

The Academic and Emotional Impact of Virtual Construction Site Visits on Students During a Pandemic Period

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THE ACADEMICAL AND EMOTIONAL IMPACT OF VIRTUAL SITE VISITS DURING A PANDEMIC PERIOD

Abstract

During the years 2020 - 2021, students and lecturers have faced motivational and academical challenges like no other generation before them. Lecturers have found themselves looking for innovative activities that make the interaction student-teacher more dynamic and less screen-based, while maintaining all the fundamental elements of the academic program. Like many curricula, Civil Engineering programs have had to endure important changes to adapt to the necessities of the contingency due to COVID-19. One of the most important changes has been the inability of attending construction sites due to the pandemic conditions. Using technological tools such as Zoom Meetings and Facebook Live, we are proposing virtual visits as an alternative that makes construction sites visits plausible during a pandemic.

The main objective of this work is to present the positive impact of virtual construction site visits in students during a contingency period, both in academical and emotional aspects. This study will also reinforce the benefits of construction site visits and the importance of maintaining them via a virtual visit for the completion of a Civil Engineering program particularly in the area of Structural Design.

Construction site visits has always been a highly valuable element of Civil Engineering programs. It allows students to visualize construction processes and translate the numerical activities studied in the classroom to tangible projects. With the pandemic and the stay-at-home guidelines, construction site visits have a positive distraction factor from reality, becoming an element that motivates the students to participate and divert themselves from the current situation, additionally to the academical benefits that the visits provides.

We did a qualitative investigation by interviewing 121 undergraduate students from different courses of the Civil Engineering program just after our virtual visit activity, to find out their perspective of the benefits they obtained academically and emotionally. We arrived at the conclusion that the alternative of a virtual site visit has indeed motivated the students and that they value being able to maintain the academical elements of the construction site visit.

Key words: Pandemic, Online Education, Educative Innovation, Higher Education, Construction, Structural Engineering, Educational Innovation.

I. Introduction

During the contingency period, teachers must approach the design and implementation of their courses from two different fronts: academic objectives and emotional state of the students. These perspectives create the necessity for activities that allow both, lecturer and student, generate a class dynamic that promotes active interaction.

In order to achieve the academical objectives in all types of scenarios, not only in the contingency one, teachers must take into consideration that the new generation of students needs frequent stimulus in order to acquire their attention and optimize their acquisition of knowledge

and competencies development. Adding interactive elements to class session can increase the students' attention span [1]. In online courses, this can present itself as a challenge or an opportunity. Institutional learning has entirely changed its dynamic process as consequence of this necessity, introducing methods as: gamification, flipped-classrooms, storytelling; for mentioning some of them. Different institutions have implemented a Challenge Based Learning programs (CBL) [2][3]. This model is based on the application of these learning methods and the idea that students are no longer required to only acquire information but encourage them to participate, interact and actively apply the knowledge obtained in classroom, developing their cognitive abilities. The resolution of challenges in real life is an intrinsic factor of these programs, it is necessary to go beyond the theory. With this purpose, construction site visits have become an even more relevant to the academic agenda.

From an emotional perspective, during 2020 - 2021, lecturers and students have been subject of highly elevated levels of anxiety due to the health care measures imposed by governments all over the world, such as "social distancing", facilities lockdown and the radical reduction of outdoors activities. This generates a learning environment in which the students are in a non-optimal disposition to learn. So, creating new and dynamic activities, that explore different capabilities of learning, is fundamental to motivate students and change the predisposition against virtual classes.

In the Civil Engineering environment, it's widely accepted that the construction site visits helps the students understand the importance of the knowledge they are obtaining in the classrooms and it also helps them visualize what they are attempting in future assignments. Therefore, it couldn't be considered that the academic program would be fulfilled without any site visits. As Hannasch and Skogrand [4] described: "These site visits are much more than just a field trip; the classes require students to analyze how the content in the classroom applies to what they saw on site".

