Medicon Microbiology
Volume 2 Issue 3 December 2023
Article Type: Research Article
ISSN: 3008-248X

# Learning Perception at Public University in Central Mexico

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**Received:** November 08, 2023; **Published:** December 20, 2023

## Abstract

The pandemic forced to move from the face-to-face classroom to the virtual classroom. This process was an opportunity to observe the predominance of immersive learning through findings related to augmented reality, gamification or the intensive use of platforms and digital social networks. Therefore, the objective of this work was to map the learning styles and types of thinking that prevailed in the post-pandemic period. A documentary, cross-sectional, exploratory and retrospective study was carried out with findings reported in the literature from 2020 to 2023. Based on an advanced search in institutional repositories, the axes of the research agenda were established and the records were compared with expert evaluations. 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. That is, academic training and knowledge management is established from immersive learning with or without critical thinking.

***Keywords:*** Immersive Learning; COVID-19; Learning Method; Critical Thinking; Learning Outcome

## Introduction

The anti-COVID-19 policies focused their attention on the distancing and confinement of people, but with the passage of immunizations and the learning of biosafety, the strategies of returning to the face-to-face classroom suppose imponderables for the learning of critical skills and immersive thinking [1]. In fact, the process of distancing, confinement, deconfinement and face-to-face return supposes institutional legitimacy [2]. 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 [3]. In these scenarios, the teaching of critical thinking through immersive environments could have been disrupted by the institutionality 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 [4]. The traditional teaching of critical thinking was established from the teacher as the central axis of student review, analysis and discussion around the topics of the research, university or local agenda [5]. In the new immersive learning, critical thinking is established from the comparison of data rather than authors or theories.

Human education and university ethics are central axes in an educational agenda aimed at transforming the university and its constituent parts: teachers, managers, students and workers [6]. Such a transformation process suggests the inclusion, gestation or activation of a critical thought that deconstructs the academic structure of isomorphism, credentialism, bureaucracy, institutionalism or absenteeism and reorients the components towards justice, coexistence and the social question [7]. They open the discussion around the gestation of critical thinking in the face-to-face and virtual classroom [8]. Human formation, as a teaching and learning process oriented to the question, justice and social coexistence, supposes critical thinking that reveals the institutional framework, deconstructs bureaucracy and rebuilds the relationship between student and teacher [9]. University ethics, understood as innovative and motivating creativity, supposes a set of principles that regulate and define critical thinking [10]. University ethics supports lateral thinking to the dominant rationality [11]. If a logic of cause and effect is trained in the classroom, critical thinking questions the absence of emotions [12]. In the traditional classroom, the predominance of linear thinking excludes new ways of teaching and learning that the labor market requires to understand the social issue.

Both fundamentals, human formation and university ethics, would be axes of the educational, professional and labor agenda [13]. It then means that the inclusion of critical thinking in the curricular map or study plan will translate into pedagogical sequences that motivate those involved through devices, technologies and electronic networks [14]. Such is the specific case of a university journal project in which human training is oriented towards the discussion of university problems: institutionalism, bureaucratism, isomorphism, credentialism or absenteeism [15]. The written reflection using a double-blind peer system assumes a high quality standard because a community of experts is created that dictates to their peers [16]. Therefore, the students and teachers who participate in the university magazine project must comply with the critical thinking and collaborative work that the subject deserves.

Human training as a promoter of justice, coexistence and social problems can contribute to generating, activating or correcting critical thinking in the parties involved [17]. In this way, the inclusion of human training in the didactic objectives and sequences will allow the establishment of axes of discussion related to the promotion of the exercise of questioning and problematization in the classroom [18]. University ethics, defined as the principles that guide the teacher's creativity towards a scenario of equity, emancipation, deconstruction and reconstruction of the teaching 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 theme, justice and social coexistence in networks and communication information channels [19]. The university journal requires the management of critical thinking in order to deconstruct educational problems, reconstruct the teacher's motivation based on human training and university ethics, as well as reduce the investigative gap between those who are dedicated to this work and those who teach or assist. to a classroom without considering the importance of human formation and university ethics.

The objective of this 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 2020 to 2023, as well as to compare the prevalence of the state of the art with respect to the assessments expert judges on the subject matter.

Are there significant differences between the prevalence of learning and thoughts reported in the literature from 2020 to 2023 with respect to the assessments of expert judges on the topics?

