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Learning of the Sustainable Development Goals (SDG) at a Public University in Central Mexico

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Abstract

The emergency of the SARS-CoV-2 coronavirus and the COVID-19 disease forced educational systems to move from face-to-face to virtual classrooms. In this scenario, disseminating the Sustainable Development Goals (SDG) on virtual platforms intensified immersive learning. The objective of this work was to establish the neural network of a sample of students exposed to the immersive dissemination of the SDGs during the pandemic. An exploratory, cross-sectional, and correlational study was conducted with a sample of 100 professional practitioners and social servants attached to a public university in central Mexico. The results show the prevalence of four nodes related to SDGs 9, 13, 14, and 15. The present work found an innovation in the order of SDGs most widespread and assimilated by the sample and about the state of the art and the limits of the sample size it is recommended to extend the study to the type of immersion: gamified, augmented, or virtualized reality to establish significant differences by type of SDG. In this sense, the gamification of quality of life was anticipated by innovative industrialization and climate action, although the other SDGs should be modeled as predictors of quality of life without gamification and rather in a risk scenario such as the effects of climate change.

Keywords - *Agenda, Immersive Learning, Quality of Life, Intellectual Capital, Sustainable Development Goals*

Introduction

Human Development is structured at different levels [1]. At the individual or personal level theories that explain the impact of childhood on the other stages of life prevail [2]. Next, the interpersonal level where the influence of relationships between humans concerning third parties is analyzed [3]. Then, the group level is where differences are observed within the group or compared to other groups concerning their needs, expectations, or resources in the face of conflicts and changes [4]. Finally, the collective, social, or ideological level where the discipline appreciates the logic of centrality as a guide for economic, political, and social decisions concerning the periphery as a provider of natural and human resources for the development of centrality [5].

From this level of explanation approach, Human and Sustainable Development are linked by the relationships between individuals, groups, and societies [6]. Indeed, the literature and curricular plans do not link or oppose the SDGs with Human Development by reducing it to

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an individual level. Still, recent studies suggest that both face the challenges of climate change [7]. Therefore, the Comprehensive Disaster Risk Management (GIRD) and the Civil Protection Frameworks (MPC) warn that the threats, risks, and dangers of climate change make individuals, groups, and societies more vulnerable and resilient [8].

In this new paradigm, the quality of life shows competitive advantages that make it a central node of communication; prevention, and risk reduction [9]. In this way, Human Development is linked to Sustainable Development [10]. Such is the case of quality-of-life models which are the analysis of vulnerability, resilience, helplessness, and happiness or subjective well-being [11]. These variables would allow a diagnosis of the impact of risks, dangers, and threats on individuals, groups, and societies [12]. Such variables can be observed indirectly in the classroom [13, 14]. In this sense, immersive learning, defined as the communication of content through gamification, virtuality, or augmented reality, can serve to transfer communication, prevention, and risk reduction in the classroom [15].

Consequently, the inclusion of immersive learning about risks in the classroom will allow for updating the Human Development subject and specifying its relationship with the SDGs [16]. The objective of this work was to analyze the relationship between the SDGs and Human Development through immersive learning published in the literature from 2020 to 2023.

Are there significant differences between the SDGs disseminated in social digital networks to immersive learning of the SDGs in the classroom?

Hypothesis 1. *Given that the SDGs and quality of life can be reduced to a minimum expression for teaching and learning in the classroom, significant differences are expected between the universal guidelines and their dissemination through gamification, augmented reality, or virtuality.*

Hypothesis 2. *If the SDGs and quality of life can be made affordable through immersive learning, then reduced dissemination of the SDGs in the classroom through Comprehensive Disaster Risk Management (IDRM) paradigms or International Protection Frameworks will be possible. Civilian (MIPC). In this way, the differences between the general and immersive contents suggest differences in terms of gamification, augmented reality, or virtuality in Higher Education Institutes (HEIs).*

Hypothesis 3. *Suppose there are differences between the SDGs concerning immersive broadcasting. In that case, impacts on quality of life and its dimensions of life satisfaction, opportunity expectations, and perceived resources will be anticipated.*

Materials and Method

A cross-sectional, exploratory, and correlational study was carried out with a sample of 100 (*M* = 21.23 *DE* = 4.3 years and *M* = 9'897.00 *DE* = 4'762.00 monthly income) professional practitioners and social servants of Information and Communication Technologies (ICT), Learning and Knowledge Technologies (TAC) and Empowerment and Participation Technologies (TEP) at a public university in central Mexico.

The Immersive Learning Inventory was used, which includes 17 items around three dimensions of analysis: 1) Gamification ("The first SDG related to poverty will be more important if it is disseminated as a game"), 2) Virtuality ("The fifth SDG alluding to gender equality will be more relevant if it is disseminated virtually"), 3) Augmentation ("The seventh SDG regarding affordable and non-polluting energy will be more credible if it is disseminated increased"). Each item includes five response options ranging from 0 = "not at all agree" to 5 = "quite agree".

The reliability reached alpha and omega values of 0.753 and 0.748, as well as correlations between the respective factor and item that ranged between 0.435 and 0.567.