During the contingency, we applied the experience of CBL programs but, in this case, it was used to involve the students so they could feel a physical connection to their learnings in their Structural Design lectures, therefore achieving an emotional effect generated by the pseudo-outdoors activity and satisfying the academical purposes. The virtual construction site visit can create vivid experiences that helps the students deal with the confinement, the possibility of expanding their horizons as there are no geographic limits for the visits and maintaining the possibility of transferring their academical knowledge to real project applications.

Site visits helps the student develop cognitive behaviors, such as problem analysis. In the future, when they are facing a situation of structural design, they can go back to the information they gather from the field and present a viable theoretical solution to the practical problems frequently faced on the field. So, construction site visits can't be overlooked in the academic program. Therefore, the necessity of creating this virtual activity in order to achieve the expected academic requirements in challenging times. It is relevant to consider that this activity helps the lecturer as well, by creating a two-way conversation with the student, achieving a beneficial effect on the learning environment, that might become tense otherwise. Creating this kind of interaction avoids having the student only as a passive participant of the class.

II. Study Purpose

The purpose of this study is to present the results obtained by giving the students the opportunity of having an interactive, live-broadcast, virtual construction site visit without the necessity of actually being in the site. The purpose of the implementation of live streaming tools is to eliminate the one-way-talk, with the professor only speaking to himself. There has to be real-time interaction with the students in order to fulfill the emotional necessity of the student to feel as an active part of the activity, as well as granting him the advantages of making all of his questions in the moment they are presented and not later on, when both, the curiosity or the complete information, may be gone.

With this research we are looking to answer the following questions:

- Question 1: Considering the pandemic situation, does students acknowledge virtual construction site visits as a valid equivalent to achieve their academic goals?
- Question 2: Have students found a motivational factor in the virtual site visits that encourage them to continue learning new concepts in class?
- Question 3: Have virtual site visits help the students in distracting their mind from the current situation becoming an emotional factor in their daily lives?

III. Methodology

One of the authors of this study is a Structural Engineer and professor of the Civil Engineering Department, he organized six virtual site visits, during the periods of February-June 2020, Summer 2020, August-December 2020, to three different construction sites in Hidalgo, Mexico. The first site is a construction site of a cable-stayed bridge formed by a hybrid structure of reinforced concrete and steel elements, the second one is the construction of a four story shopping mall also with a hybrid structural system and finally a fourteen story office building. So, the opportunity for the students to attend the sites has a highly academic relevance.

Two of the visits were broadcasted via Facebook Live and four of them via Zoom Meetings.

In total, there was a participation of 121 undergraduate students from the following courses:

- Foundations Engineering,
- Design of Steel Structures,
- Structural Systems,
- Design of Reinforced Concrete Structures,
- Capstone Project in Structural Design.

The average age of the participants is twenty-one years. They were notified about the virtual visit a week before the first one, and one session before the following five.

III.a. The virtual site visits

Students were asked to connect to Zoom or Facebook at the beginning of the class. The professor would already be in the construction site. The professor used a cellphone Samsung Galaxy S9+, to broadcast the visit. The simplicity of the tool was a key factor that allowed the professor to

move safely through the site and manipulate the equipment efficiently to show elements of the construction in order to answer students' questions.



Fig. 1. Two of the authors showing the construction and health security equipment in the virtual visit.

The visit started with an introduction of the activities that were happening in the site at the moment of the broadcast, such as: pile drilling and rebar, concrete pouring or general rebar process. Then, the professor proceeded to walk through the construction site explaining different components of the structure and the application of the topics previously seen in the classroom. Facebook Live and Zoom allowed the students to interact with the teacher whenever they had a relevant question, giving him the opportunity to make the corresponding remarks in-site, while he had the physical example in hand.

The live visits had a duration of forty minutes in average, followed by a discussion during the next session in class. In the discussion, students interact with each other and the teacher, giving a more extended opinion and perception about the activity and what they saw, making remarks of relevant information for their classroom assignments. This session also gives the professor an opportunity to assess the academical impact of the visit in the students.

