

4.0 in 40 Series: An Extension Program to Develop Awareness for Industry 4.0

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Abstract

“4.0 in 40 Series : Industry 4.0 applied at the best organizations” is an extension project developed by the Research Group in Industry 4.0 (GPI4 – *Grupo de Pesquisa em Indústria 4.0*) of the Federal Institute of São Paulo (IFSP) that produced monthly webinars to both academic and industry communities in order to increase awareness around Industry 4.0 and the Post-Graduate Course in industry 4.0 that was implemented while the Series was ongoing. The objective of this paper is to present the utilized strategies to keep proximity, even virtually, with our student base, society in general and partners of IFSP during the isolation period imposed by COVID-19. We used the webinars as a digital marketing tool to generate awareness and keep the target audience engaged with both the school and the theme of Industry 4.0. Our results show that the objectives set for the 4.0 in 40 Series were achieved.

Keywords

Engineering Education, Extension Programs, Webinars, Industry 4.0.

1. Introduction

The beginning of 2020 was a great historic mark for humanity that will be remembered and studied for years to come. The appearance of a new virus (SARS-CoV-2) at the end of 2019 with a lethal index of approximately 5% but with high contagious index due to the propagation speed made the disease COVID-19 into one of the great epidemics of history, affecting all continents and creating, possibly, the great social isolation ever seen (Arruda, 2020).

Communication and Information Technologies allowed society to perceive, at the same speed as the virus was spreading, that the world was not ready for the sanitary, social, cultural, educational and economical effects brought by the pandemic. On January 2020, the images of the Chinese city of Wuhan, the virus epicenter, choked the world, displaying empty streets on a city with millions of inhabitants. However the low fatality index, as well as previous experiences with variations of the Corona viruses brought a felling that this would not happen in the Western World (Arruda, 2020).

This false tranquility ended quickly in Brazil and other Western countries around March 2020, as a radical transformation in personal relations and isolation measures were taken by local and federal governments. Panic rapidly emerged with the fast-developing scenarios of infection and deceased cases by COVID-19. Social isolation promoted severe and immediate economic changes, with the complete closing of some industry and service sectors and modified the relationship between people in several other activities, such as education.

According to Xiao & Li (2020), the new Corona virus made schools in one of the most feared spaces due to the high risks in contamination between kids and teenagers as even though they are less likely to have severe symptoms they would keep close contact with several adult groups such as teachers and educational professional and also at home with risk groups such as grandparents. Teachers and students were perceived as one of the main vectors for contamination of COVID-19 and, due to that perception, world policies left schools for last when considering eligible sectors to return to normal activities. Presential classes are only allowed to take place if several sanitary conditions and protocols are maintained and enforced. These protocols made the public-school system in several countries fall behind as they did not have the necessary resources to implement such measures.

In Brazil, the Health Ministry implemented measures towards the necessity of social isolation in order to reduce the spread of COVID-19. The São Paulo State Government shut down all public schools and declared a quarantine period based on the pandemic. The Rector of IFSP, that took a preventive measure in March 14th stopping classes for a period of 15 days, issued the Regulation N° 1.200/2020 suspending for an undetermined period the academic calendar for all its 37 campuses and administrative sectors, that included also distance learning, starting on March 23rd 2020 (IFSP, 2020)

More than a simple education problem, the impediment of schools to function reconfigured society, as families took over responsibilities on the every-day life of students that in a normal configuration would be held by educational staff. The absence of presential contact, classroom experience sharing and the direct contact between teachers and students promoted a deconstruction on both teaching and learning mechanisms. The complete new scenario generated discomfort with many social actors, increasing the risks for school dropout rates in this new educational context (Xiao & Li, 2020)

The Sorocaba campus of IFSP was, in 2020, still establishing itself in the city. As the second unit was still being adapted, through the implementation of laboratories for the Electronics and Mechatronics courses, there was a demand from several industry sectors through the Local Productive Arrangements (APL - *Arranjos Produtivos Locais*) tied to sectors such as Aeronautics, Renewable Energies and Metal-Mechanic, for the implementation of a post-graduate specialization course in Industry 4.0. The GPI4 was already working on the implementation of the course as described by Caldana (2020). The course began its first enrolment cycle in the second semester of 2021 offering 20 vacancies