The premises that guide this work suggest that learning styles and types of thinking spread asymmetrically in the transition from the face-to-face classroom to the virtual classroom [20]. In this way, gamification, augmented reality and social-digital platforms or networks should have promoted an observable learning style in the self-management of information, communication, knowledge, empowerment and participation [21]. In this virtual scenario, human training, university ethics and critical thinking must have been fundamental [22]. The three training instances had to consolidate collaborative, entrepreneurial and innovative training, as well as production, management and transfer of knowledge aimed at academic, professional and work training.

Consequently, the model and the hypotheses to prove are:

Hypothesis 1. Learning styles and thought self-management are correlated [23]. The factorial analysis of main axes allowed us to establish four dimensions that reflect the relationship between learning styles and thought self-management.

Hypothesis 2. Immersive learning and critical thinking are associated and spread across factors [24]. The sedimentation analysis of the factors allowed corroborating the relationship between immersive learning and critical thinking.

Hypothesis 3. The indicators of the four factors are linked [25]. The exploratory factorial analysis allowed corroborating the degree of relationship between the indicators and the main axes. In addition, the trajectory analysis established the impact of the immersive learning style and critical thinking on other learning and thinking.

## Methods / Materials

Given that learning styles and self-management of thought have been observed in specific scenarios of the impact of the pandemic on the educational system through anti-COVID -19 policies focused on distancing and confinement of people, we proceeded to select informative sources and expert judges, considering the specificity of the literature in the period that the pandemic takes from December 2020 to October 2023. In this way, the Class, Latindex and Redalyc repositories were selected for their intensive use in the sample of judges. experts.

A documentary, cross-sectional, exploratory and retrospective study was carried out with a selection of abstracts searched by keyword in institutional repositories such as Clase, Latindex or Redalyc during the period from 2020 to 2023.

Preliminary abstracts were selected in the first instance in order to be able to examine the relationships between learning style and thought self-management. 16 abstracts were selected for the final analysis of their contents by expert judges in the field. The learning method and the type of self-management of thought in a risk prevention environment associated with COVID-19 were considered.

The selection of the expert judges was established from the citation index published in academic Google [26]. The experts were contacted through their institutional mail. The expert judges were informed about the object of the investigation and those responsible for carrying it out [27]. 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 [28]. 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 [29]. In a second round, the initial ratings were compared to 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. Contingency, normality, adequacy, sphericity, validity, correlation, and regression coefficients were estimated [30]. 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 categories of analysis.

## Results

The hypothesis test on the contingent relationships between the immersive learning category and the critical thinking categories suggests non-rejection [$\chi$ 2 = 483.400 (62 df) p = .0001]. That is, both categories have a constant dependency ratio in the period from 2020 to 2023.

However, its structure of main axes suggests four dimensions in which both categories are structured, immersive learning and critical thinking. 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.

Principal axis factor analysis demonstrates the first hypothesis that learning styles and thought management are associated. Therefore, it is possible to verify the second hypothesis that immersive learning and critical thinking are associated. In order to test the second hypothesis, the sedimentation of the four factors that explained 88% of the total variance was estimated.

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).

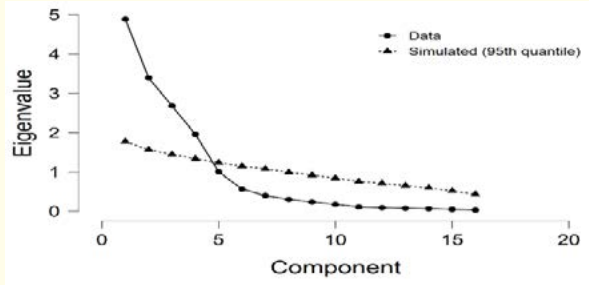


***Figure 1:*** Sedimentation of factorial weights.

The sedimentation coefficients demonstrated the second hypothesis that immersive learning is linked to critical thinking. Such a demonstration made it possible to test the hypothesis that the indicators of the variables are correlated. The relationship between self-management of knowledge, as an indicator of immersive learning, and informative questioning, as a reflection of self-management of thought, was established from the exploratory factor analysis.

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. critical (see Figure 2).

The exploration of the main axes, as well as the relationship between the factors and indicators, allowed us to move towards the analysis of the relationships between the four dimensions. The trajectory analysis allowed corroborating the relationship between immersive learning and critical thinking.

The relationships between the factors suggest that non-immersive learning without critical thinking is correlated with non-immersive learning with critical thinking (0.18), as well as with immersive learning without critical thinking (0.07) and immersive learning with critical thinking. critical (0.05). That is, the policies of return to the virtual classroom seem to have influenced the learning and thoughts reported in the literature from 2020 to 2023.