The visit is recorded simultaneously in order to give the students the opportunity to go back looking for specific information just as they would go back to photographs taken by them on physical site visits. It is important to clarify that the real time interaction is fundamental in order to avoid being just a recorded video. The recording of the session purpose is only storing the information for the future academical needs of the students.

III.b. Safety of the lecturer during contingency

Construction sites often have a strict policy of security measures that must be fulfilled before any activity begins in site such as: foot ware, security helmet and vest, goggles, etc. In the year 2020, constructions sites required that, not only those physical safety measures were meet, but also all the personnel had to wear health security equipment, such as: face mask, globes, and comply the social distancing measures.

The lecturer met all the sanitary requirements of the site. At the beginning and the end of the virtual visit, he showed to the camera his health equipment. This also reminded the students the

necessity of implementing the visit virtually instead of physically, due to the pandemic circumstances.

III.c. The student-teacher interaction

The live-stream factor of the visit allows the students, not only to see an outdoor activity been carried out, like they would see in a pre-recorded video; but to interact with the environment. The capacity that the virtual visit gives the student of making a real time questions, asking the teacher to focus on a specific detail, or even just asking to move the camera to one side so they can see from another angle; wakes a most needed curiosity just like in presential visits. The students can even ask the teacher to approach to workers or site engineers and make some questions or express opinions about what they are seeing in the broadcast.

The student has been in isolation due to the health contingency, so the live-stream also gives them an emotional effect as they have, for a brief moment, the capacity to interact with a surrounding that is completely different from the ones they are living every day. The social media and entertainment industry are already experimenting with this effect, providing live-stream concerts, charity events, theater plays, religious masses, among others. The study results of these activities in the entertainment environment are yet to be concluded, but the future outcome in behavioral impact looks promising [5][6].

IV. Data analysis and results

At the end of the three academic periods of the year 2020 and the six virtual visits, a sample of 121 undergraduate students answered a questionnaire about their experience in the virtual construction site visits and their perception of the obtained benefits. The survey consisted in 18 questions asked via Google Forms. In this study, we are only going to analyze 9 of these questions, that are relevant for our purposes.

IV.a. Students' perception of the academical impact

The students were asked to rate the visit, from 1 to 5 points (5 being the highest), in terms of the academical impact perception they achieve from it. Fig. 2 shows the scores given by the participants. The results displayed that 83.47% of the students (n=101) found it highly relevant, giving it the highest rate. Meanwhile, the remaining 16.53% (n=20) gave it the second highest.

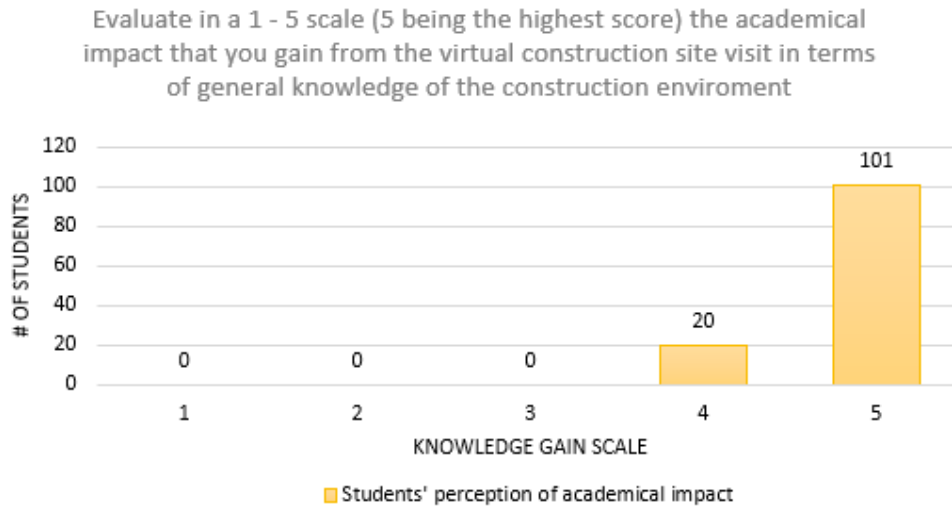


Fig. 2. Participants perception of academical impact obtain from the site visit

The results demonstrated that the students are fully aware of the academical impact that a site visit can provide, and that they recognized the benefits and the importance of being able to have these types of activities, even in contingency situations. Students were also asked to write a comment of their general opinions about the visit. In Fig. 3 we have an example of some of them. We selected ten comments that gave a projection of the rest of the opinions.

