

# A case for internet memes in education: a focus on mathematics and medical science

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## ABSTRACT

In this review, I reflect upon writings on, and teaching experiences of, using internet memes as a pedagogical tool for enhancing learner engagement. The review also looks at how viable it is to incorporate internet memes into teaching of mathematics and medical science. I reviewed a range of studies from Russia, India, Oman, Spain, Italy, Ukraine, USA and the UK within the context of the online learning environment. Results from this review showed mixed responses to the use of internet memes. Positive views include that staff and students enjoyed the humorous nature of internet memes, while negative views showed many staff reluctant to use internet memes, pertaining to their levels of comfort in using creative digital methods. The review also shows mixed results when internet memes are used as a replacement for assignments set for formal grading.

## INTRODUCTION

In recent years, the use of online learning in education, especially higher education, has significantly increased, necessitating adjustments in schools and universities. The Covid-19 pandemic and technological advancement stand out as the driving forces behind this expansion of online learning (Anton-Sancho *et al.*, 2022).

A growing effort is being made to understand students' interests, in order to tailor these learning environments,

due to the pedagogical need to improve student motivation in the online learning space. The need for educators to encourage students through creative, digital resources to promote student engagement, motivation and enhance the teaching-learning process has led to the emergent use of unconventional teaching resources, such as internet memes.

The purpose of this paper is to review recent research into the different uses of internet memes as a tool in

## KEYWORDS

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DIGITAL EDUCATION

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education. I will reflect upon writings and teaching experiences using internet memes in sources from Russia, India, Oman, Spain, Italy, Ukraine, the USA and the UK to illustrate the potential benefits of using internet memes in teaching practice. I will demonstrate several ways others have used memes in the educational process, organised by subject fields of mathematics and medical sciences.

## WHAT ARE INTERNET MEMES?

An internet meme is an idea, behaviour, image or style that circulates online, frequently through social media platforms. The definition of an internet meme differs among online communities, and its intended use may change over time. For example, internet memes were once exclusively conceived of as images, concepts or catchphrases. The idea has since expanded and taken on many forms, including more complex structures like challenges, GIFs, videos, songs, dances and other viral sensations. The definition that I will use is that internet memes are the act of rapid dissemination of a 'specific notion expressed as a written text, image or some other unit of cultural stuff – videos, melodies, images, dances' (Knobel & Lankshear, 2007, p. 202).

Internet memes are regarded as a staple of internet culture and reliable user communication (Borzsei, 2012). Instant communication on the internet facilitates word-of-mouth transmission, resulting in fads and sensations that spread quickly or 'go viral'. Scholars (Shifman, 2015; Aslan, 2018; Marchant, 2021) argue that while memes may appear insignificant, they reflect deep social and cultural processes. They stress that we must pay attention not just to the words but also to the cultural norms and expectations surrounding the memes because memes 'are the backbone of complex digital civilisations' (Shifman, 2015, pp. 78). Internet memes are effective as they frame discussions that are usually informal and digested in parts; as Brown (2017) states, 'Memes condense the richness and intricacies of unique experiences into a single expressive unit' (p. 84). Therefore, internet memes provide people with a medium to broadcast their thoughts and feelings and provide a quick and engaging means of entertainment and self-expression online (Hodson, 2017).

## GENERATION OF LEARNERS, COVID-19 AND INTERNET MEMES

Every generation is subject to stereotypes, but one constant description of the newest educational cohorts is that they are 'digital natives', having been born in the era of the internet and other digital innovations or shortly after that (Williams, 2020). Many learners have spent much of their lives surrounded by and using computers, video games, tablets, apps, virtual reality (VR) and other tools of the digital age (Collins & Halverson, 2018). As a result, it is assumed that these groups use digital devices, media and social media more frequently in all aspects of their daily lives, including at work, play and school. It is suggested that due to this ubiquitous environment and the volume of interaction with mass information provided by digital platforms, modern students may think and process information fundamentally differently from their predecessors. Therefore, adapting education to how students learn is critical given the contexts in which each generation processes and consumes information (Brown, 2020). Kyrpa *et al.* (2022), in their study of meme use in education in Ukraine, found that while these students process information more quickly, the period of concentration on one subject is reduced, and students prefer concise vivid visual images. This is interesting as it aligns with the understanding of memes as units of visual expression and appears to have the potential to meet the needs of digital learners.

