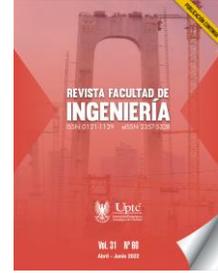


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Internet Memes as Reading Controls in a Geometric Road Design Course

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Abstract

Technological development and access are currently leading to changes in the habits of population such as access to information. Short videos and images are used in newspapers, social networks, and university education. Images or internet-meme has been used in several areas of knowledge to improve the students learning, but not in the road design, which content is hand-delivered traditionally. Therefore, this study aims to show an academic activity using internet memes to analyze a weekly topic before synchronous virtual classes. To do this, four groups of students from the Geometric Road Design course participated. They were asked to review the weekly academic content before the class and prepare an internet meme, and their classmates graded those images. As a result, the memes can be used as reading controls before attending the virtual session. They could also be employed before a face-to-face class. The students agreed with the use of memes

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but were less enthusiastic about the peer review. Despite this trend, the memes produced in combination with peer review increases the possibility of a student to understand the subject. The groups gave an average score to the course of 8.86/10. They were aware of their self-learning with an average rating of 7.74/10. This article describes the experience of students using internet-memes and evaluates the pros and cons.

Keywords: active learning; distance learning; illustrations; road engineering.

Internet-memes como controles de lectura en la materia de diseño geométrico de carreteras

Resumen

En la actualidad, el desarrollo y acceso tecnológico está llevando a cambiar diversos hábitos en población, como, por ejemplo, la forma en cómo se consume la información. Es así, que el uso de videos cortos e imágenes se usan los periódicos, redes sociales hasta alcanzar a la educación universitaria. Esta imagen o internet-meme ha sido usado en varias áreas del conocimiento para mejorar el aprendizaje de sus estudiantes, pero no en el diseño de carreteras, cuyo contenido se suele mantener las clases de forma tradicional. Por lo tanto, este estudio tiene por objetivo presentar una actividad académica que utiliza internet-memes para analizar un tema semanal antes de las clases virtuales síncrona. Para ello, participaron cuatro grupos de estudiantes de la materia de diseño geométrico de carreteras. Ellos debían revisar el contenido antes de la clase y elaborar un internet-meme, que era revisado por pares. Como resultado, los internet-memes pueden ser utilizados para controlar que el estudiante revise el material académico (videos, artículos, etc.), antes de asistir a la clave virtual, incluso se podría utilizar antes de una clase presencial. Los estudiantes estuvieron de acuerdo con el uso de los internet-memes, y en menor proporción con la revisión por pares. A pesar de esta última tendencia, la elaboración en combinación con la revisión por pares aumenta la posibilidad de que estudiante comprenda verdaderamente el tema. Por otro lado, los grupos dieron una valoración promedio del curso de al menos 8,86/10. Los estudiantes fueron conscientes del autoaprendizaje, quienes dieron una calificación promedio de al

menos 7,74/10. Este artículo describe la experiencia de los estudiantes con el uso de los internet-memes, evaluando sus pros y contras de su uso.

Palabras clave: aprendizaje activo; educación a distancia; ilustraciones; ingeniería vial.

Memes da Internet como leitura de cheques sobre o desenho geométrico de estradas

Resumo

Atualmente, o desenvolvimento e o acesso tecnológico estão levando à mudança de diversos hábitos da população, como, por exemplo, a forma como a informação é consumida. Assim, o uso de vídeos curtos e imagens são utilizados em jornais, redes sociais até chegar ao ensino universitário. Essa imagem ou meme da internet tem sido utilizada em diversas áreas do conhecimento para melhorar o aprendizado dos alunos, mas não no projeto de estradas, cujo conteúdo costuma ser mantido nas aulas tradicionais. Portanto, este estudo tem como objetivo apresentar uma atividade acadêmica que utiliza memes da internet para analisar um tema semanal antes das aulas virtuais síncronas. Para isso, participaram quatro turmas de alunos da disciplina de projeto geométrico de rodovias. Eles tiveram que revisar o conteúdo antes da aula e criar um meme de internet, que foi revisado pelos colegas. Como resultado, os memes da internet podem ser usados para controlar que o aluno revise o material acadêmico (vídeos, artigos, etc.), antes de participar da chave virtual, podendo até ser usado antes de uma aula presencial. Os alunos concordaram com o uso de memes da internet e, em menor grau, com a revisão por pares. Apesar desta última tendência, a elaboração em combinação com a revisão por pares aumenta a chance do aluno de realmente entender o tópico. Por outro lado, os grupos deram uma avaliação média do curso de pelo menos 8,86/10. Os alunos estavam cientes do autoestudo, que deram uma nota média de pelo menos 7,74/10. Este artigo descreve a experiência dos alunos com o uso de memes da internet, avaliando seus prós e contras de seu uso.