Student #1	The explanation is highly detailed, and all doubts were answer in the best possible way.
Student #2	The visits were very cool, the explanations are very useful. Don't stop making them. Sometimes the audio was distorted but that's another topic.
Student #3	I think the visits were a very fun and different activity, it helps us to relax in class but without stop learning new relevant topics. I liked that in each visit we could clarify different types of doubts and topics.
Student #4	I found the visits as a cool alternative; the visits always started on time and refer to the topics seen in class. It's a cool idea.
Student #5	It was a different experience, but highly satisfactory. Sometimes it presented audio problems but in general it helped me understand important points of the class.
Student #6	I liked the flexibility of being able to see constructions in different cities than mine.
Student #7	I really liked the site visits. I think they could be an excellent alternative even when the pandemic is over.
Student #8	As a Civil Engineer student is very important to understand construction processes. This was my first construction site visit at all, the virtual visit gave me an opportunity of having it even with the pandemic guidelines.
Student #9	I liked that I could see concepts that I couldn't imagine in class. It has an advantage over the traditional visits that in the virtual one I could hear everything all the time.
Student #10	I liked that it was a break of theory classes and we could see the applications of the things we have learned.

Fig. 3. Examples of participants comments of their general opinion of the virtual construction site visits. (Comments were translated from Spanish to English by the authors)

As we can see, the students highly valued the academical benefits they obtained from the visit as well as having suggestions for the next ones. With these comments you can take a glimpse of the general students' opinion and we can conclude that it has a positive perspective. It's important to state that we didn't add any negative comments in Fig. 3 because they were none, giving us an even more cheering result.

The participants were also asked to select qualitative elements that they appreciate most from the visit. They were given four options: (1) the general tour of the construction site, (2) the lecturer's explanation, (3) the construction views and (4) the audio; they could choose multiple elements.

Fig. 4 shows that the most enjoyable and appreciated element was the lecturer's explanations with 114 votes. This displays that 94.21% of the participants thought that the explanation was a key factor of the success of the visit. Meanwhile, the least appreciated factor was the audio, with only 10.74% (n=13) of the participants selecting it as key factor. This gives an area of opportunity for improving the technological equipment used in the visit, in order to improve the audio quality.

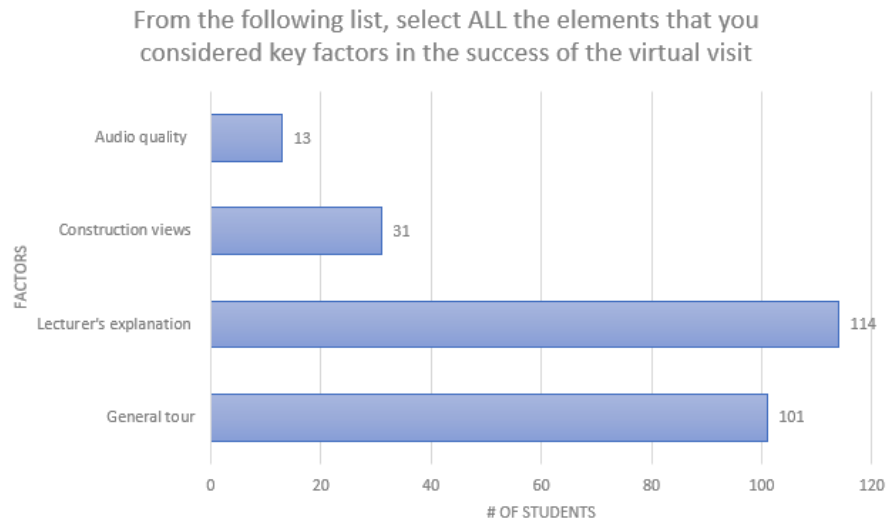


Fig. 4. Key elements of the construction site visit according to the students

In this question (Fig. 4), we can see that students have answered the question about their perspective about academical value indirectly. They understand that the visit goes beyond a simple sightseen, showing that they value the professor's explanation more than any other factor.

