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SHORT PAPER

Unveiling the Acronyms: A Flipped Classroom Activity for Building Theoretical Knowledge

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ABSTRACT

The use of acronyms in many disciplines, particularly in today's digital world, is large, and the knowledge behind each acronym is sometimes taken for granted. For example, common acronyms such as GPS, LCD, LED, SIM, Wi-Fi, PDF, HDMI, MPEG, IP, or HTML are used without considering what is behind each letter. The reality is that they are all acronyms. This work proposes an inverted classroom activity in the course Architecture and Telematic Networks of the Bachelor's Degree in Telecommunication Engineering at the Escuela Politécnica Superior de Gandia of the Polytechnic University of Valencia, Spain. In this activity, once a week, the students, in groups of two or three people, must expose to the rest of their classmates through an elevator pitch the hidden meaning behind each acronym used in the contents of the subject. The acronyms in this course are more cryptic (ARP, ICMP, DHCP, NAT...), and in the end, their thoughtless use can be more of a problem than a help to understand the topic. So, this activity addresses two problems. First, they strive to understand what lies behind each acronym collectively, and second, they acquire the knowledge they will need for their professional careers in the future. In short, this classroom experience has demonstrated that providing a vital glossary of the course helps the students to delve into purely theoretical concepts differently and engagingly.

KEYWORDS

active learning, learning strategies, higher education, pedagogical issue, self-regulated learning

1 INTRODUCTION

Acronyms have become essential to our daily communication, particularly in the digital world. From GPS to PDF, these seemingly innocuous abbreviations are used so frequently that we often forget to stop and think about what they actually mean. This is a problem in casual conversation and education, where acronyms are often used in textbooks, lectures, and other instructional materials without any explanation or context. As a result, students can struggle to understand the meaning and

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significance of these acronyms, which can hinder their ability to grasp the concepts and theories essential to their academic and professional development.

Active learning strategies are one approach that can be used to address this problem. Active learning is a pedagogical approach involving engaging students in activities requiring them to participate in their learning process actively [1]. In recent years, a growing body of research has demonstrated the effectiveness of active learning strategies in improving student engagement, motivation, and retention of course material. This approach has been used in various educational contexts, from K-12 classrooms to higher education, and is particularly effective in STEM fields [2]-[4].

This paper proposes an inverted classroom activity to help students in the Architecture and Telematic Networks Bachelor's Degree in Telecommunication Engineering course at the Escuela Politécnica Superior de Gandia of the Polytechnic University of Valencia, Spain, to understand better the acronyms used in their coursework. In this activity, students must research and present the meaning and significance of the acronyms used in the course material. Through this activity, we aim to address two problems. First, we hope to help students collectively understand the meaning and significance of the acronyms in the course material, enabling them to more effectively grasp the concepts and theories essential to their academic and professional development. Second, we aim to help students acquire the knowledge they will need for their future careers in telecommunications engineering.

This paper is inspired by other similar works that have been conducted in the field of education. For example, in the studies proposed by [5]-[7], an inverted classroom model was used to improve student engagement and learning outcomes in a university-level course. Similarly, the studies [8]-[13] used a flipped classroom approach to enhance student learning outcomes and engagement. These works demonstrate the potential of active learning strategies in improving student engagement and learning outcomes in STEM fields and provide a strong rationale for our proposed approach.

This paper will describe our study's inverted classroom activity and a rubric to evaluate student presentations. We will also present the results of our study, which provide evidence of the effectiveness of the proposed approach in improving student engagement, motivation, and retention of course material. Finally, we will discuss the implications of our findings for future research and practice in STEM education. The activity described here was carried out during the 2022–2023 academic year in the course Architecture and Telematic Networks of the Bachelor's Degree in Telecommunication Engineering at the Escuela Politécnica Superior de Gandia of the Polytechnic University of Valencia, Spain.

2 METHODOLOGY

The weekly inverted classroom activity was an innovative pedagogical approach that aimed to enhance student engagement and participation in the Architecture and Telematic Networks course of the Bachelor's Degree in Telecommunication Engineering at the Escuela Politécnica Superior de Gandia. The activity lasted for 10 weeks, during which students were organized into groups of 2–3 people, each assigned a set of acronyms to research and present to the class in the form of an elevator pitch.

The rubric used to evaluate the weekly presentations was designed to assess different aspects of the group's performance, including their understanding of the

acronym, the clarity of their presentation, their engagement with the audience, and the overall effectiveness of their communication. Each criterion was weighted equally, with a maximum score of 5 points, making a total of 20 points for each presentation.

The first criterion, knowledge of the acronym, was aimed at ensuring that the group understood the meaning and significance of the acronym they were presenting. This criterion evaluated the depth and accuracy of the group's research and their ability to explain the key concepts and ideas related to the acronym. A score of 5 points was awarded to groups that demonstrated a comprehensive and insightful understanding of the acronym, while a score of 1 point was given to groups that showed a lack of understanding or presented inaccurate information.

The second criterion, clarity of the presentation, focused on the organization, coherence, and fluency of the group's delivery. This criterion evaluated the group's ability to structure their presentation logically and easily, avoiding technical jargon or overly complex language that might confuse the audience. A score of 5 points was awarded to groups that delivered a clear and engaging presentation, while a score of 1 point was given to groups that struggled to convey their ideas or failed to engage the audience.

The third criterion, engagement with the audience, assessed the group's ability to connect with the audience and facilitate discussion. This criterion evaluated the group's responsiveness to questions and comments, ability to stimulate curiosity and generate interest, and ability to engage the audience. A score of 5 points was awarded to groups that effectively engaged with the audience, while a score of 1 point was given to groups that failed to generate interest or could not answer questions adequately.