Palavras-chave: aprendizagem ativa; educação a distância; engenharia rodoviária; ilustrações.

I. INTRODUCTION

Currently, most of the students entering universities belong to Generation Z [1]. Their native technological skills [2] can be combined with today's diverse ways of consuming information [3] to reach higher levels of learning. The Internet meme is an active learning technique that meets these conditions. They take the form of images (pictures, animations such as GIFs) taken from other media, e.g., television or film, or photographs from everyday life, often with text juxtaposed with specific phrases or quotes. Internet memes are quite reusable, which is why their popularity has increased among students but also among teachers who want to use this tool to enhance their students learning. They have spread on the Internet in various ways: social networks, forums, blogs, or instant messaging [5], [6]. Despite their benefits, there are copyright concerns in education; however, these images can be declared "fair use" and, therefore, do not infringe copyright [7].

Internet memes have been used in several areas of knowledge; even so, there are few experiences in engineering. In mathematics, internet memes were based on three main aspects: structural, social, and specialized [8]. In Pharmacy, the students generated content through them [4]. It also motivated to learn English [9], helped students learn petroleum engineering English vocabulary quickly and in a solid way [10], promoted critical thinking in political science [11], and helped students review content when preparing their final chemistry test [12], among others. As can be seen, few studies have been conducted in the literature that used internet memes for educational purposes. Only one was related to the civil engineering career and none to the geometric road design course. In this subject, teachers are reluctant to include active learning methods due to the high need of physics and mathematics.

In this context, this study aims to present an academic activity that uses internet memes to help students analyze a weekly topic before the synchronous virtual class of the geometric road design course. To explain the results of this experience, the rest of the document first presents the methods; then, it presents the results and their subsequent discussion.

II. METHODOLOGY

A. Course Selection

The subject Road Construction I at the Universidad Técnica Particular de Loja (UTPL), Ecuador, was taught virtually due to the COVID-19 restrictions. This subject had several learning moments: watching a prerecorded lecture, problem-solving, application to real projects, and presentation of progress [13]. One of those moments applies flipped learning, where the student must review a video prepared by the instructor before attending the synchronous virtual class. However, this was not always the case; thus, it was decided to apply random control readings before starting the virtual session. The creation of this instrument took a considerable amount of time, even so, some students did not review the videos. Therefore, to motivate students to watch it before attending the virtual class, internet memes were included with two planned academic activities: image elaboration and peer review.

B. Selection of Groups

Four groups of students participated in the use of internet memes in flipped learning. All group members were enrolled in the subject of Road construction I at UTPL for two academic periods. Group A (n=56 students enrolled in the course) and B (n=58) during April-August 2021, groups C (n=32) and D (n=43) from October 2021 to February 2022. All groups had the same instructor and they received the same content of the subject.

C. Procedure for Using Internet-Memes

Each week, the students were required to review the pre-recorded lecture. After reviewing these videos, the students made an internet meme adding the information seen in the weekly video. The instructor delivered a static meme template to create the meme. The creation was uploaded to the virtual learning environment (VLE). Then, the VLE automatically assigned them two images to be graded. Students rated their peers' images using the rubric in Table 1. Then, they attended a problem-solving session (Wednesday, 2 hours) and the application of the weekly topic to a

real project (Thursday, 3 hours). Subsequently, the students had to make an oral presentation as a team or present an infographic of the progress of the weekly project. After these activities, the next topic began with a new process starting with the visualization of the pre-recorded master class. The images were graded zero when the file was not uploaded, not understood, or not related to the weekly topic.

Table 1. Internet meme evaluation rubric.

Criterion	Score			%
	Outstanding 4 points	Regular 2 points	Deficient 1 point	
Knowledge of the topic. It refers to the degree of understanding regarding the weekly topic.	It shows that they reviewed all the shared material.	They watched and reviewed the material, but some parts are unclear.	It seems that they did not review the shared material.	40
Creativity. It refers to creativity in image development. They could use a fine sense of humor.	The image is very creative.	The image is creative.	The image is not creative.	40
Image creation. It refers to the quality of the image that has been presented, for example, scales, colors.	The image has a good quality.	The image has a certain quality.	The image has no quality.	20

Only three evaluation criteria were placed in the rubric, as shown in Table 1, so it was easier for peer evaluation. The lack of practice as critics of the homework of their classmates can become complicated with more criteria. Also, the rubric was related to the criteria (structure, social, and specialized) of a previous investigation in a mathematics course [8]. The grades of the evaluating pairs were averaged to prevent students from feeling unfairness. The internet memes were 10% of the final grade of the course.

