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Teamwork skills in academic events that promote open innovation: A comparative analysis between in-person and virtual formats

Habilidades de trabajo en equipo en eventos académicos que fomentan la innovación abierta: Un análisis comparativo entre formato presencial y virtual

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Abstract

Academic events that promote open innovation, within the training of engineers, allow knowledge to be obtained and developed in certain areas, but also promote the development of competencies and skills in the participants. In this research, the teamwork skills they develop within two academic events, in person and virtually, with similar characteristics, were evaluated with the aim of comparing how much they take advantage of the ability to work as a team. A methodology was used with a descriptive quantitative approach and through the application of evaluation instruments that were designed based on item response theory and classical test theory. This project was applied at the Instituto Tecnológico de Tlalnepantla in the Latin American Innovation Rally event in virtual format and the Hackatec event in-person format in local stages. They participated in each event through multidisciplinary work teams, responding to NGO challenges in a continuous period of 28 hours. Based on the results obtained in a comparative table, the hypothesis that the ability to work as a team is developed in the same way in an academic event in virtual format as in one in person.

Teamwork, Multidisciplinary teams, Academic innovation events

Resumen

Los eventos académicos que fomentan la innovación abierta, dentro de la formación del ingeniero permiten obtener y desarrollar el conocimiento en determinadas áreas, pero también impulsan el desarrollo de competencias y habilidades en los participantes. En esta investigación se evaluó la habilidad del trabajo en equipo que desarrollan dentro de dos eventos académicos, de forma presencial y virtual con características similares con el objetivo de comparar que tanto aprovechan la habilidad de trabajar en equipo. Se utilizó una metodología con enfoque cuantitativo descriptivo y por medio de la aplicación de instrumentos de evaluación que se diseñó en base a la teoría de respuestas del item y la teoría clásica de pruebas. Este proyecto se aplicó en el Instituto Tecnológico de Tlalnepantla en el evento Rally latinoamericano de innovación formato virtual y el evento Hackatec formato presencial etapas locales. En cada evento participaron por medio de equipos de trabajo multidisciplinario dando respuesta a desafíos de ONG en un lapso de 28 horas continua. Con base en los resultados obtenidos en un cuadro comparativo se refutó la hipótesis de que la habilidad de trabajar en equipo se desarrolla de igual manera en un evento académico en formato virtual que en uno de formato presencial.

Trabajo en equipo, Equipos multidisciplinarios, Eventos académicos de innovación

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Introduction

Competence-based education at higher level, specifically in engineering education, is based on identifying and developing specific and generic competences within engineering education, the latter offering students life skills that they can apply in their personal or work environment. Academic events play a very important role in the development of these competences, which is why this research project analyses the use of teamwork skills in academic events, specifically the participation in Hackatec in a face-to-face format and the Latin American Innovation Rally in a virtual format, both in the year 2022. It is important to verify the contrast of these events due to their similarity in work characteristics, in both events challenges are solved in a period of 28 continuous hours of work, the teams that participate.

They must be multidisciplinary and elaborate the solution proposals with an exposition of the team work. In order to carry out this analysis, information was collected by means of evaluation instruments applied to the participants of both events at the Tlalnepantla sites. The information obtained was analysed using SPSS software, where proposals for improvement were identified for future participation in these events.

The methodology applied was the descriptive quantitative one, which answers the research question: What level of success does the ability to work as a team develop in engineering students when participating in academic events in person and virtually? This allows us to fulfil the objective of evaluating the teamwork skills indicator with participants in the Hackatec and Rally Latinoamericano de Innovación academic events at the Tlalnepantla 2022 headquarters, using a form that is analysed with SPSS software, in order to highlight the success of teamwork in each of the events.

Methodology

Delimitation of the problem and research question

The participation in academic events in the past years has reflected the lack of skills that allow them to achieve one of the first places in the finals at national level.

For this reason, this project is carried out to identify the influence of the ability to work in teams in different formats to obtain better results in the participation in academic events. In past years, participation in the Latin American Rally event was a unique case within the institution and on two occasions it managed to reach second place nationally.

In 2022, this new event called Hackatec will be integrated in an on-site format that offers participants experiences similar to the Rally. Given these options, we seek to answer the following question: What level of success does the ability to work as a team develop in engineering students when participating in academic events in different formats (face-to-face and virtual)? The study was carried out with the analysis of data from the events: Latin American Innovation Rally 2022 virtual format and Hackatec 2022 face-to-face format, which allow a comparative table to be drawn up of the participants' achievement in working on the skill of teamwork. Both events have similar characteristics, such as solving challenges in a period of 28 continuous hours and participating in multidisciplinary teams with proposed solutions, but they take place in different formats.

Procedure

The competences and soft skills within engineering education in Mexico are applied in each classroom with the didactic tools that each teacher masters; however, it is very important to consider the options that the institution itself provides to enrich them. This project is based on a descriptive quantitative methodology which, through the collection of data from each of the participants in these events, allows us to reflect on the benefits of working as a team in different formats in order to obtain better results in the competences.

