Structural Equation Modelling of Learning Styles and Thought Management in The Covid-19 Era

Cruz Garcia Lirios*

Department of Social Work, Autonomous University of the State of Mexico.

*Corresponding Author: Cruz Garcia Lirios, Department of Social Work, Autonomous University of the State of Mexico.

Abstract

The pandemic forced the transition from the face-to-face classroom to the virtual classroom. This process was an opportunity to observe the prevalence of immersive learning through findings related to augmented reality, gamification or the intensive use of social digital platforms and networks. Therefore, the objective of this work was to map the learning styles and types of thinking that prevailed in the period since the pandemic. A documentary, cross-sectional, exploratory and retrospective study was carried out with findings reported in the literature from 2019 to 2022. From an advanced search in institutional repositories, the axes of the research agenda were established and the records were compared with evaluations by expert judges through the Delphi technique. The results show the prevalence of four dimensions: non-immersive learning without or with critical thinking and immersive learning without or with critical thinking. When analyzing the relationships between the four components, it was found that non-immersive learning without critical thinking influenced the other elements. In relation to the confinement and deconfinement policies, as well as the transition strategies to the virtual classroom and return to the face-to-face classroom, the scope and limits of the study are discussed.

Keywords: immersive learning; face-to-face classroom; virtual classroom; covid-19; critical thinking

Introduction

The anti-COVID -19 policies focused their attention on the distancing and confinement of people, but with the passing of immunizations and the learning of biosafety, the strategies of returning to the face-to-face classroom suppose imponderables for the learning of critical and immersive thinking (Carreon et al., 2020). In fact, the process of distancing, confinement, deconfinement and face-to-face return supposes institutional legitimacy (Bustos et al., 2020). It is about the identity, reputation and institutional image that justifies the transition from the face-to-face classroom to the virtual classroom and from this to the face-to-face return (Lirios et al., 2020). In these scenarios, the teaching of critical thinking through immersive environments could have been disrupted by the institutionalism that distinguishes universities and resistance to change.

In this way, the teaching of critical thinking in immersive environments is an area of opportunity for traditional public institutions with a high normative isomorphism in their academic training of human capital (García et al., 2021). The traditional teaching of critical thinking was established from the teacher as the central axis of the student's review, analysis and discussion regarding the topics of the research, university or local agenda (Aguayo et al., 2020). In the new immersive learning, critical thinking is established from the comparison of data rather than authors or theories.

Human formation and university ethics are central axes in an educational agenda aimed at the transformation of the university and the parts that make it up: teachers, administrators, students and workers (García et al., 2014). Such a transformation process suggests the inclusion, gestation or activation of a critical thought that deconstructs the academic structure of isomorphism, credentialism, bureaucratism, institutionalism or absenteeism and reorients the components towards justice, coexistence and the social issue (Carreón et al. al., 2016). They open the discussion around the gestation of critical thinking in the face-to-face and virtual classroom. Human formation, as a teaching and learning process oriented to the issue, justice and social coexistence, supposes critical thinking that reveals institutionalism, deconstructs bureaucratism and rebuilds the relationship between student and teacher (García et al., 2015). University ethics, understood as innovative and motivating creativity, supposes a set of principles that regulate and define critical thinking. University ethics supports lateral thinking to the dominant rationality (Sandoval et al., 2016). If a logic of cause and effect is trained in the classroom, critical thinking questions the absence of emotions. In the traditional classroom , the prevalence of linear thinking excludes new ways of teaching and learning that the labor market demands to understand the social issue.

Both fundamentals, human formation and university ethics, would be axes of the educational, professional and labor agenda (Carreón et al., 2014).

It then means that the inclusion of critical thinking in the curricular map or the study plan will translate into pedagogical sequences that motivate the parties involved through devices, technologies and electronic networks (García et al., 2014). Such is the specific case of a university journal project in which human training is oriented towards the discussion of the university's own problems: institutionalism, bureaucratism, isomorphism, credentialism or absenteeism (Hernández et al., 2014). The written reflection using a double-blind pair system supposes a high quality standard because a community of experts is created that dictates their peers (Sánchez et al., 2018). Therefore, the students and teachers who participate in the university magazine project must comply with the critical thinking and collaborative work that the issue merits. Even

Human training as a promoter of justice, coexistence and social issues can contribute to generating, activating or correcting critical thinking in the parties involved (Carreón et al., 2015). In this way, the inclusion in human formation in the didactic objectives and sequences will allow establishing axes of discussion related to the promotion of questioning and problematization exercise in the classroom (Carreón et al., 2014). University ethics, defined as the principles that guide the teacher's creativity towards a scenario of equity, emancipation, deconstruction and reconstruction of the teacher's identity, complements its foundations with human training and contributes to the management of critical thinking in the classroom.