When it comes to peer-review-based learning there are several elements to consider. First, students had the same template and topic every week, so diverse outcomes were expected. This result is because students combined what they understood about the topic with their creativity on the internet meme creation. Second, in the peer review, they had to indirectly compare the way others approached the topic with the image they made. This review will also provide the opportunity to enhance the creation of the internet meme. In addition, they will

improve in the peer review by observing how the other classmates evaluated the image. The possibility that the student understands the weekly topic increases with these learning moments. They can also have a better result if they know the topic before attending the synchronous virtual class.

D. Data Collection

The data collection was conducted using three principal sources: the final grades, the average scores of the internet memes, and a survey. 53 students from group A answered the survey; group B, 56; group C, 21; and group D, 43. The instructor shared the survey in week 15 through the VLE as it was a voluntary activity. However, the instructor offered an additional 1% in the final grade for those who participated, regardless of their positive or negative answers.

E. Data Processing

The data collected was processed as follows. The number of fails and the average grade were calculated with a 95% confidence interval in each group. Also, the average was estimated with a confidence interval (95%) in the survey questions in which students had to choose a value.

III. RESULTS

A. Creation of Internet-Memes

Figure 1 shows some examples of the creation of internet memes. Interestingly, the student must analyze how the template has been used previously and what is the context in order to make them. For example, the week two template references scenes from the movie *Finding Neverland*; the first scene features a teary-eyed boy saying why he is upset, followed by a scene where the adult looks at him sympathetically, and a final part where the two of them hug [14]. On the internet meme created by students, the boy tells the adult that he has had a road accident for not slowing down his vehicle, then the adult (in the second part) asks about the type of workload that the road generates in the driver, the boy replies that it was

high. With a high workload, the driver can make mistakes; thus, the limitations of the drivers and their relationship with the road design have been understood.

WEEK TWO: DRIVERS



By: Karla Armijos (Group A)

WEEK THREE: TRAFFIC STUDY



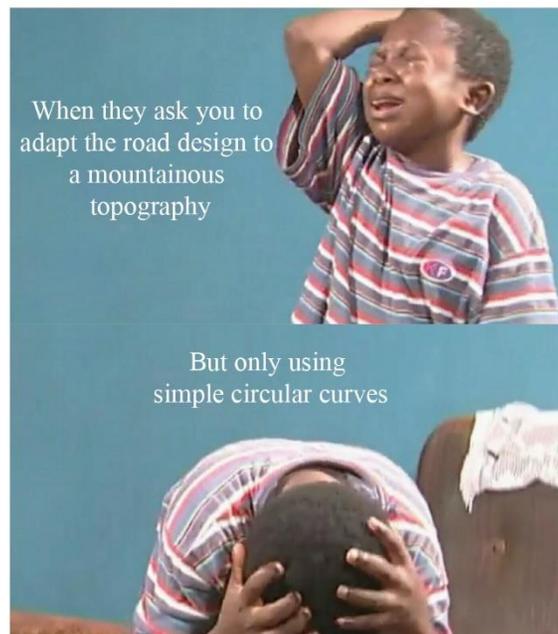
By: Emilio Andrade (Group C)

WEEK ELEVEN: THE SUPERELEVATION



By: Adriana Chicaiza (Group B)

WEEK NINE: COMPOSITE CIRCULAR CURVES



By: Roberth Azanza (Group D)

Fig. 1. Examples of the creation of internet memes. Adapted from images on the Internet.

The internet meme template from week three is a modified image of rapper Drake. This meme came from scenes from the single *Hotline Bling*, in which the artist performs various dance moves [15]. This time, the meme has been modified by changing the artist and placing Goku, the main character of the *Dragon Ball* cartoon, but the gestures that made this meme famous are maintained. In this case, the student has placed an image of a vehicle with a load over the maximum allowed. In the second scene, it shows what should be the right thing to do, i.e., respect the maximum load. With this simple image, the student relates the concept that exceeding the maximum load of the road can have severe consequences for the life of the pavement structure.

In the template of week six, one of the scenes of the film *Intelligent Student* with the Nigerian actor Chinedu Ikedieze is represented. The origin of the meme is a scene when the actor cried because his father stole the money the boy earned working on the street [16]. They are used to exemplify the reaction to a succession of complicated situations. In this case, the student shows the child's frustration when asked to design a road in a mountainous topography, and then, in the second scene, it is mentioned that only simple circular curves can be used. The geometric design of roads is more complex in mountainous terrain than in flat terrain. Moreover, although simple circular curves adapt well to this type of terrain, compound circular curves adapt better to it, so these would have fewer nature modifications, therefore, lower construction costs. On this occasion, the student has exceeded the expectations of the weekly topic content since he has linked two previous academic matters.