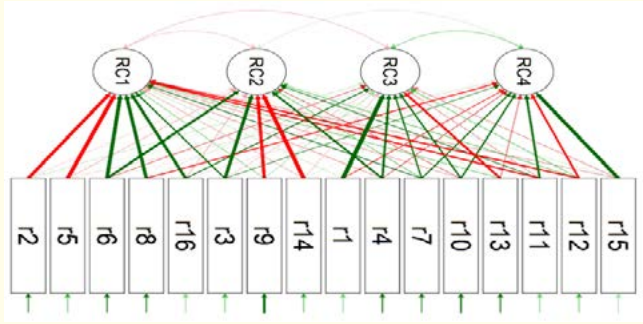


***Figure 2:*** Factor analysis of principal axes with promax rotation. Source: Prepared with data from the study. RC1 = Traditional Learning, RC2 = Immersive Learning, RC3 = Uncritical Thinking, RC4 = Without Immersive Learning and Without Critical Thinking.

The hypothesis that traditional learning determines immersive learning because it is considered to be an extension was verified through the analysis of direct effects. An incidence of traditional learning on uncritical and critical thinking is appreciated, although not significant. Such relations are intensified when observing the indirect effects. An increase in predictive power is noted, but without significant scope.

In addition, the analysis of the total effects suggests that immersive learning is not a mediating factor of the effect of traditional learning. In other words, the coexistence between traditional and immersive learning does not mean that they are structured in a mediating process.

Regarding the relationship between the dependent variables, uncritical and critical thinking maintain insignificant covariances. In other words, they can be modeled as dependency relationships. The learning outcome, being related to the learning method, suggests a trajectory structure.

The trajectory model indicates the spurious relationship between the learning method, whether traditional or immersive, with respect to the learning outcome, whether uncritical or critical. In other words, the mediation and moderation of the relationships between the method and the learning outcome will explain and predict a structure of relationships alluding to the management, production and transfer of knowledge (see Figure 3).

In summary, the literature consulted from 2020 to 2023 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 immersive learning 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 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 no -immersive learning without critical thinking is the central axis of the research agenda during the pandemic in the reviewed literature.

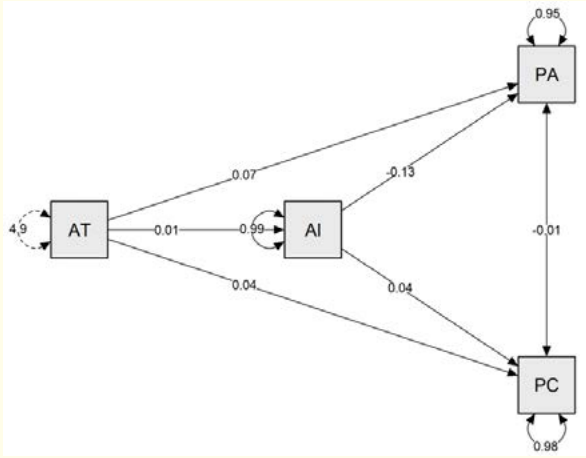


***Figure 3:*** Trajectory model of the determinants of uncritical and critical thinking. Source: Prepared with data from the study. AT = Traditional Learning, AI = Immersive Learning, PA= Uncritical Thinking, PC = Critical Thinking.

## Discussion

The contribution of this study to the state of the question lies in the establishment of non-immersive learning without critical thinking as the guiding axis of the research agenda in the period 2020 to 2023. In reference to the state of the art where it was suggested that in the virtual classroom formative learning with a humanistic sense predominated, the present work warns that this learning could have been influenced by another traditional learning style, but not critically [31]. 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 does not seem to have been oriented towards immersive or critical learning [32]. In addition, the lack of confinement and the return to the face-to-face classroom does not seem to guarantee the emergence of immersive learning with critical thinking. Lines of research on the effects of the pandemic on the types of learning will make it possible to identify ways of analyzing 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, digital social networks and platforms, but the literature warns that this type of immersive learning would not be related to other types of learning, although will link with others not. critical thoughts [33]. 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 the autonomy of the students 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 quite 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 returning to the face-to-face classroom can influence the predominance of some type of learning and thought management, although its legitimacy or at least not being questioned is guaranteed because some style of learning and thought prevails in the virtual classroom. was not established.