It is important to consider that the data collection was based on the item response theory and classical test theory, identifying a test of mastery calculated by the point biserial coefficient, making it possible to identify the use of an assessment instrument based on the skills that ASIBEI in the engineering graduate profile book (2016) defined as a priority in the training of the engineer.

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Subsequently, the data was downloaded to SPSS software where the variables of use were defined to obtain the results to identify the development strategies within the specific objectives of the project.

Hypothesis

The ability to work in teams is developed in the same way in face-to-face events as in virtual events.

Population and sample

In the Rally (event2) and Hackatec (event1) events in 2022 the population size was 53 and 51 participants respectively with a 95% confidence level which consisted of a sample of 47 questionnaires in event2 and in event1 the population size was 50 which consisted of a sample of 45 questionnaires.

This sample was determined by finite sample calculation:

$$n = \frac{z^2 pqN}{e^2(N-1) + z^2 pq}$$

Figure 1 Formula determined for the finite sample calculation

Results

Descriptive statistical analyses for both events were first defined for each of the questions. Table 1 Rally (event1) and Table 2 Hackatec (event2)

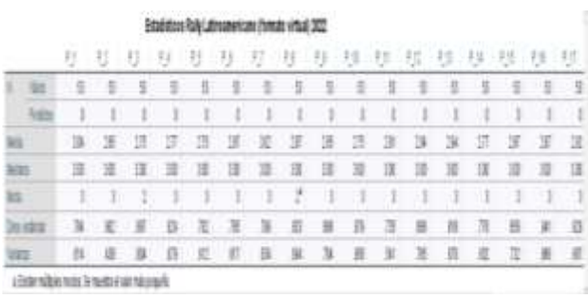

Table 1 Descriptive analysis by question event 1

Table 2 Descriptive analysis by question event 2

When comparing the results of both events, it can be identified that the trend is reflected in the statement number 3 "almost always", so it is determined that the event in which the ability to work in a team is most developed is in the Hackatec face-to-face format. Also, out of 19 questions, 89.47% of the "almost always" statements were for the Hackatec event. This indicates that the event that requires reinforcement of teamwork skills is the virtual format Rally. In order to identify areas of opportunity in the development of improvement strategies, we considered the frequency of successes in statement number 2 "not very often", where it was important to establish workshops that allowed us to reinforce these actions in order to apply them in the next edition of the Latin American Rally, as well as in Hackatec. Table 3 Comparison of frequency between both events.

Rally			Hackatec		
P_1 Rally			**P_1 Hackatec**		
	N	**%**		**N**	**%**
Never	1	1.9%	Never	2	3.9%
Bit	12	22.6%	Bit	11	21.6%
Almost always	24	45.3%	Almost always	21	41.2%
Always	16	30.2%	Always	17	33.3%
P_2 Rally			**P_2 Hackatec**		
	N	**%**		**N**	**%**
Bit	16	30.2%	Bit	15	29.4%
Almost always	29	54.7%	Almost always	28	54.9%
Always	8	15.1%	Always	8	15.7%
P_3 Rally			**P_3 Hackatec**		
	N	**%**		**N**	**%**
Never	3	5.7%	Never	1	2.0%
Bit	20	37.7%	Bit	16	31.4%
Almost always	17	32.1%	Almost always	20	39.2%
Always	13	24.5%	Always	14	27.5%
P_4 Rally			**P_4 Hackatec**		
	N	**%**		**N**	**%**
Never	3	5.7%	Never	5	9.8%
Bit	16	30.2%	Bit	14	27.5%
Almost always	24	45.3%	Almost always	21	41.2%
Always	10	18.9%	Always	11	21.6%
P_5 Rally			**P_5 Hackatec**		
	N	**%**		**N**	**%**
Never	2	3.8%	Never	3	5.9%
Bit	18	34.0%	Bit	14	27.5%
Almost always	24	45.3%	Almost always	19	37.3%
Always	9	17.0%	Always	15	29.4%
P_6 Rally			**P_6 Hackatec**		
	N	**%**		**N**	**%**
Never	2	3.8%	Never	1	2.0%
Bit	14	26.4%	Bit	10	19.6%
Almost always	26	49.1%	Almost always	28	54.9%
Always	11	20.8%	Always	12	23.5%
P_7 Rally			**P_7 Hackatec**		
	N	**%**		**N**	**%**
Never	1	1.9%	Never	1	2.0%
Bit	13	24.5%	Bit	14	27.5%
Almost always	23	43.4%	Almost always	20	39.2%
Always	16	30.2%	Always	16	31.4%
P_8 Rally			**P_8 Hackatec**		
	N	**%**		**N**	**%**
Never	1	1.9%	Never	3	5.9%
Bit	19	35.8%	Bit	7	13.7%
Almost always	19	35.8%	Almost always	29	56.9%
Always	14	26.4%	Always	12	23.5%