Two scenes of the TikTok® user Khaby Lame (@khaby.lame) [17] body language appear in the week 11 template. Lame's videos on this social network show complicated situations that can be resolved more easily. The expressions on his face have become a meme. The student, in the first panel, put an image of a vehicle that rollovers in horizontal curves, and whose solution — shown in the second panel — is superelevation. Although the lack of adequate superelevation is not the only cause

of an accident in this type of curve, the student has understood the relationship between vehicular traffic and the geometric design of the cross-section in a curve.

B. Peer Review

Figure 2 shows the weekly grades of the images of all the groups. There is a considerable dispersion in the first weeks, possibly because the students are adapting to this learning moment — both the elaboration and the peer review —, not only to the use of an image editing program, but to the relationship between the image and the text. The latter is what makes the creation complicated. Also, they must be creative by adding scientific content to an image used in other contexts. Students like to consume internet memes, but their elaboration is much more complex.

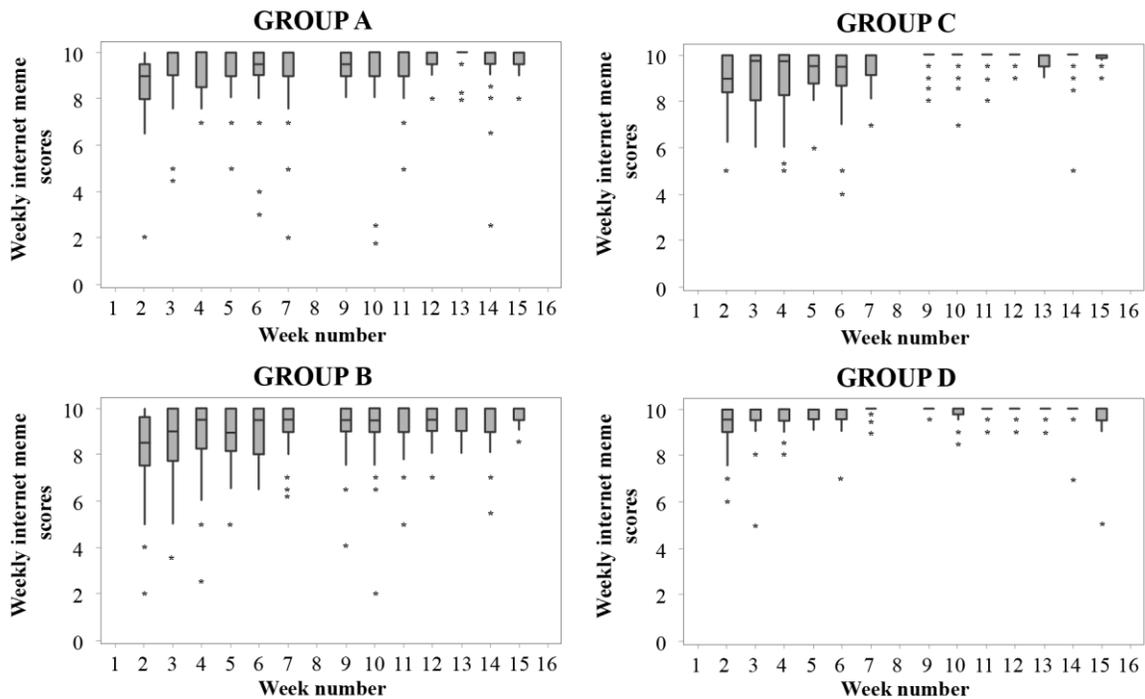


Fig. 2. Weekly grades of the internet memes of the study groups.

Around the first eight weeks, the student already knows how to make an internet meme. Then, the grades are more uniform and with less dispersion. Moreover, the students have little experience in grading the work of other students, so those eight

weeks serve also as an adaptation period to the evaluation rubric, and to giving and receiving critics on the images. If the average values of the groups are analyzed, groups B and D have a more uniform trend, that is, in the first eight weeks, the ratings increase until they reach values close to 10 points. After that, the ratings continue increasing but more slowly, that is, with a lower slope than in the first eight weeks. This trend is not noticeable in groups A and C, whose average values in 1–8 weeks or 8–16 weeks have very varied values without any observable trend.

C. Final Grades

Table 2 shows the final grades of the groups. In this table, two groups that resemble each other can be distinguished: A and C, and B and D. The former has higher failure rates than the latter. It also has lower grade point averages than groups B and D. There is a higher dispersion in groups A and C than in groups B and D. The same trend is observed in the confidence interval.