If human education and university ethics contribute to the management of critical thinking in the classroom, then the didactic strategy should consist of disseminating the issue, justice and social coexistence in networks and communication information channels (Guillén et al., 2021). The university journal requires the management of critical thinking in order to be able to deconstruct educational problems, reconstruct the teacher's motivation based on human training and university ethics, as well as reduce the research gap between those who are dedicated to this work and those who they teach or attend a classroom without considering the importance of human formation and university ethics.

The objective of the present work was to establish a mapping of the learning styles and types of thinking derived from the transition from the face-to-face classroom to the traditional classroom, considering the period from 2019 to 2022, as well as to compare the prevalence of the state of the art with respect to the evaluations of expert judges in the themes.

Are there significant differences between the prevalence of learning and thoughts reported in the literature from 2019 to 2022 with respect to the evaluations of expert judges in the themes?

The premises that guide this work suggest that learning styles and types of thinking were asymmetrically disseminated in the transition from the face-to-face classroom to the virtual classroom (Guillén et al., 2022). In this way, gamification, augmented reality and socio-digital platforms or networks should have promoted an observable learning style in the self-management of information, communication, knowledge, empowerment and participation. In this virtual scenario, human training, university ethics and critical thinking must have been essential (Hernández and Quintero, 2018). The three training instances had to consolidate a collaborative, entrepreneurial and innovative training, as well as a production, management and transfer of knowledge oriented to academic, professional and work training.

Method

A documentary, cross-sectional, exploratory and retrospective study was carried out with a selection of abstracts searched by keywords in institutional repositories such as Clase, Latindex or Redalyc during the period from 2019 to 2022 (see Table 1).

	Immersive Learning				Critical thinking			
	2019	2022	2021	2022	2019	2020	2021	2022
Class	2	4	2	1	5	2	3	5
latindex	3	3	5	3	3	2	1	4
Redalyc	5	1	4	2	2	1	1	2

Source: Prepared with study data

Table 1: Descriptives of the sample.

The selection of the expert judges was established from the citation index published in academic Google (García et al., 2021). The experts were contacted through their institutional mail. The expert judges were informed about the objective of the investigation and those responsible for carrying it out. Confidentiality and anonymity were guaranteed in writing, following the guidelines of the format of the American Psychological Association and the American Medical Association in their sections corresponding to the Helsinki protocol with human studies.

The Delphi technique was used to evaluate the selected abstracts in three rounds (Carreón et al., 2018). In the first, the summaries were scored considering the criteria of totally disagree to totally agree on the theoretical or empirical relationship of immersive learning with critical thinking. In a second round, the initial ratings were compared with the average of all expert judges on the subject. The third round consisted of the registration of reconsidered or reiterated qualifications.

The data was captured in Excel and processed in JASP version 14 (Carreón et al., 2014). Contingency, normality, adequacy, sphericity, validity, correlation, and regression coefficients were estimated. Values close to unity were established as evidence of statistical analyzes favorable to the minimum quality requirements and values close to zero as evidence of spurious relationships between the variables and analysis categories.

Results

The hypothesis test regarding the contingent relationships between the immersive learning category and the critical thinking categories suggests non-rejection $\lceil \chi2 = 483.400\ (62\ df)\ p = .0001 \rceil$. That is, both categories have a constant dependency relationship in the period from 2019 to 2022.

However, its structure of main axes suggests four dimensions in which both categories, immersive learning and critical thinking, are structured (see Table 2). That is, the relationship between both categories is reflected in four main components: immersive learning without critical thinking, immersive learning with critical thinking, non-immersive learning without critical thinking, and non-immersive learning with critical thinking.