Adding to this, the Covid-19 pandemic changed the way of life for many people: their home space has become an office, university and school (Kidd & Murray, 2020). The pandemic necessitated using social media platforms to supplement social interaction that had been removed to comply with social distancing laws (Subbiramaniyan *et al.*, 2022). There were mixed responses to the move to the online space. Since digital natives are

people who were born and raised during the digital era (Prensky, 2001), and who are expected to be tech-savvy, they found the move easier than those who are not as tech-comfortable. This is especially true for some faculty members and contemporary students. Shariman *et al.* (2012) concluded that the effects of new digital technologies in redefining online education are still being fully explored because a sizable portion of students and staff do not possess the skills expected of digital natives due to factors like age, location and socio-economic background (Bennett *et al.*, 2008).

## INTERNET MEMES IN EDUCATION

Internet memes are a growing body of literature on many levels. Much of the current literature on memes pays particular attention to political memes, such as the Trump Election (Schill & Hendricks, 2018), and to conspiracy theories, including government control (Ross, 2011), anti-vax (Geniole *et al.*, 2022) and Covid-19 conspiracy memes (Panchal & Jack, 2020). More recently, research has emerged with a focus on the use of internet memes and society (Denisova, 2020), neurodiversity (Cromby, 2022) and mental health (Adams, 2021). There is a comparatively small body of literature that is concerned with memes in education, in areas like critical thinking (Wells, 2018), languages (Lankshear, 2017; Dongqiang *et al.*, 2020; Sedliarova *et al.*, 2020) and teaching human–animal relations (Tammi & Rautio, 2022) and physical education (Tinning, 2012). The main reason for choosing to focus on mathematics and medical science memes in this review is to explore how memes may interact with more fact-based science subjects, as this is an under-researched area of education. In this section, I will review available studies to highlight how internet memes, mathematics and science have been used together in an educational environment. This kind of research takes on interest because it aims to demonstrate that, in the digital age,

scientific disciplines like mathematics are no longer the sole preserve of traditional educational contexts. It indicates that scientific subjects can be effectively taught using unconventional tools that provide opportunities for connections between classroom science, mathematics and students' digital languages, giving value to youth culture (Dongqiang *et al.* 2020).

## INTERNET MEMES AND MATHEMATICS: CASES FROM ITALY AND NEW YORK

Mathematical internet memes combine mathematical and memetic elements to produce hybrid representations of mathematical statements, endowed with an epistemic power to initiate argumentation processes among users (Bini *et al.*, 2020). Despite these evident potentialities, mathematical memes are still widely understudied in mathematics education.

A small-group study from the Department of Mathematics and Physics at the University of Turin presented research on the creation and classroom use of internet memes about mathematics during a workshop on alternative teaching methods. They highlighted the educational potential of digital objects and expressions common to modern Web 2.0 culture, such as internet memes

(Bini & Robutti, 2019). The workshop included mathematical memes along with a breakdown of their social meaning and the conceptual mathematical problem being taught (an example shown in Figure 1).

The 'Distracted Boyfriend' meme from the workshop described the social meaning of a meme. It is used to represent situations where someone (the boyfriend), instead of connecting with the right thing (the girlfriend in blue on the right), is diverted to something more alluring (the woman in pink on the left). This meme refers to the cognitive obstacle of distinguishing the role of a sign in the expression of a power number. The wrong outcome (connected to the girl in pink) is the result of  $(-5)3 = -125$ , which is often mistaken for  $5-3 = 1/125$  (the girlfriend in blue). The meme expresses that although the correct way has been taught (the girlfriend in blue), it is common for students to use the incorrect way, as if allured to it (the girl in pink). The expression of the girlfriend in blue is humorous to staff and students as it has been described as mimicking the face teachers pull whenever they see the incorrect way on a paper (Bini & Robutti 2019).

The results of this workshop highlighted that those mathematical concepts could be communicated using memes and would help students to remember this

common mistake to avoid it in the future. From the learning point of view, it guides and motivates students to understand the meme's specialised meaning. From the teaching point of view, it can be exploited by teachers who can use memes to connect to students in a humorous and visual way, a step forward from a more formal rote or memorisation technique (Arzarello *et al.*, 2008).

In a later study, Bini & Robutti (2022) conducted an exploratory teaching experiment with a group of 12th-grade students in Milan as part of another study to evaluate the potential educational efficacy of memes. The task was to make a meme about one of the year's math course topics and record a video explaining the mathematical concept recalled by the meme. They posted the memes in a collective space, using the free web app Padlet (set up for the occasion to mimic the social media environment), allowing for multilayered student interaction. The findings of this study have not yet been publicly disclosed. However, it has been noted that numerous Reddit and Facebook groups have mathematical themes (some with names like 'Complex Analysis Memes for Holomorphic Teens'). Here, thousands of users from around the world regularly discuss a post and share mathematical internet memes to demonstrate their mastery of mathematics (Bini & Robutti, 2022). This is interesting as mathematical internet memes appear to be naturally emerging from social media platforms like Facebook and Instagram's thematic groups. These groups appear to be avidly frequented, and serve as authentic, unplanned communities of practice where information is shared in the service of group learning. This shows that people see value in using internet memes to convey mathematical concepts accurately online, which is encouraging to the appeal to use memes in an educational setting.