Table 2. Descriptive statistics of final course grades.

Descriptive statistic	Students				Grade average	CI (9 5%)
	Group	N°	Approved	Failed		
A	56	43	13	0	7.31	0.19
B	58	55	3	0	7.62	0.16
C	32	13	10	9	6.72	0.42
D	43	38	5	0	7.38	0.18

D. Students' Perception

In the survey, the students answered four questions where they had to select a value between 1–10, one being the lowest and ten the highest. The categories evaluated were general grade of the course, self-study, elaboration of internet memes, and the peer grade (see Table 3). Group B has the highest rating, which coincides with the highest average rating. This outcome suggests that the "best students" value the course in a better way.

As far as self-learning is concerned, the groups that perceived more work (such as group C) have a lower average score. This trend also suggests that the groups with

“worse students” consider that they do a better job than the rest. This trend should be explored in future studies.

Table 3. Scores of student's perceptions of the activities carried out in the group.

Descriptive statistic	Overall score of the course	Self-learning	Internet memes creation	Peer review
Ave. \pm CI _{95%} (A)	8.86 \pm 0.35	7.47 \pm 0.59	8.30 \pm 0.63	7.95 \pm 0.73
Ave. \pm CI _{95%} (B)	9.16 \pm 0.32	7.63 \pm 0.47	9.05 \pm 0.42	8.28 \pm 0.50
Ave. \pm CI _{95%} (C)	8.86 \pm 0.59	8.43 \pm 0.67	8.71 \pm 0.69	8.43 \pm 0.75
Ave. \pm CI _{95%} (D)	8.84 \pm 0.27	8.05 \pm 0.45	9.42 \pm 0.31	9.26 \pm 0.42

The confidence intervals between these two pairs of groups (A-C and B-D) are very similar, as previously detected in the final grades. The same is observed in the confidence intervals for the peer review. Despite these differences between groups, the average values were higher than 8.3/10. So, in general, the students are satisfied with this activity. In turn, the peer review showed a reduction in the score assigned concerning the internet memes creation. This reduction in students' satisfaction may be because they do not like the activity, they are not used to criticizing the work of their classmates, to use grading rubrics, or they disagree with the rubric criteria or even with using it. A combination of all the above may be possible; however, it should be further studied in later works. Despite these reductions, the average minimum rating was 7.95; thus, most agree with this trend.

IV. DISCUSSION AND CONCLUSIONS

The data suggest that students can successfully use internet memes to analyze course topics before attending synchronous virtual classes. They were used as an alternative to reading controls; however, the images cannot be considered as the only learning activity, it must be complemented with others.

The creation of internet memes can be complicated at first, but if the images are expressive and evocative, users can go from pure consumers to producers, as in Baozou emoticons [18]. In this investigation, students improved that skill as weeks passed. It is necessary to mention that the students had no previous experience with images in any other course. Moreover, not everyone will like this activity since students have different learning styles.

Regarding the images' peer review, despite having a low rating, this type of learning is based on previous literature [19]. This activity allows students to develop critical thinking, which is necessary in the civil engineering profession [20]. Despite the good results, internet memes do not solve the problem of complex concepts, they rather simplify the complex procedure of any subject taught by the teacher [3]. We must also consider that not all internet memes are good or not all are closely related to the weekly topic. Some images were submitted without prior review of the template or watching the prerecorded lecture; however, students can have a fun time producing or grading internet memes, which would positively affect them in university classrooms. Instructors can also enjoy this activity and reduce the working hours because students evaluate the creations.

Further research is needed to establish the relationship between final grades and job satisfaction as some interesting trends were found here. It should also be analyzed why students are less satisfied with peer review than with the internet memes creation. Likewise, why the groups with lower grades consider that they do more self-learning than the groups with higher grades, and the latter experience greater satisfaction than the first ones. Finally, the rubric that contains structural, social, and specialized criteria [8] is adequate for this type of evaluation.

This research has several limitations. First, the study only focused on one subject from a single university in Latin America. Students received the internet meme templates; therefore, they could not present images of their liking or the most common for them. Despite these limitations, the study is a first experience using these images in courses related to geometric design. It offers details of an experience using internet memes as a flipped learning activity complemented by peer review. The evidence suggests that they can be used in other courses that have a content based on physics and mathematics.

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AUTHORS' CONTRIBUTION

Yasmany García-Ramírez: Investigation, Methodology, Writing – original draft, Writing – review & editing, Visualization, Conceptualization, Formal Analysis.

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