IV.b. Students' perception on the motivational impact

In the questionnaire, the students answered 4 questions regarding the motivational impact they perceived in academical and emotional terms. In Fig. 5, 6, 7 and 8 we can observe a positive tendency in the emotional perspective.

In Fig. 5, students were asked to evaluate the effect of the virtual visit in their ability to relax or distract themselves from the current pandemic situation in a scale from 1 – 10 points, (10 being the highest). In Fig. 6, we used the same scale so they could evaluate the effect of the virtual visit but now, in their motivation to continue learning new construction concepts in class.

Considering that any punctuation equal or over 7 points is perceived as a positive result we can observe from the poll, that in Fig. 5, 95.04% (n=115) of the students consider they have a positive impact in reducing stress, distracting themselves and relaxing emotionally from the current situation. With only the remaining 4.95% (n=6) giving it a regular effect between 5 and 6 points. Meanwhile in Fig. 6 we can observe the 100% (n=121) of the students reported a positive effect (7 or more points) in their motivation in continue learning new topics in class, due to the virtual visit.

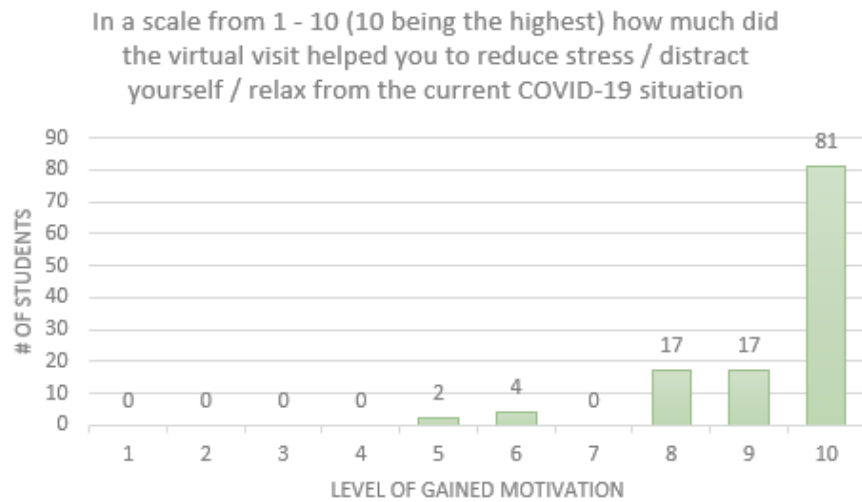


Fig. 5. Scale of reduction of stress, relaxation, and distraction for the pandemic situation from students' perspective

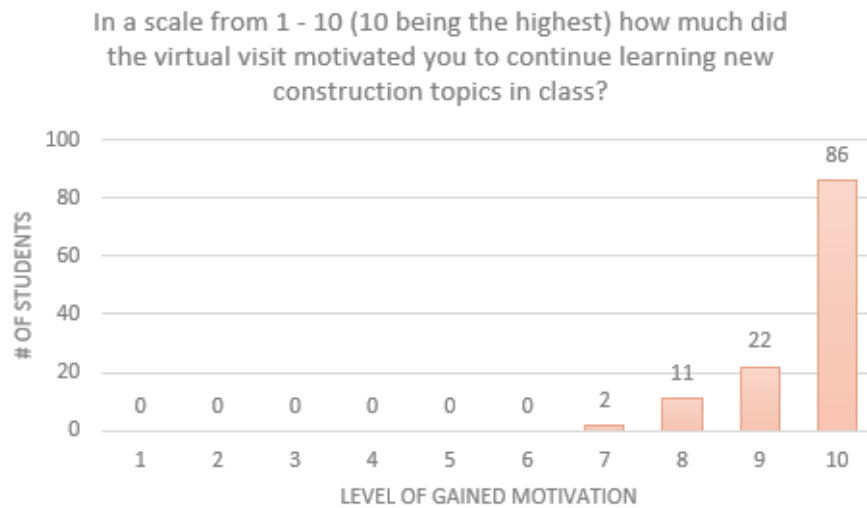


Fig. 6. Scale of motivation gained in learning new topics from students' perspective