1.1 Objectives

The suspension of all presential activities, as described above, jeopardized the natural growth of the campus in the Sorocaba city. It would be necessary to keep proximity, even virtually, with students and industrial partners of the institution while classes did not resume. GPI4 was then tasked to answer the following questions:

- What can we do to keep students and industry partners connected to the Institution?
- How to obtain information about the needs of industry during the pandemic process to further develop the curriculum and adapt the recent launched Post-Graduate program?

In order to answer both questions above, GPI4 developed the “4.0 in 40 Series”, with the objective of making monthly webinars for both the academic and industry communities presenting applications and other pertinent and relevant factors of Industry 4.0. We would focus not only on implemented solutions but also on ideas and start-ups on the sector with brand new ideas to display the possibilities and the reach of the pillar technologies of Industry 4.0 preferably in our local region but with opening for the global country scenario as well.

Even though the target audience was described on the project to be aimed at professionals, researchers and educators on both the public and private sectors the main focus was undoubtedly the students of Sorocaba’s IFSP as well as the other campuses of IFSP and other education institutions both private and public. For the 2020 year a minimum attendance of 10 viewers was expected at each event and for 2021 a minimum of 15. The structure of the webinars was to be such that it would be suitable for technicians to post-graduate professionals and students.

2. Literature Review

The literature review was divided in three main areas to support and orient the decisions as follows:

- a) What are the Distance Learning Education strategies?
- b) How to successfully implement a Youtube Webinar;
- c) What aspects of Industry 4.0 can be approached by the webinar method?

The researchers used Google Scholar (<https://scholar.google.com/>) as it allows for queries in several bases simultaneously. The keywords used were: **Distance Learning Education; Youtube Webinars; Industry 4.0**. Results were then revised with thesis and technical articles removed. Only English texts with more than 10 citations were selected and after the full review and selection process of reading the abstracts the articles on Table 1 were selected.

To support the webinar development, due to the rapid evolving documentation on the subject, further texts and blogs were added to the main result showed in Table 1 allowing for a better understanding and

evolution of the project. The Industry 4.0 review is very brief as material on it can be easily found in other articles and was not the focus of this research paper.

Table 1 –Literature Review Selected Papers

Author(s)	Title	Year
Frederick B. King, Michael F. Young, Kelly Drivere-Richmond, P. G. Schrader	Defining Distance Learning and Distance Education	2001
Puteri Suhaiza Sulaiman	Engineering Education through Students' Engagement in Virtual Learning Space	2019
Saurabh Vaidya, Prashant Ambad & Santosh Bhosle	Industry 4.0 – A Glimpse	2018
Edi Irawan, Ahmadi, Agus Prianggono, A.D. Sapaturo & M.S. Rachmandhani	YouTube Channel Development on Education: Virtual Learning Solutions during the Covid-19 Pandemic	2020
Maziriri, Eugene Tafadzwa; Gapa, Parson; Chuchu, Tinashe	Student Perceptions towards the Use of YouTube as an Educational Tool for Learning and Tutorials	2012

2.1 Distance Learning and Distance Education

According to King et al. (2001) learning improves capabilities in knowledge and/or behavior as a result of mediated experiences that are constrained by interactions with the situation. The author also subdivided into three different types: 1) instruction: objectives-driven learning; 2) exploration: without objectives; and 3) serendipity: unintended learning. King et al. (2001) defines Distance Learning as learning capabilities in knowledge and/or behaviors as a result of mediated experiences that are constrained by time and/or distance such that the learner does not share the same situation with what is being learned.

Still according to King et al. (2001), there are two forms of presenting the content to the spectators, either Synchronously or Asynchronously. Synchronous situations are time sensitive but geographically insensitive and they allow for more interaction with the public. Asynchronous are both time and geographically insensitive however with less interaction. Sulaiman (2019) also points to the increased necessity to develop content in these new platforms for the newer generation of students.