Hypothesis 1 that learning styles and thought self-management are associated was demonstrated [34]. The learning method and the means of knowledge are linked by the didactic results. The cognitive-affective model of immersive learning includes six dimensions: interest, motivation, self-efficacy, achievement, cognition, and self-regulation. In the present work, four dimensions related to the learning method and the type of thinking were established. Contrary to the cognitive-affective model of immersive learning, which maintains that the learning method produces agency, the present study warns that immersive learning coexists with non-immersive learning. In other words, the sample surveyed suggests that, in a risk scenario, both learning methods coexist with respect to the type of thinking. Such a finding is relevant because immersive learning is a determinant of factual, conceptual or procedural knowledge, but in the face of the pandemic, both immersive and non-immersive learning methods would be linked to the three types of knowledge.

Hypothesis 2 that immersive learning and critical thinking are correlated was demonstrated [35]. Teaching through augmented reality determined the questioning of unverifiable information. The impact of immersive learning on conceptual knowledge and argumentation was established in a context of exposure to risks of contagion, disease and death from COVID-19. The present work assumed that immersive learning and critical thinking are associated with non-immersive learning and non-critical thinking. Spurious relationships were found that open the discussion about the impact of the learning method with respect to the self-management of thought.

Hypothesis 3 immersive indicators of learning style and associated thought self-management was demonstrated [36]. The authors tested the model in which external determinants (utility, curiosity, and influence), mediators (absorption and reflection), and moderators (openness and literacy) affect reflexive intention. In the present work it is verified that the factors of immersive and non-immersive learning with critical and uncritical thinking are associated. Therefore, the model can include mediating and moderating factors to determine the self-management of procedural, conceptual or factual thought and knowledge.

## 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. When comparing the state of the art with the evaluations of Los Expert judges 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 work warns that non-immersive learning without critical thinking could legitimize any anti-COVID-19 policy and strategies. the face-to-face classroom was not replaced by the virtual classroom, it is expected that both coexist in a scenario of return to the face-to-face classroom.

In consideration of the studies where the learning method is associated with the learning outcome, the present work corroborates the assumption that immersive learning is linked to critical thinking. Rather, traditional learning, as assessed by expert judges, has a greater impact on uncritical thinking and has the same effect as immersive learning on critical thinking. In other words, both methods coexist with respect to the prediction of both learning outcomes. Such a finding suggests that the pandemic impacted both learning methods by reducing their effects on learning outcomes. In the case of distancing and confinement policies, the traditional learning method was reduced to a minimum, although immersive learning was not consolidated in relation to the prediction of the uncritical and critical learning outcome. Therefore, the model suggests that traditional learning and immersive learning are emerging as indirect determinants of learning outcome. The inclusion of mediating and moderating variables will increase the predictive power of the model.

The findings found in the present work warn that traditional learning and immersive learning predict critical thinking. Such a result indicates a dual teaching strategy that would increase the predictive power of the model. The consulted literature warns that mediating variables such as reflection and absorption increase the explanation of the learning result, but moderating variables such as openness and literacy increase the prediction of uncritical and critical thinking more. In the pandemic scenario, the traditional class-

room gave way to the virtual classroom, although the traditional learning method consisting of one-way communication and unilateral motivation prevailed over virtual learning based on content self-management.

Therefore, the virtue of this work lies in the prediction of the learning outcome from the learning method. In the case of critical thinking, no difference was found with respect to its prediction from traditional learning and immersive learning. It means then that immersive learning did not consolidate or replace traditional learning in terms of predicting critical thinking during the pandemic according to the sample of expert judges. In contrast, the limitation of the study consists in the size of the sample of 100 expert judges from universities in central Mexico. The representativeness of the sample could be greater with the increase in the number of respondents. In addition, the review of the literature could extend the Journal citation Report to be able to generate a more representative selection of findings that the judges can evaluate.

It is pertinent to recommend a line of research concerning the inclusion of mediating and moderating variables to generate a predictive structure of the learning outcome. The inclusion of the Journal citation Report will increase the size of the sample of findings and the more deliberate evaluation of the expert judges. The Delphi Technique can be complemented with the survey of a Likert scale-type instrument that allows investigating the mediating and moderating variables stated in the literature as factors that reduce or increase the predictive power of the learning method on the learning outcome. In this way, a model of structural equations would be generated in order to evaluate the reliability, validity and adjustment of the structure of predictive relationships between the external, mediating, moderating and dependent variables.

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