; Brush, Thomas A (2008). "Student Perceptions of Collaborative Learning, Social Presence and Satisfaction in a Blended Learning Environment: Relationships and Critical Factors". *Computers & Education*, v. 51, n. 1, pp. 318-336. <https://doi.org/10.1016/j.compedu.2007.05.009>

- Sparks, Jesse R; Song, Yi; Brantley, Wyman; Liu, Ou Lydia** (2014). "Assessing Written Communication in Higher Education: Review and Recommendations for Next-Generation Assessment". *ETS Research Report Series*, v. 2014, n. 2, pp. 1-52. <https://doi.org/10.1002/ets2.12035>
- Spring, Kristian J; Graham, Charles R; Hadlock, Camey A** (2016). "The Current Landscape of International Blended Learning". *International Journal of Technology Enhanced Learning*, v. 8, n. 1, pp. 84-102. <https://doi.org/10.1504/IJTEL.2016.075961>
- Suarta, I Made; Suwintana, I Ketut; Sudhana, IGP Fajar Pranadi; Hariyanti, Ni Kadek Dessy** (2017). "Employability skills required by the 21st century workplace: A literature review of labor market demand." In: *International Conference on Technology and Vocational Teachers (ICTVT 2017)*. pp. 337-342. Atlantis Press. <https://doi.org/10.2991/ictvt-17.2017.58>
- Thorne, Kaye** (2003). *Blended learning: how to integrate online & traditional learning*. Kogan Page Publishers. <https://dl.acm.org/doi/abs/10.5555/862445>
- Trilling, Bernie; Fadel, Charles** (2009). *21st Century Skills: Learning for Life in Our Times*. John Wiley & Sons. <https://www.wiley.com/en-us/21st+Century+Skills%3A+Learning+for+Life+in+Our+Times-p-9780470553916>
- Uğur, Benlihan; Akkoyunlu, Buket; Kurbanoglu, Serap** (2011). "Students' opinions on blended learning and its implementation in terms of their learning styles". *Education and Information Technologies*, v. 16, n. 1, pp. 5-23. <https://doi.org/10.1007/s10639-009-9109-9>
- Van Waes, Luuk; Van Weijen, Daphne; Leijten, Mariëlle** (2014). "Learning to write in an online writing center: The effect of learning styles on the writing process". *Computers & Education*, v. 73, pp. 60-71. <https://doi.org/10.1016/j.compedu.2013.12.009>
- Vo, Hien M; Zhu, Chang; Diep, Nguyet A** (2017). "The effect of blended learning on student performance at course-level in higher education: A meta-analysis". *Studies in Educational Evaluation*, v. 53, pp. 17-28. <https://doi.org/10.1016/j.stueduc.2017.01.002>
- Zhao, Yiran; Breslow, Lori** (2013). "Literature Review on Hybrid/Blended Learning". *Teaching and Learning Laboratory (TLL)*, pp. 1-22.