2.2 YouTube Webinars

YouTube is a global video platform, that allows users to watch, share and interact with videos. YouTube also has “live” events of streaming and it is used not only for entertainment purposes but also allows creation of educational content.

The YouTube Platform offers several advantages as described by Irawan et al. (2020):

“First, it can be accessed easily at any time, not necessarily at the same time. So the learning process is more flexible. Second, learning videos can be downloaded so that they can be studied offline. Third, videos can be integrated with other learning management systems such as Google Classroom, Moodle, and Edmodo easily. Fourth, videos can be shared via social media like WhatsApp, Facebook and Telegram easily”.

Maziriri et al. (2020) also cites other benefits such as the ability to attract the interest of the students, the ability to increase the focus and concentration on the subject as they are able to get context that would otherwise be difficult to obtain (such as rare experiments or keynote speakers). The platform also generates interest and suggested videos according to their database, allowing for a larger reach for the videos subject.

With the evolving and more advancing digital marketing strategies, there are several ways in which opportunities and engagement with the target audience can be explored with both the current public as well as new leads. Capturing leads in marketing exists before the internet, but in digital marketing a lead is often an internet website user, an event participant or a social media member that made their data

available. An excellent solution to show to current and new “customers” of a company and keep them engaged in your brand is the virtual seminar or Webinar (Tannure, 2016).

According to Santos (2019), the webinar is a growing marketing strategy, as it allow the presentation of relevant content as well as it can have a high level of interaction with the participants. The Webinar also allows growth, engagement and conversion of leads into “customers”. It is a naturally appealing format, with audiovisual contents that can lead to a higher engagement by the users based on the more humanized and personal experience.

For an education institution such as IFSP, a Webinar can be seen as a course preview or an exclusive masterclass, something that generates more attraction by the public than other formats such as PDF folders and flyers. It resembles a physical event and gathers an interested audience surrounding a previously arranged theme, allowing all participants to follow the knowledge path during transmission. As the transmission of the live event is a valued content, participant can subscribe to the event and the public on the live streaming session will be genuinely interested on the Webinar topic (Resultados Digitais, 2020).

Besides, according to Resultados Digitais (2020), Webinars generates a sense of authority and respect supported by the institution behind it. Taking part in the live streaming can greatly enhance the image of the brands and companies in the Webinar. The fact that Webinars have a set date and time brings the quality of a live event and the audiovisual content contributes to maintain engagement and empathy towards the hosts. It can be recorded to be posted and made available for future use and view.

2.3 Industry 4.0

The fourth industrial revolution, also called Industry 4.0, is defined as a new level of organization and control over the entire value chain of the life cycle of products; it is geared towards increasingly individualized customer requirements. It is composed of nine pillars: Big Data and Analytics, Autonomous Robots, Simulation, System Integration, The Industrial Internet of Things, Cyber security and Cyber Physical Systems, The Cloud, Additive Manufacturing and Augmented Reality. The vast reach of themes and applications allows all pillars to be explored by Webinars (Vaidya et al., 2018).

3. Methods

GPI4 started the project in May 1st 2020, after submission and approval on the institutions internal extension program portfolio of the “4.0 in 40 Series” following the guidelines established by notice n° 843/2019 - PRX/IFSP (IFSP, 2019). Due to the positive results in 2020, its relevance to the external community, the continuation of the isolation scenario due to the pandemic the 4.0 in 40 Series was extended to 2021. A new phase was submitted and approved for the period between January 26th and December 14th of 2021 following the guidelines of Notice N° 14, dated November 16th 2020, of the IFSP’s Sorocaba Campus (IFSP-SOR, 2020).