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Rally			Hackatec		
P_9 Rally	**N**	**%**	**P_9 Hackatec**	**N**	**%**
Never	3	5.7%	Never	2	3.9%
Bit	16	30.2%	Bit	13	25.5%
Almost always	20	37.7%	Almost always	24	47.1%
Always	14	26.4%	Always	12	23.5%
P_10 Rally	**N**	**%**	**P_10 Hackatec**	**N**	**%**
Never	6	11.3%	Never	2	3.9%
Bit	15	28.3%	Bit	15	29.4%
Almost always	18	34.0%	Almost always	22	43.1%
Always	14	26.4%	Always	12	23.5%
P_11 Rally	**N**	**%**	**P_11 Hackatec**	**N**	**%**
Never	1	1.9%	Bit	13	25.5%
Bit	17	32.1%	Almost always	27	52.9%
Almost always	26	49.1%	Always	11	21.6%
Always	9	17.0%			
P_12 Rally	**N**	**%**	**P_12 Hackatec**	**N**	**%**
Never	3	5.7%	Never	1	2.0%
Bit	13	24.5%	Bit	12	23.5%
Almost always	21	39.6%	Almost always	24	47.1%
Always	16	30.2%	Always	14	27.5%
P_13 Rally	**N**	**%**	**P_13 Hackatec**	**N**	**%**
Never	2	3.8%	Never	1	2.0%
Bit	13	24.5%	Bit	10	19.6%
Almost always	24	45.3%	Almost always	24	47.1%
Always	14	26.4%	Always	16	31.4%
P_14 Rally	**N**	**%**	**P_14 Hackatec**	**N**	**%**
Never	1	1.9%	Never	2	3.9%
Bit	20	37.7%	Bit	9	17.6%
Almost always	22	41.5%	Almost always	26	51.0%
Always	10	18.9%	Always	14	27.5%
P_15 Rally	**N**	**%**	**P_15 Hackatec**	**N**	**%**
Never	2	3.8%	Bit	13	25.5%
Bit	17	32.1%	Almost always	26	51.0%
Almost always	20	37.7%	Always	12	23.5%
Always	14	26.4%			
P_16 Rally	**N**	**%**	**P_16 Hackatec**	**N**	**%**
Never	5	9.4%	Never	3	5.9%
Bit	12	22.6%	Bit	13	25.5%
Almost always	21	39.6%	Almost always	23	45.1%
Always	15	28.3%	Always	12	23.5%
P_17 Rally	**N**	**%**	**P_17 Hackatec**	**N**	**%**
Never	2	3.8%	Never	2	3.9%
Bit	14	26.4%	Bit	10	19.6%
Almost always	23	43.4%	Almost always	29	56.9%
Always	14	26.4%	Always	10	19.6%
P_18 Rally	**N**	**%**	**P_18 Hackatec**	**N**	**%**
Never	2	3.8%	Never	1	2.0%
Bit	17	32.1%	Bit	10	19.6%
Almost always	22	41.5%	Almost always	28	54.9%
Always	12	22.6%	Always	12	23.5%
P_19 Rally	**N**	**%**	**P_19 Hackatec**	**N**	**%**
Never	3	5.7%	Never	2	3.9%
Bit	11	20.8%	Bit	12	23.5%
Almost always	28	52.8%	Almost always	23	45.1%
Always	11	20.8%	Always	14	27.5%

Table 3 Frequency analysis per statement per question for both events

The last results are shown in Table 4 where the descriptive statistics for both events were analysed in general

Heckatec Statistics				**Rally Statistics**		
ID				ID		
N	Valid	51		N	Válido	53
	Lost	0			Lost	0
Half		26.00		Half		27.00
Median		26.00		Median		27.00
Fashion		1[a]		Fashion		1[a]
Standard Deviation		14.866		Standard Deviation		15.443
Variance		221.000		Variance		238.500
a. There are multiple modes. It shows the smallest value				a. There are multiple modes. The smallest value is displayed.		

Table 4 Descriptive-total analysis of both events

In summary, the results of the statistical analysis of both events indicate that the centre of the distribution is around the values of the means 26 for event1 and 27 for event2, where in both cases the standard deviation and variance are relatively high, suggesting that the individual values vary significantly in relation to the mean indicating a rather dispersed or asymmetric distribution.

Conclusions and decisions

It is important to identify that both events identify similar results with small variations from each other, allowing us to identify that the importance of participating in face-to-face academic events will continue to take a significant advantage over virtual academic events. This also allows us to know that the results obtained within this data analysis reject the hypothesis that both events have the same level of achievement in the ability to work in teams.

Currently, education and the development of competences within the training of students at higher education level is oriented towards diversified learning where, after the pandemic, strategies are being tried to be taken advantage of that in an emerging manner have solved immediate problems, but with which it is still not possible to complement them in their totality for meaningful learning. There are now many ways to make inroads into both formats and with more time to make them fully two hundred per cent effective ways of training future engineers. The work is still part of the updating of both actors, teachers and students, to be able to show better results in academic events with higher competitiveness.

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