	RC1	RC2	RC3	RC4	uniqueness
r1			1,579	-0.463	0.451
r2	-1,304				0.348

	RC1	RC2	RC3	RC4	uniqueness
r3	0.677	1,251		0.417	0.475
r4		0.872	0.877		0.486
r5	-1,478				0.211
r6	1,371	1,041			0.330
r7	0.510		0.639	0.635	0.873
r8	1,261			-0.595	0.352
r9		-1,189			0.237
r10			0.711	0.702	0.545
r11	-0.756	0.481		0.859	0.484
r12	-0.765			-0.832	0.685
r13			-0.966		0.522
r14		-1,494			0.234
r15				1,381	0.328
r16	1,156		0.575		0.165

Note. Applied rotation method is promax .

Table 2. Main components of the categories.

In this way, non-immersive learning without critical thinking explains the highest percentage of variance (0.313), followed by non-immersive learning with critical thinking (0.217), then immersive learning without critical thinking (0.158) and immersive learning with critical thinking. (0.123). The percentages of total explained variance (0.811) suggest the inclusion of another factor that the literature identifies as the absence of learning as an effect of the pandemic (see Figure 1).
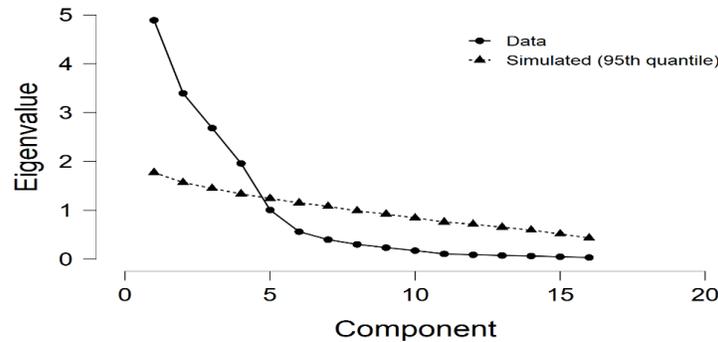

Figure 1: Sedimentation of factorial weights

Source: Prepared with study data

The resulting diagram of the relationships between the indicators (qualifications of the expert judges) and the factors (dimensions of the relationships between immersive learning and critical thinking), suggests the prevalence of non-immersive learning without critical thinking and immersive learning without critical thinking (see Figure 2).
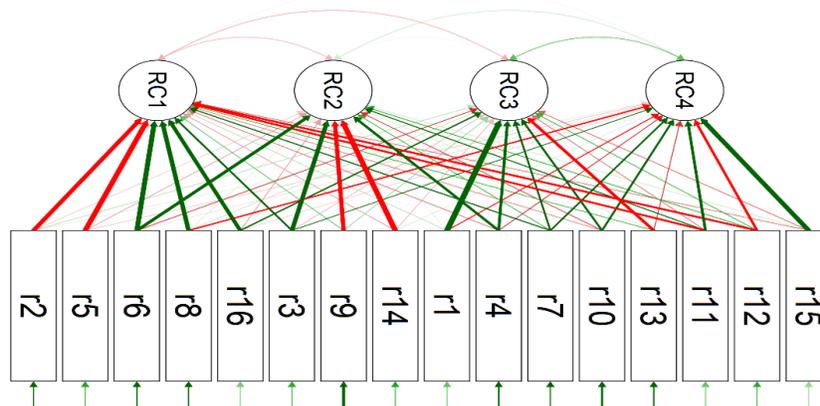
Figure 1: Factor analysis of principal axes with promax rotation