The 2021 guidelines allow for a fellow scholarship to be selected between the students, and according to the Notice N° 1, dated January 5th 2021 of the IFSP’s Sorocaba Campus IFSP (IFSP-SOR, 2021) a fellow student was selected. The fellow performed research on improvement, advertisement and administrative rolls. The 4.0 in 40 series was executed in consonance with other activities of the GPI4, such as the beforementioned implementation of the Post-Graduate Course in Industry 4.0 as described by Caldana (2020).

3.1 Selection of Topics and Webinar Format

The selection of topics and speakers for the Series was conducted by members of GPI4. The topics would vary from Webinars, however they were to address the main pillars of Industry 4.0. The selection criteria would involve the speaker’s knowledge and the case study being presented. Speakers would then be asked about availability to present. The Series established a date and time (the last Tuesday of each month at 8PM) as the preferred date for the monthly Webinars, but exceptions were made to meet the speaker’s agenda when needed.

After the selection, a formal invitation was sent with instructions about the live event, websites to login and the agreed content to be covered during the Webinar. Each Webinar would follow the same structure as described below:

- 5 minutes for GPI4 presentation, Series objectives and basic introduction to Industry 4.0

- 30 minutes for the guest's presentation (either via PowerPoint or in an interview format)
- 5 minutes for Q&A from the YouTube chat feed.

3.2 Event Publicize Actions

For each Webinar several actions were performed to publicize it. Firstly, a standard banner was provided as can be seen in Figure 1 below. The banner would be accompanied by a standard text and released by the coordinator of the project and the Extension department of the IFSP's Sorocaba campus. Social media such as LinkedIn, Facebook, Instagram, WhatsApp and Telegram were used to reach the target audience. E-mails were also sent to the subscribed members of the series. A gentle reminder to all subscribed members was sent on the day of the event.



Figure 1 – Template for 4.0 in 40 Series

The written communication would contain the information regarding the speaker, the theme, date and time and the YouTube link for the live streaming event. After the event another e-mail was sent with the permanent link for those who missed the live streaming.

3.3 Live Streaming and Post-Event Actions

In order to take advantage of both scenarios as described by King et al. (2001) and Resultados Digitais (2020) the 4.0 in 40 Series adopted a Hybrid model, using the advantages of both Synchronous and Asynchronous scenarios. YouTube was selected as the transmission platform since IFSP already had a channel on the platform with over 1.000 subscribed followers.

The Synchronous portion is the YouTube Live Stream. When the Series started in 2020, the Jitsi Meet platform (<https://meet.jit.si/>) was used as it was free and could connect to YouTube for the streaming. However, on the first three events there were connection issues with YouTube in two of them and, to avoid similar issues on new events the streaming platform was changed to Stream Yard (<https://streamyard.com/>). Since its adoption Stream Yard has proven stable and it's features allow for better control of the online chat and presentation.

After the Webinar is finished, for the Asynchronous delivery, the video is downloaded and edited with KineMaster (<https://www.kinemaster.com/>) by the fellow student to enhance audio and remove unnecessary footage from both beginning and end. After this process the video is uploaded on the

Projects Coordinator YouTube channel¹, where it is made available on the 4.0 in 40 Series Playlist. There is also a webpage within the Sorocaba Campus Extension Department website where the information is kept updated regarding all the past events, speakers, themes and YouTube links².

4. Results

This section describes the results divided in 3 sections: 1) Live Streams and results, 2) 2020 and 2021 asynchronous results and 3) Subscribed members. All data was collected on October 27th 2020.

4.1 Live Streams and Results

Since its beginning up to the date of the data collection, a total of 18 events were recorded and made available to the public. The online views from these webinars is displayed in Figure 2. The dates, themes, organization and guests are described in Table 2 below. On September 2020 two events were conducted on the same month due to the calendar of Federal Congressman Vitor Lippi and the launch of the Industry 4.0 Regional APL Project.