The Quality of Life Gamification Scale was used, which includes 9 items structured in three dimensions related to life satisfaction ("The fourth SDG regarding quality education will be more satisfactory if its gamification is systematic"), perceived resources ("The fifth SDG related to gender equality will be more useful if real cases are disseminated in socio-digital networks"), expectations of opportunity ("The eighth SDG associated with decent work and economic growth will be more convincing if it is exhibited in augmented reality"). Each item is answered with seven response options ranging from 0 = "It does not look like my situation at all" to 7 = "It looks a lot like my situation". The reliability of the general scale and the subscales reached alpha and omega values that ranged between 0.745 and 0.770, as well as item factor correlations between 0.324 and 0.567.

Respondents were contacted through institutional mail. Confidentiality letters were attached to guarantee anonymity and information about the objectives of the study and those responsible for the project. In a focus group session, the concepts were equated, in another Delphi, the items were evaluated and in a final session, the respondents answered the final instrument. All the sessions were carried out on the page: https://meet.jit.si/FollowingPathsUndermineHappily The data was processed in JASP version 16.

The coefficients of centrality, grouping, and structuring were estimated to contrast the study hypotheses. The values of the parameters that approached the unit were assumed as evidence of non-rejection of the hypotheses.

Results and Discussion

The centrality, estimated by four indicators, suggests that the immersive learning of SDG 13 related to climate action is a regulator of the other nodes. In this sense, the immersive learning of SDG 13 differs from the other nodes in that it filters its impact on the study sample. SDG 13 reduces the impact of the other SDGs established as learning information nodes (see Table 1).

Table 1: Centrality Measures Per Variable.

	Networks			
Variable	Betweenness	Closeness	Strength	Influence
SDGs1	-0.581	0.684	0.573	-1,204
SDGs2	-0.215	0.822	-0.529	0.352
SDGs3	1,614	1,073	1,155	-1,254
SDGs4	0.333	-0.136	-0.766	-0.528
SDGs5	-0.581	-1,997	-1,823	-0.959
SDGs6	-0.764	-0.594	0.849	-0.720
SDGs7	-0.581	-0.948	-0.091	1,385
SDGs8	-0.947	-1,778	-1,830	0.711
SDGs9	-0.215	-0.529	-0.798	-0.484
SDGs10	-0.398	0.012	0.014	1,275
SDGs11	-0.947	-0.548	0.149	-0.780
SDGs12	-0.581	0.209	0.562	1,405
SDGs13	2,162	1,568	1,047	1,280
SDGs14	-0.032	0.525	0.683	0.735
SDGs15	1,065	1,349	1,099	0.385
SDGs16	-0.947	-0.039	-1,215	-0.222
SDGs17	1,614	0.328	0.922	-1,376

The grouping measured by four other coefficients suggests that SDG 14, alluding to underwater life, reconfigures the other SDGs established as information, dissemination, and learning nodes. Therefore, the regulation of the SDGs, although it is established by node 13, which suggests direct action against climate change, is complemented by SDG 14, referring to the importance of reefs as CO2 collectors and oxygen producers (see Table 2).

Table 2: Clustering Measures Per Variable.

	Networks			
Variable	Barratt	Onnela	WS	Zhang
SDGs1	-0.380	0.353	-0.667	-0.046
SDGs10	2,081	0.770	2,128	0.431
SDGs11	-0.282	0.327	-0.667	0.945
SDGs12	-0.143	-0.209	-0.160	1,969
SDGs13	1,396	1,281	1,192	-1,644
SDGs14	1,410	0.677	2,128	1,542
SDGs15	-1,474	0.711	-0.667	-0.713
SDGs16	0.377	-0.593	-0.160	-0.617
SDGs17	-0.925	0.359	-0.667	0.641
SDGs2	-0.469	-0.609	-0.667	-0.452
SDGs3	1,201	2003	1,192	-1,012
SDGs4	-0.891	-0.733	-0.160	-0.957
SDGs5	-0.191	-1,775	-0.160	0.461
SDGs6	-0.946	0.569	-0.667	-0.172
SDGs7	-0.790	-0.703	-0.667	1,075
SDGs8	0.405	-1,535	-0.667	-0.541
SDGs9	-0.377	-0.894	-0.667	-0.908

Structuring anticipates the input and output of information. In the case of node 13, it was related to node 9 related to industry, innovation, and infrastructure (.534). It means, then, that climate action has its principle of a learning network in industrialization with social responsibility. In the case of node 14, it was associated with node 15 alluding to the life of terrestrial ecosystems (.729). In other words, responsible production and consumption end with the balance of terrestrial ecosystems (see Table 3).

Table 3: Weight Matrix.