The fourth criterion, overall effectiveness, assessed the extent to which the presentation effectively communicated the significance of the acronym and its relevance to the course material. This criterion evaluated the group's ability to make a compelling case for the importance of the acronym and its potential impact on the field of telecommunications engineering. A score of 5 points was awarded to groups that presented a convincing and compelling case, while a score of 1 point was given to groups that failed to make a clear and convincing argument.

Finally, the fifth criterion required groups to identify their strengths and areas for improvement after each presentation. This criterion encouraged groups to reflect on their performance, identify areas where they could improve, and develop strategies to enhance their skills for future presentations.

Overall, the weekly inverted classroom activity was a successful pedagogical approach that allowed students to develop a range of essential skills, including research, critical thinking, public speaking, and teamwork. The rubric used to evaluate the presentations ensured that students received constructive feedback that was specific and actionable, enabling them to identify areas for improvement and work on enhancing their skills. By fostering student engagement and participation, the activity helped to create a dynamic and stimulating learning environment, which enhanced the overall learning experience for all students involved.

Specifically, the rubric was as follows:

1. Knowledge of the acronym (5 points): Did the group demonstrate a clear understanding of the meaning and significance of the acronym?
2. Clarity of the presentation (5 points): Was the presentation well-organized, easy to follow, and free of technical jargon?

3. Engagement with the audience (5 points): Did the group effectively engage with the audience, answering questions and eliciting discussion?
4. Overall effectiveness (5 points): Did the presentation effectively communicate the significance of the acronym and its relevance to the course material?
5. Strengths and areas of improvement of each presentation are made, so that the presentation becomes an excellent tool for improving the skill.

3 RESULTS

The weekly inverted classroom activity results were positive, with students demonstrating a significant improvement in their understanding of the course material and the acronyms used in the subject matter. The rubric was used to evaluate each group's presentation, and the average score for each criterion was calculated. The results are summarized below:

- Knowledge of the acronym: The average score for this criterion was 4.2 out of 5, indicating that most groups demonstrated a good understanding of the acronyms they presented.
- Clarity of the presentation: The average score for this criterion was 4.5 out of 5, indicating that most groups could present the material clearly and engagingly.
- Engagement with the audience: The average score for this criterion was 4.3 out of 5, indicating that most groups could engage with their classmates and elicit discussion effectively.
- Overall effectiveness: The average score for this criterion was 4.4 out of 5, indicating that most presentations effectively communicated the significance of the acronym and its relevance to the course material

The results of the weekly inverted classroom activity demonstrate that the use of active learning strategies can be effective in helping students to engage with technical material and acquire the necessary knowledge for their future careers. The activity helped students to collectively understand the concepts and acquire the knowledge necessary for their future careers. The activity also had implications for self-regulated learning in higher education, as it encouraged students to actively take responsibility for their learning and engage with the material.

Fig. 1. Photographs from one of the students' acronym presentation sessions

4 DISCUSS ON FINDINGS' AND FUTURE RESEARCH

The findings of this study have several implications for future research and practice in STEM education. Firstly, using active learning strategies, such as the inverted classroom model, can enhance student engagement, motivation, and retention of course material. The results of this study provide evidence of the effectiveness of the proposed approach in improving student understanding of acronyms used in the course material. Therefore, future research can explore the effectiveness of this approach in other fields and courses.

While the inverted classroom activity described in this paper shows promise in addressing the challenges associated with understanding acronyms in STEM education, there is still room for improvement. One potential limitation of this approach is that it relies heavily on students' motivation to participate actively in the activity. If students are not motivated to engage with the material, the activity may not be as effective in achieving its intended goals.

To address this limitation, future studies could explore ways to incentivize student participation and provide additional support to students who may be struggling with the material. For example, it could offer extra credit for participation in the activity or provide additional resources to help students understand the acronyms. Additionally, it could consider incorporating the activity into the overall course grade, which could increase student motivation to participate.

Another potential improvement to the inverted classroom activity is to include opportunities for peer feedback and collaboration. By working in groups and providing feedback to one another, students may be more likely to engage with the material and develop a deeper understanding of the concepts. Moreover, peer feedback can help students improve their presentation skills.

Overall, while the inverted classroom activity described in this paper is a promising approach to addressing the challenges associated with understanding acronyms in STEM education, much remains to be explored and improved upon. Future studies could incorporate additional strategies to enhance student motivation and engagement, such as gamification or other forms of active learning. Additionally, I would like to explore ways to integrate the activity more seamlessly into the overall course curriculum, ensuring it is effectively integrated with other course materials and objectives. As this is a first pilot experience, I am sure this will be implemented in the future.

5 CONCLUSION AND DISCUSSION

Acronyms play a significant role in daily communication, particularly in the digital world. However, their frequent use of educational materials without proper explanation or context can hinder students' understanding of critical concepts and theories essential to their academic and professional development. Active learning strategies, such as the inverted classroom model, have effectively addressed this problem and improved student engagement, motivation, and retention of course material in STEM fields. Our proposed inverted classroom activity, implemented in the Architecture and Telematic Networks course at the Escuela Politécnica Superior de Gandia of UPV (Spain), demonstrates the potential of this approach in helping students understand the meaning and significance of acronyms used in their coursework. Our results provide evidence of the approach's effectiveness in achieving

these goals, highlighting the importance of incorporating active learning strategies. Future research in this area could explore optimizing the inverted classroom model further to enhance student learning outcomes in different educational contexts and disciplines.

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