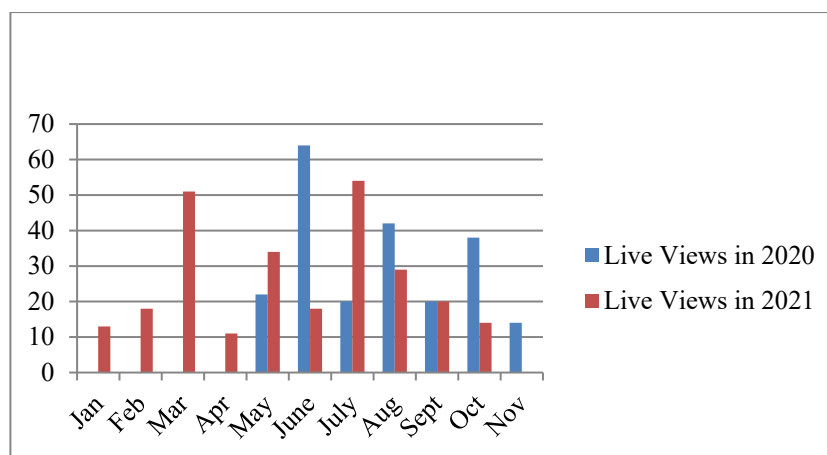


Figure 2 –2020 and 2021 online views

Table 2 - Webinars

Date	Theme	Organization	Guest
26/05/2020	FCA Implemented 4.0 Solutions	Fiat Chrysler Automobiles	Rutson Aquino
30/06/2020	Predictive Maintenance and Failure Detection	Robert Bosch Automotive Steering	Milena Franco de Oliveira
28/07/2020	Start-ups in Industry 4.0	Criabiz Ventures	Christian Pensa
25/08/2020	Intelligent Optimization	BirminD	Diego Mariano
08/09/2020	Industry 4.0 APL	Sorocaba Municipality	Federal Congressman Vitor Lippi
29/09/2020	How Industry 4.0 can increase valve reliability	Neles do Brasil	Renato Gardiman
27/10/2020	Management 4.0	Ribas Institute	Wagner Ribas
01/12/2020	Virtual Reality x Augmented Reality	CNH Industrial	Douglas Romão
26/01/2021	Digitalization of the Machining Process	Walter Tools	Sander Gabaldo
02/03/2021	Cybersecurity	Infinity Safe	Brian Benigno
13/04/2021	IFSP Sorocaba 4.0 initiatives	IFSP	Sérgio Shimura
27/04/2021	Digital Twin	Infinity Foundry	Bruno Eisinger

¹Available at:

<https://www.youtube.com/watch?v=VTsX2zpvatU&list=PLtHQeivHEWSqGqtKgUzTMFLHslgP2AiKl>

²Available at:

<https://sor.ifsp.edu.br/index.php/component/content/article/2-artigos/850-cex-projetos-4-0-em-40>

25/05/2021	Maturity to Implement Industry 4.0 Solutions	Zorfatecque	Eliane R. R. Message
29/06/2021	Lean in Industry 4.0	Lean Institute Brasil	Flávio Augusto Picchi
27/07/2021	Jobs and Careers in Industry 4.0	PGR Advisor	Suzana Rodrigues
31/08/2021	Hydraulic Automation 4.0	Connected Hydraulics	Alex Lima
29/09/2021	Logistic 4.0	Ser Logístico	Carlos Menchik
26/10/2021	Microbrewery APL and Industry 4.0 applications	IFSP	Felipe Ramos

4.2 2020 and 2021 asynchronous results

To determine the asynchronous results, each Webinar was considered after the date of publication. The data is extracted from YouTube graphs and data. In Figure 3 displays the results of 2020 and Figure 4 the results of 2021. All results take into consideration days after publication. For the latest Webinars in 2021 some results are not available yet as the necessary time after the publication has not yet been reached.