	Networks																
	SDGs1	SDGs2	SDGs3	SDGs4	SDGs5	SDGs6	SDGs7	SDGs8	SDGs9	SDGs10	SDGs11	SDGs12	SDGs13	SDGs14	SDGs15	SDGs16	SDGs17
SDGs1	0,000	0.222	-0.236	0.017	0.017	0.257	-0.234	0.224	-0.100	-0.122	-0.452	0.602	0.365	0.510	-0.036	-0.347	-0.566
SDGs2	0.222	0,000	0.593	0.233	-0.105	-0.075	0.050	-0.080	0.293	0.090	0.194	0.015	-0.487	0.215	-0.520	0.366	0.018
SDGs3	-0.236	0.593	0,000	-0.141	-0.301	-0.483	0.540	0.091	-0.270	0.407	-0.232	0.246	0.365	0,000	0.156	-0.213	-0.431
SDGs4	0.017	0.233	-0.141	0,000	0.334	-0.160	0.014	0.294	-0.336	0.187	-0.035	-0.351	0.383	-0.401	0.491	0,000	-0.020
SDGs5	0.017	-0.105	-0.301	0.334	0,000	-0.396	0.539	0.115	-6,994	0.233	0.075	0,000	0.139	-0.062	0.015	-0.201	-0.139
SDGs6	0.257	-0.075	-0.483	-0.160	-0.396	0,000	0.857	0.097	-0.248	0.852	0.101	-0.068	-0.080	-0.125	-0.147	0.285	-0.265
SDGs7	-0.234	0.050	0.540	0.014	0.539	0.857	0,000	0.023	0.109	-0.664	-0.160	0.032	0.132	0.093	0.136	-0.060	0.212
SDGs8	0.224	-0.080	0.091	0.294	0.115	0.097	0.023	0,000	0.485	-0.054	0.169	0.066	-0.479	0.023	-0.106	0.193	0.168
SDGs9	-0.100	0.293	-0.270	-0.336	-6,994	-0.248	0.109	0.485	0,000	0.322	-0.212	0.066	0.534	-0.139	0.147	-0.101	-0.010
SDGs10	-0.122	0.090	0.407	0.187	0.233	0.852	-0.664	-0.054	0.322	0,000	0.083	-0.079	0,000	0,000	0.210	-0.267	0.357
SDGs11	-0.452	0.194	-0.232	-0.035	0.075	0.101	-0.160	0.169	-0.212	0.083	0,000	0.616	0.383	0.510	-0.212	0.060	-0.523
SDGs12	0.602	0.015	0.246	-0.351	0,000	-0.068	0.032	0.066	0.066	-0.079	0.616	0,000	-0.007	-0.831	0.606	0.064	0.653
SDGs13	0.365	-0.487	0.365	0.383	0.139	-0.080	0.132	-0.479	0.534	0,000	0.383	-0.007	0,000	0.119	-0.483	0.484	0.191
SDGs14	0.510	0.215	0,000	-0.401	-0.062	-0.125	0.093	0.023	-0.139	0,000	0.510	-0.831	0.119	0,000	0.729	-0.012	0.614
SDGs15	-0.036	-0.520	0.156	0.491	0.015	-0.147	0.136	-0.106	0.147	0.210	-0.212	0.606	-0.483	0.729	0,000	0.366	-0.309
SDGs16	-0.347	0.366	-0.213	0,000	-0.201	0.285	-0.060	0.193	-0.101	-0.267	0.060	0.064	0.484	-0.012	0.366	0,000	0.071
SDGs17	-0.566	0.018	-0.431	-0.020	-0.139	-0.265	0.212	0.168	-0.010	0.357	-0.523	0.653	0.191	0.614	-0.309	0.071	0,000

The examined centrality, grouping, and structuring values suggest non-rejection of the hypotheses. In other words, the dissemination and learning of the SDGs in the immersive classroom is centered at node 13, clustered at node 14, started at node 9, and finished at node 15. Therefore, the neural network of information and learning was established with the immersive learning of SDGs 9, 13, 14, and 15 related to industrialization and innovation, climate action, life below water, and terrestrial ecosystems. That is the SDGs that were assimilated through gamification, augmented and virtual reality suggest that species and their environment are compromised by an innovative industrialization in the making.

To establish the determinants of the gamified quality of life, we proceeded to estimate the trajectory model in which SDGs 9 and 13 are included as exogenous factors, and nodes 14 and 15 as predictive endogenous factors. The results show that SDG 9 predicts gamification of quality of life.

Fit and residual values [x^2 = 13.24 (13gl) p = 0.61; GFI = 0.990; IFC = 0.995; RMSEA = 0.087] indicate non-rejection of the hypotheses. In other words, SDGs 9 and 13 are predictors of gamification of quality of life, even when the other nodes do not predict it satisfactorily. The two determining factors suggest that climate change and industry coexist in a gamification of favorable scenarios. for the quality of life.

Conclusion and Recommendations

This study aimed to create a network for sharing information and knowledge on how to integrate the Sustainable Development Goals (SDGs) in the classroom. The research identified nodes 9, 13, 14, and 15 as the central axes of the revised research agenda for 2020-2023. The findings indicated that the immersive integration of the SDGs is not consistent across the board. To improve the accuracy of the coefficients, it is recommended to expand the study and address the sample limitations. The study can help differentiate the teaching and learning of the SDGs based on the type of immersion, such as augmentation, virtuality, and gamification. Lastly, the study suggests that industrialization can be socially responsible while making efforts towards climate change, leading to improved quality of life.

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