The students were notified of the virtual site visit a session before the event. We asked them if knowing that a virtual visit was coming, generated a positive expectation sensation in them. We can see in Fig. 7. that 80.16% (n=97) considered they experienced excitement from the upcoming visit, evaluating it with 4 or more points. Giving us the possibility to classify this activity as a motivation to raise students spirits regarding online classes.

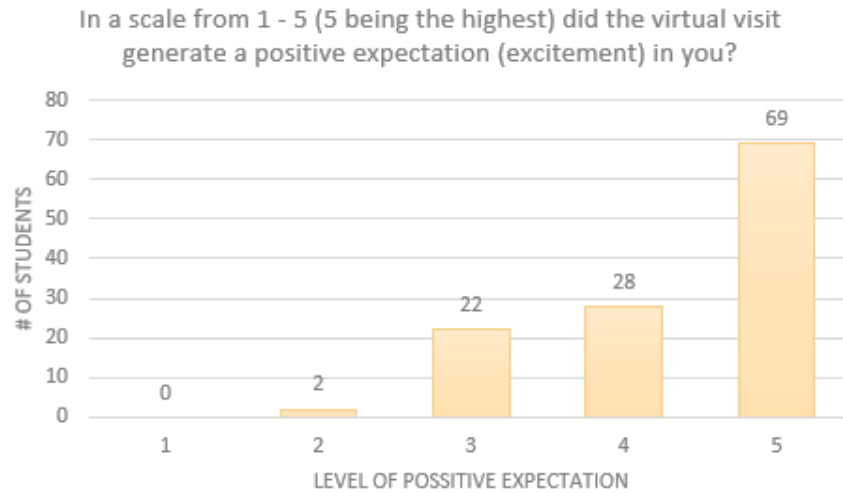


Fig. 7. Scale of positive expectation regarding the virtual visit.

Additionally, students answer if they felt that they interact more with their classmates through hearing their doubts in the visit. A majority of 61.98% (n=75) score this interaction with the highest score, we obtain that results tend to the lower half of the scale more than any other question before, but we can still observe that the results are overall positive.

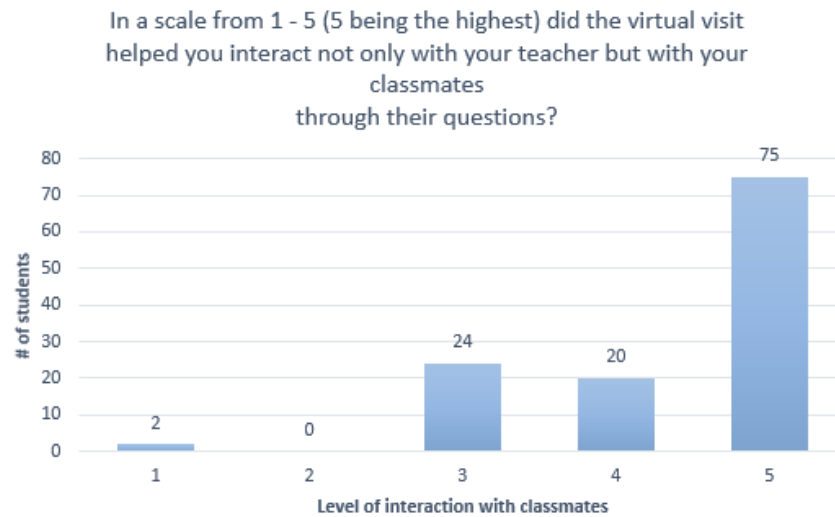


Fig. 8. Scale of motivation gained in learning new topics from students' perspective