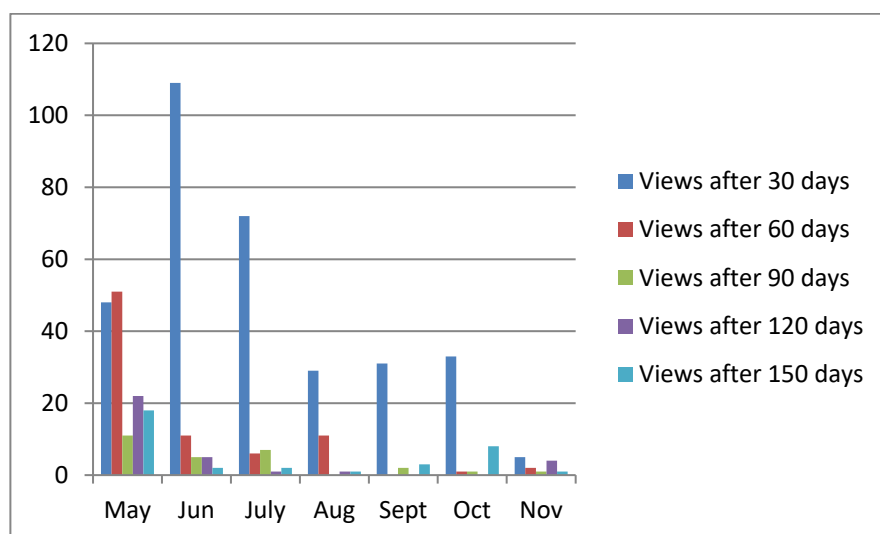


Figure 3 - 2020 Asynchronous Results.

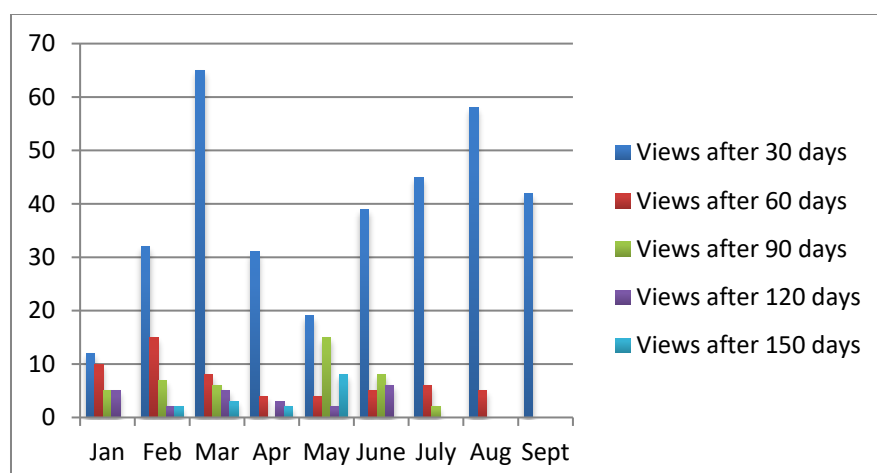


Figure 4 - 2021 Asynchronous Results.

4.3 Subscribed members

The Series had a specific form available at Google Forms³ to keep track of subscribed members that would receive the e-mails described in section 3.2. Figure 5 shows the results since 2020 of the number of subscribed members divided into 3 categories:

³ Available at: <https://forms.gle/otF74PKVL5momWQY6>

- Academia: Teachers and Researches from both private and public institutions.
- Industry: Members of the industry and professionals.
- Students: All students from IFSP and other institutions from both private and public schools.