In contrast, several studies in education have noted that internet memes are not always positive (e.g. Flecha Ortiz *et al.*, 2020; Iloh, 2021; Valensise *et al.*, 2021).



Figure 1. Source: Instagram: Juicy Mathematical Memes, found in Bini & Robutti (2019).

Numerous data sources were used in Benoit's (2018) analysis of mathematical internet memes to show that students are exposed to messages about mathematics through memes in popular culture. Findings showed that social media practices (liking, commenting, sharing and creating) that reify negative messages about mathematics and memes are used to depict mathematical stereotypes, reinforcing negative messages and potentially reducing the participation of future students in uptake of mathematical topics.

Overall, these results indicate that internet memes can be used as a successful teaching tool to demonstrate corrections in a humorous and positive way for both staff and students. Furthermore, because internet memes exist in online mathematic groups, it shows they can be successfully used to convey mathematical concepts; however, it is still unclear how that can fully and accurately transition to the educational setting.

## MEMES IN PHARMACEUTICAL & MEDICAL SCIENCE: CASES FROM FLORIDA, MEXICO, INDIA AND OMAN

In, 2020, the University of Florida Pharmaceuticals College held the opinion that using internet memes could make fun lecture material and would increase the likelihood that students who prefer more visual approaches will remember the concepts. Furthermore, memes were believed to convey course material that could go beyond simple memorisation and even encourage higher-level thought, application, and retention of those concepts due to memes' highly contextual nature. The University used its third-year 'Pharmacoepidemiology and Drug Safety' course to put theoretical understandings of meme usage into practice. This final assignment would usually be a comprehensive, two-page-article critique that evaluates students'

ability to apply concepts learned in class to a mock peer-review activity using an already-published article. The ability to explain complex studies to a layperson, in this case, a patient, is described as the core competency expected from the course. Instead, to gauge the effectiveness of using memes to meet course competencies, Brown (2020) asked the 225 third-year pharmacology students in their cohort to produce at least two 'work-appropriate' memes per three- or four-person group. Brown (2020) also measured the effectiveness of doing so to gain student feedback.

The outcomes of the assignment were mixed, although mostly positive. It was found that memes could be viewed positively as they demonstrate opportunities for students to learn course content through creative methods. One of the most prominent outcomes of the study was that memes gave students the chance to connect over memes' origin stories. For example, responding to a Lord of the Rings meme, a student commented, 'this is from my favourite movie'. This connection was described as important to students in an online learning environment due to the social isolation resulting from the Covid-19 pandemic. Students also stated that the activity supported an active and positive learning environment and was a humanising task (Brown, 2020). However, while students enjoyed the task, in the findings, groups of students had focused too often on a particular concept or repeatedly misinterpreted or misrepresented a concept over multiple submissions, suggesting a lack of conceptual or contextual understanding of both the mathematics and the memes. This is potentially due to the highly contextual nature of internet memes. A positive view of this outcome, however, is that the memes were able to highlight areas where course content may need to be bolstered, reduced or revised.

The study was also shared on Twitter, allowing for additional feedback from

peer colleagues within and outside the University of Florida. Twitter responses were overwhelmingly positive, with over 10,000 engagements, and individual feedback expressing personal opinions about the ideas or subjects covered by memes. However, while positive, the Twitter feedback also showed some scepticism about the educational value and general concept of a meme when sharing the activity with co-workers who might be categorised as 'GenX' or older and stereotypically thought to be less comfortable with such communication media. Despite not being found in the empirical data, Twitter feedback revealed that people felt memes might not appeal to colleagues who have stricter standards for what 'professionalism' entails. This feedback is contrary to that of Brown (2020) who found that by including these informal activities in a professional learning environment, there was a chance to create a safe space to develop good practices in these types of communications. It could also lead to a generation of professionals at ease with both formal and informal means of disseminating information about science and health.