In the questionnaire, the participants were able to reflect the level of satisfaction provided by the virtual activity. The students were asked the question “Considering the pandemic period, do you find the virtual site visit to be an equivalent and effective alternative to maintain construction site visits?”. The results demonstrate that the students appreciated the academical and emotional value of the site visit, with 100% (n=121) of the participants establishing that they have found the virtual site visit to be an effective and equivalent activity, considering the COVID-19 restrictions.

The duration of the visits was of forty minutes approximately. The participants were asked if they were in favor of this duration, or if they weren't due to either, wanting more time or fewer. The results were encouraging. Fig. 9 presents the perception of the students about the duration of the activity. The results show that 76.85% (n=93) of the participants were in favor of forty minutes sessions and the remaining 23.14% (n=28) were against it because they actually wanted more time.

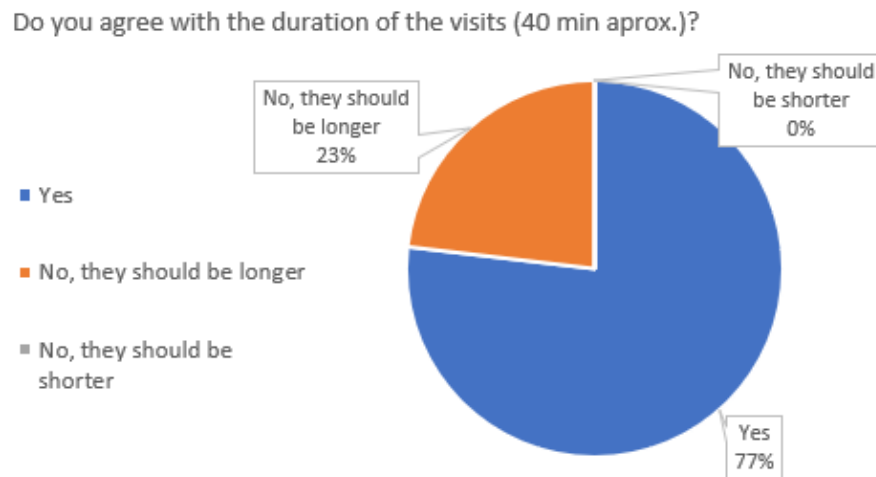


Fig. 9. Students' opinion on the duration of the virtual visits

These last two results show the necessity presented by the students for activities such as the virtual construction site visits, that not only encourage them to learn and achieve their academic goals but to be an emotional support in these difficult times.

V. Discussion and conclusions

The capability of students to attend construction sites in contingency situations, is fundamental for the completion of the academic goals of the Civil Engineering curricula. It's important that the students recognize this and the importance of the opportunity of experiencing these activities in challenging times. From the previous results we can state that students have indeed noticed the value of the virtual construction site visit. We can acknowledge this by the analysis of the results on the previous section IV. *Data analysis and results*, and by evaluating the tendency of the students' responses to the question in Fig. 9 and the result of the question "Considering the pandemic period, do you find the virtual site visit to be an equivalent and effective alternative to maintain construction site visits?". We can observe that, either for academical or motivational purposes students enjoyed the visit and, with the support of the students answers in section IV.a *Students' perception on the academic impact*, we can state that the virtual site visit activity is not only a question of entertainment, but a full package of emotional and academical value in these pandemic times. This combination results sustain that the students are fully aware of the importance of making site visits available in contingency times.

This paper shows the results of the virtual site visits from the perspective of academical and motivational impact on the students. The obtained results were highly encouraging to continue

the pursuit of perfecting this activity. The emotional impact of the virtual site visit was shown to be highly beneficial to the learning environment of the student. This study has shown that the students value the importance of field activities in the area of Civil Engineering and welcome the idea of maintaining the possibility of virtual site visits.

VI. Acknowledgements

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