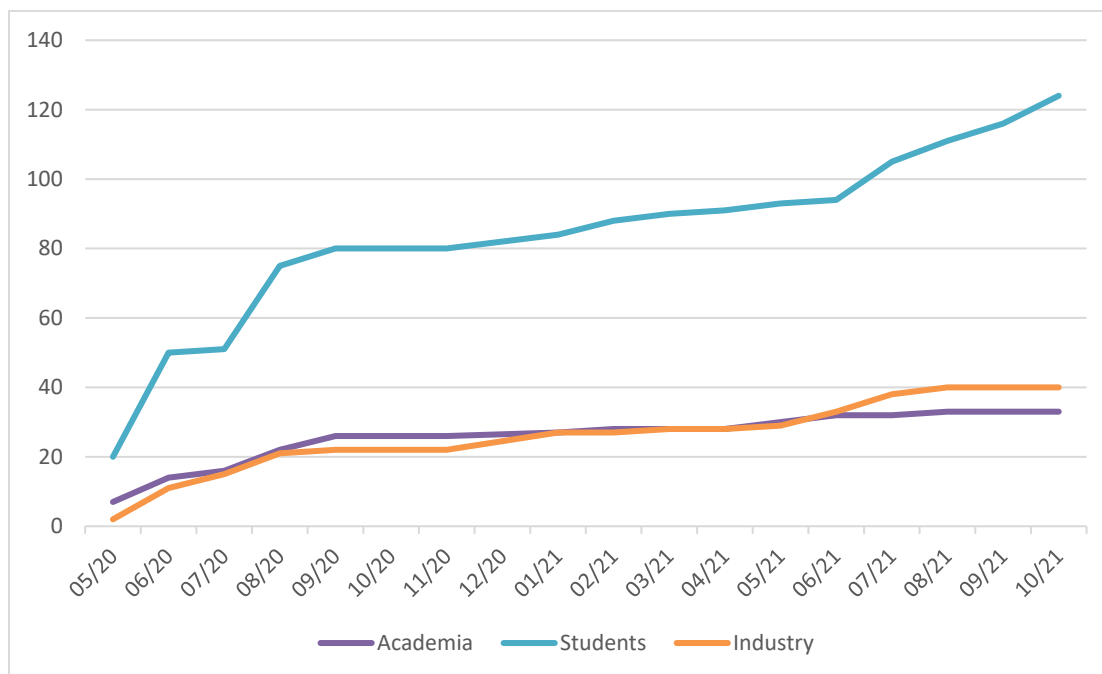


Figure 5 – Subscribed Members

Figure 6 below shows the comparison between the subscribed members sectors

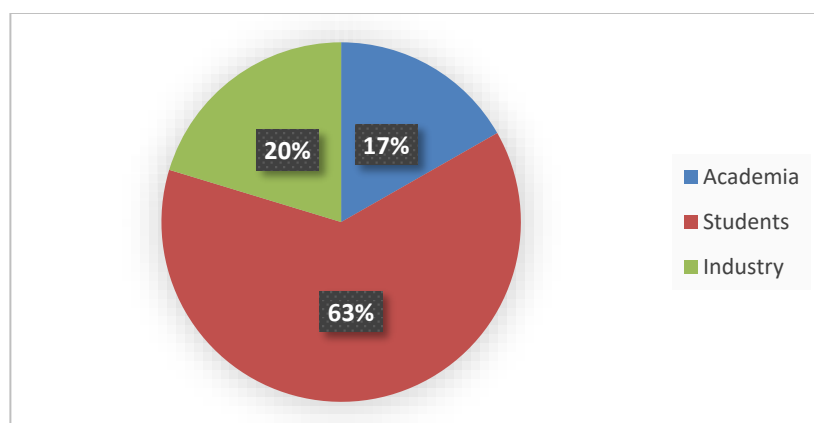


Figure 6 – Subscribed Members By sector

5. Discussion

When analyzing the information from Figure 2, it is possible to observe that there is not a trend from how many people would watch the event online. There is a great deal of oscillation between events from the month before as well as events from the same month on the previous year. Actions to publicize the Series and the continuity of the events seem to have little effect on the online viewer performance. This can be determined as by 2021 there was a bigger marketing strategy at play with more actions due to the inclusion of the fellow student to the project. This leads to the hypothesis that the number of people online is determined more in terms of adherence to the theme than rather a continuous growth.

When considering the asynchronous results for both 2020 and 2021 it is visible that the number of visualizations on the first 30 days period is significant and often greater than the synchronous event. This is mainly because the user can pick the best time to watch the Webinar. In both years after 150 days the number of views falls to very low values. This might reflect that the event has begun to be “dated” and

needs to be updated, which would suggest that the contents of the Series could be restarted and selected again after a period.