In an immunology class in Mexico, an assignment to create a meme that explained any second-term themes, such as phagocytosis, inflammation, antigen

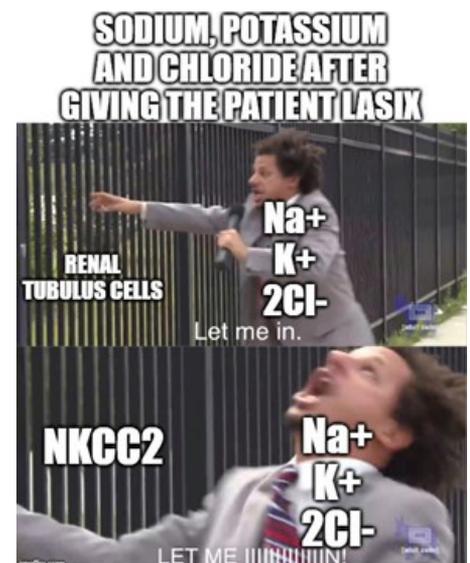


Figure 2. Pharmacology meme. Source: 'Is There Any Other Way to Study Pharmacology?' Reddit, 2019

presentation and natural killer (NK) cells, was given in a novel effort to increase class participation and evaluate students' understanding of the course material. The positive response led to the creation of 64 memes by 45 students, some of whom posted more than once. Using internet memes' visual representations, students made clever connections. All the internet memes used in this task to illustrate immunology concepts were accurate and understood. Additionally, informal student evaluations of the meme activity were favourable, with one stating, 'It was a fun assignment. I even started gathering memes from my social media feed over the weeks because I thought they would help explain the procedures we were covering in class.' One student said she appreciated the teacher's extra effort to adapt the class to a fully online environment. Another student remarked that when developing the meme, he put a lot of effort into conveying the information and learning how to use images to communicate. Despite the positive results of this study, some staff members expressed doubt about the validity of using internet memes in scientific research.

Similarly, Subbiramaniyan *et al.* (2022) investigated the usefulness of internet memes in learning renal physiology at the Mahe-Farmer Institute in India and the College of Medicine and Health Sciences in Oman. There was an option for 280 students to make memes based on their renal physiology learning objectives. Of these 280 students, 146 (52%) were selected to make memes, and the remaining students were chosen to submit a concept map or a labelled diagram. All students (labelled-diagram and meme users) received the full 1% grade mark for this assignment, which counted as 1% of their final course grade. This suggests that meme submissions were as effective at meeting grading requirements as traditional diagrams. Staff and students were also asked to submit feedback relating to this task, and the comments were subjected to thematic analysis to

understand how students felt about the meme task. The most exciting finding from this analysis described by students was the 'joy of learning', present in 44% of comments, with quotes used such as 'it's [i.e. memes are] useful because we can explain some complex topics in a fun way that makes it easy and refresh our mind'. However, staff reported concerns about the application of internet memes across the board as findings showed they would not be sufficient for more critical formally graded exams due to the high risk of misinterpretation of memes given their highly contextual nature. None the less, staff did report that memes were enjoyed by students, creating a more engaging learning environment.

Taken together, the findings of these studies suggest a positive association between the use of internet memes and science education. It is possible to tell from these studies that using internet memes in education could enrich scientific courses and encourage student creativity. However, the results also indicate that using internet memes for formally graded assignments may not be appropriate, due to the contextual nature of internet memes and the high risk of misinterpretation. Furthermore, it is highlighted that another barrier to using internet memes in education is use of memes with hesitant staff who may not understand or feel comfortable using creative digital resources.

## CONCLUSION

This study reviewed recent research into the different uses of internet memes as a tool in education in various countries. The results of this investigation show that using internet memes in education may have positive implications for learners. Students welcomed internet memes throughout the curriculum and described the effect of using internet memes for increased engagement and enjoyment. In general, it seems that internet memes were able to provide a creative way for students to present scientific concepts and meet course competencies.

However, caution should be exercised when using internet memes as they are highly contextual so there is a high risk of misinterpretation or misrepresentation of concepts relating to the memes. This could impact students' grades if used in a formally graded assignment.

This review contributes to the growing literature on the use of internet memes in education. It has highlighted that in most studies, staff have reported scepticism over internet memes in education, perhaps relating to their position in the 'digital age' and feeling less comfortable using digital methods than their 'digital native' students. The generalisability of these findings is subject to certain limitations. For instance, all the studies in this review were conducted within the online learning environment. Therefore, further work is required to establish the viability of if and how internet memes may function in a face-to-face teaching environment. Furthermore, this review focused only on scientific subjects and has not looked at the broader background in education in which internet memes could be used. Overall, relating to scientific and mathematical knowledge and digital resources in this review, it appears that internet memes can be used as a strategy in the repertoire of available tools to engage with students during and after the pandemic. ■

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