Source: Prepared with study data

The relationships between the factors suggest that non-immersive learning without critical thinking correlates with non-immersive learning with critical thinking (0.18), as well as immersive learning without critical thinking (0.07) and immersive learning with critical thinking (0.05). That is, the policies of return to the virtual classroom seem to have influenced the learning and thinking reported in the literature from 2019 to 2022 (see Figure 2).
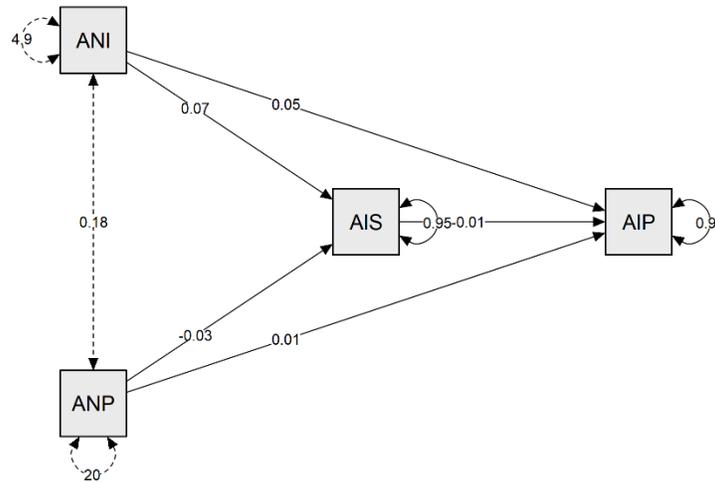

Figure 2: Trajectory model

Source: Prepared with study data

In summary, the literature consulted from 2019 to 2022 suggests four dimensions of learning and thinking in the virtual and face-to-face classroom: non-immersive learning without critical thinking, non-immersive learning with critical thinking, immersive learning without critical thinking, and learning immersive with critical thinking. The first component or dimension related to non-immersive learning without critical thinking affects the other factors. It then means that the confinement and deconfinement policies, as well as the face-to-face and virtual classroom strategies, could be legitimized by the literature from 2019 to 2022. That is, the findings consulted, selected, processed and analyzed suggest that non-immersive learning without thought critical is the central axis of the research agenda during the pandemic in the reviewed literature.

Discussion:

The contribution of this study to the state of the question lies in the establishment of non-immersive learning without critical thinking as a guiding axis of the research agenda in the period from 2019 to 2022. In reference to the state of the art where it is suggested that the formative learning with a humanistic sense prevailed in the virtual classroom, the present work warns that this learning could have been influenced by another traditional learning style, but not critically (Hernández et al., 2021). The implications of this finding for policies to return to the face-to-face classroom suggest that the area of opportunity in this scenario is immersive learning with critical thinking. In other words, the transition from the face-to-face classroom to the virtual classroom seems not to have been oriented towards immersive or critical learning (Sánchez et al., 2022). In addition, the lack of confidence and return to the face-to-face classroom does not seem to guarantee the emergence of immersive learning with critical thinking. Lines of research concerning the effects of the pandemic on types of learning will make it possible to identify paths of analysis that clarify the coexistence of multiple types of learning in the face-to-face classroom.

In the virtual classroom, immersive learning had a great boost through gamification, augmented reality, social digital networks and platforms , but the literature warns that this type of immersive learning would not be related to other types of learning, although it was linked to non-critical thoughts (Espinoza et al., 2022). The impact of this immersive scenario without critical thinking supposes a return to the face-to-face classroom without an essential tool for the formation of criteria in decision-making. If the virtual classroom promoted student autonomy for the self-management of their learning, critical thinking must have been a fundamental component to deliberate the most appropriate path of knowledge and skills in distancing and confinement.

However, this study warns that rather different learning and thinking styles coexisted in the virtual classroom and suggests that this diversity will continue to exist when returning to the face-to-face classroom. The policies of return to the face-to-face classroom can affect the prevalence of some type of learning and thought management, although their legitimacy or at least not being questioned is guaranteed because in the virtual classroom the prevalence of some style of learning and thought was not established.

Conclusion

The objective of the present work was to establish a mapping of the learning styles and types of thinking that proliferated in the virtual classroom and were reported as research findings in the literature from 2019 to 2022. By comparing the state of the art with the evaluations of judges experts demonstrated the prevalence of non-immersive learning with and without critical thinking compared to immersive learning without or with critical thinking. In addition, a structure of relationships was established in which non-immersive learning without critical thinking was a determinant of the other learning styles and types of thinking. In relation to the confinement and deconfinement policies, as well as the transition strategies to the virtual classroom and return to the face-to-face classroom, this paper warns that non-immersive learning without critical thinking could legitimize any anti-COVID-19 policy and strategies. Since the face-to-face classroom was not replaced by the virtual classroom, it is expected that both will coexist in a scenario of return to the face-to-face classroom.

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