According to figure 5 there was a continuous increase in the number of subscribed members through the 18 months of the project. The steady rise would indicate the variety of the subjects would attract a different target audience for each event, thus contributing to the steady rise in subscriptions but not the equal rise in attendance for either the synchronous or the asynchronous results. This data supports the hypothesis derived from the synchronous and asynchronous attendance results about relevance and engagement to the content based on the theme rather than the Series itself.

Students were the most engaged audience of the Series, with over three times the amount from Academia or Industry, for a total of approximately 63% of our audience. Academia and Industry flowed with similar growth and numbers during the elapsed period in the project. Contrary to our belief that the public would increase over time, the event with the highest results in both synchronous and asynchronous was the second one on June 2020 with 64 online viewers and 109 asynchronous views on the first 30 days.

6. Conclusion

Even without the continuous increase in synchronous and asynchronous attendance the project was able to meet the expectations drawn at the beginning of 2020 and achieve the connection between IFSP and the exterior community as well as obtaining relevant information to develop the Post-Graduate course. The target synchronous attendance of 10 (in 2020) and 15 (in 2021) viewers was achieved during the 18 months the project ran, with continuous increase in members and awareness about Industry 4.0 and IFSP. The target audience represented the expectations, with a larger portion being students, which was one of the goals of the project – to maintain contact between students and the Institution during the pandemic.

The events also allowed IFSP and GPI4 to increase awareness about the Post-Graduate Specialization Course in Industry 4.0 that was launched in the second semester of 2021. For the first enrollment cycle there were a total of 186 applicants for 20 vacancies on the program - a 9.3 student/vacancy ratio. The ratio achieved was the second highest ratio of all courses (technical, graduate and post-graduate) of the IFSP Sorocaba campus in that semester, with higher values than established courses such as Electronics Technician Course that is being offered since 2016.

All obstacles to proper publicize and accomplish the synchronous events were overcome, and the change in streaming platform to Stream Yard showed to be the correct decision. With a regular monthly flux of Webinars and a standardized media format (for both banners and texts) the project achieved a steady method to create and publicize the events, yielding in the necessary online viewers target for both 2020 and 2021 years. YouTube was also a steady platform for the views with good tools to engage and interact with online viewers.

Even though the Project will not continue in 2022 due to the return of presential activities and regular classes, the experiment showed itself to be effective and the learning experiences for the project members as well as the audience is unique. The results and methods will be recorded should another similar scenario presents itself and a similar project is needed.

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Biographies

Vitor Mendes Caldana is a professor at the Sorocaba Campus of the Federal Institute of São Paulo (IFSP) in the industry department. Received his Electrical Engineering degree from Universidade Presbiteriana Mackenzie in 2004 and his M.Sc. in Industrial Engineering from UNIP in 2017. In 2016, as a full-time professor, began teaching at IFSP Sorocaba to implement the technical course of Electronics and in 2021 implemented the Post-Graduate Specialization Course in Industry 4.0. Since 2018 is the head of the Industry 4.0 Research Group. Before becoming a full-time professor worked in the printing industry for over 15 years in the fields of maintenance and project management based in Brazil covering all Latin America. As well as heading the project and contacting all guests, the responsibilities also included creating the banner and marketing material, hosting the event and tutoring of the fellow student.

Dalton Oswaldo Buccelli is a professor at the Sorocaba Campus of the Federal Institute of São Paulo (IFSP) in the Management Department. Received his Mechanical Engineering degree from Faculdade de Engenharia Industrial in 1980, his Master's degree in Administration from Universidade Presbiteriana Mackenzie in 2009 and his Ph.D. in Production Engineering from Universidade Paulista in 2014. In 2017 began teaching at IFSP Sorocaba, as a full-time professor. He is participating in the Extension Project, responsible for the initial contact with guests, facilitator of the question and answer process during the events, responsible for the preparation, writing and critical review of the content of the experience report and the analysis and interpretation of data.

Guilherme Galiazzi Carriel de Lima is a student and scholarship holder since the beginning of 2021, being responsible for the dissemination of the Extension Project's actions and for the collection and availability of the article's data.