



Enhancing the student learning experience through memes

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ABSTRACT

Meme-making is an effective method for engaging students and enhancing the learning environment. Memes are a social media cultural phenomenon that the majority of those in Higher Education are exposed to on an almost daily occurrence. This research examined the use of meme-making within the forensic sciences to allow students to reflect on their knowledge. Students studying modules in forensic science across six universities in the UK and USA participated in the study. At the end of a teaching session, students produced a meme (using Meme Generator) to reflect on what they had learned; memes were then shared with the class anonymously via Padlet. This allowed all class members to see and engage with the memes created. At the end of the activity students were anonymously surveyed on their experience using Microsoft Forms and analysis of the results were undertaken using SPSS software.

Meme-making was found to be an inclusive learning activity with no limitations, including age (part-time, distance learning and visually impaired students were not part of the study parameters). Results showed that not only did students find the practice fun, but it also helped with the retention of the class content suggesting that the meme-making process is an effective way to enhance the learning environment while engaging students.

Student feedback suggests that to maximise participation the educator should stress reflection and learning as the key purpose of generating a meme, rather than being witty or entertaining. The forensic science educator should be mindful of selecting appropriate subject matter for this often-humorous activity.

1 Introduction

The term “meme” was first used by Richard Dawkins in 1976 to describe one organism creating a literal copy or imitation of a “unit of culture” [1]. Although this was undoubtedly used in a biological context, it is clear to see the link between this use of the word meme and the modern day understanding of what an internet meme is. Shifman describes the internet meme as a tag word commonly applied to describe the propagation of items such as jokes, rumours, videos and websites from one person to another via the internet [2]. The scale of this sharing is vast with over one million memes shared each day on Instagram alone

post-Covid, making the format one of the most popular forms of visual communication of modern times [3]. The posting and sharing of memes through social media thematic groups can also generate discussion and critique through comments posted, promoting peer learning [4].

Meme-making as a concept is relatively new to the classroom with Kyrpa and Antón-Sancho et al. advocating the integration of memes into teaching material for educational or informational benefit [5,6]. Boyle also uses memes for teaching material, creating her own memes to inform students around information and fact-checking from an information literacy perspective [7]. Romero and Bobkina deploy memes in their classroom as a mechanism to evaluate critical and visual literacy

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within a group of final year English Studies undergraduate students at the Complutense University of Madrid in Spain to assess skills gaps [8]. Incorporating memes into educational materials is regarded as a modern approach to engage learners, leveraging their familiarity and frequent interaction with such content.

Several researchers have expanded this by getting their students to be the producers of memes within the classroom. Tammi and Rautio, for example, use students making memes as a way of exploring ethico-political tensions of human-animal relations [9]. This research highlights some of the complexities of asking students to construct a humorous representation of a complex and emotionally difficult subject describing the process as “feral pedagogical creatures”. Taylor and Stump allowed their students to express their module feedback by each producing two memes, one compliment and one area for improvement, which were then submitted to the course team allowing them to identify themes of feedback [10].

Memes have also been used to explore students’ well-being issues. Ask and Abidin analysed memes contained within the public Facebook Group “Student Problem Memes” to identify themes. Through their analysis they were able to establish clear topics relating to work/study balance and mental health as persistent features alongside the daily modern struggles of being a student [11]. Maples uses memes posted to the social media account “High-Impact PhD Memes” to assess well-being issues associated with PhD students noting that the thematic analysis showed most common concerns related to literature access, financial/employment stresses, and overwork [12].

Despite meme-making being used in a variety of subjects, there is no research into its use within forensic science as a teaching tool to enhance the student experience in the classroom and the perception of improved learning. Whilst there has been a plethora of literature published post-COVID on the use of different technologies in the forensic science classroom, none of these focus on the use of memes as a teaching method [13–17].

The popularity of meme culture makes it an ideal vessel for enhancing and modernising the classroom, which is especially pertinent with the association of memes with youth culture, the predominant age range within Higher Education. This research therefore aims to address

whether the concept of meme-making can enhance student engagement in the classroom within forensic science as well as aid the student perception of (and thus confidence in) their knowledge understanding. The students were asked to produce a meme that reflected something they had learnt within their teaching session and these memes were then shared to enhance collective learning.

2 Methods

2.1. Meme-making in the classroom

Students studying forensic science within their undergraduate (UG) and postgraduate (PG) degree programmes at 6 Universities (one in USA, three in England, two in Scotland) were included in this research (Table 1). This project was approved by the Teesside University Ethics Board. All participating students provided their consent to support the anonymous evaluation of this initiative, including use of any free text statements.

The research was undertaken as part of the students’ normal learning and teaching activities on the participating modules. Students were asked at the end of a teaching session to reflect on their knowledge from within the session and express their learning in the form of a meme. The first session in which the students undertook this task, they were briefed on how to produce and share their meme. Instructions were available via the virtual learning environment for all sessions and provided as a reminder in lecture slides. Sessions where the meme-making was employed were deliberately across the spectrum of the forensic sciences to assess the versatility of the method. However, topics which may be considered triggering or the introduction of humour inappropriate (such as sexual assault cases) were not included within the parameters of the study.

Memes were produced using “Meme Generator” (<https://imgflip.com/memegenerator>) allowing the creator complete control over the choice of image and accompanying wording, whilst providing a generic structure for students to follow. These were then shared in real time during the session via Padlet (<https://padlet.com/dashboard>) allowing the class to reflect on their shared knowledge. There was no limit on the

Table 1
Overview of meme-making within sessions for participating universities. Note – UG is undergraduate degree and PG is postgraduate Masters degree.

Level of Study (UG/PG)	Year of Study	University	Module Topic	Class Type	Number of Students on Module	Approximate Number of Students Attending Session(s)	Number of Weeks Class Type Delivered on Module	Number of Weeks Memes Conducted	Number of Student Memes Created shared via Padlet	Number of Students Completing Survey
PG	N/A	University A	Presentation of digital evidence	Practical	12	10	6	1	20	10
UG	2nd year	University A	Criminalistics	Lecture	56	40	12	1	7	1
UG	3rd year	University B	Drugs of abuse and analytical chemistry	Lecture	79	45	5	5	169	25
UG	1st Year	University C	Introduction to Forensic Science	Lecture	53	25	12	3	63	16
UG	1st Year	University D	Crime scene investigation	Lecture	48	25	12	4	31	23
PG	N/A	University D	Criminalistics	Lecture	29	24	12	4	36	20
UG	2nd through final year	University E	Forensic Science: Methods & Techniques	Lecture	24	22	14	8	95	13
UG	2nd and 3rd year	University F	Introduction to forensic science	Lecture with Workshop	112	50	12	4	17	6
					= 413	= 141	= 85	= 30	= 438	= 114

number of memes each student could produce and no obligation to share these memes to ensure that all students felt comfortable undertaking the activity. The memes were added anonymously to the Padlet.

Students gained access to the “Meme Generator” and Padlet using QR codes provided on lecture slides. Padlets were set to allow for students to “like” the memes, allowing for interaction with the Padlet even if an individual did not produce a meme. The contents of each Padlet were exported as either a PDF or image to allow for sharing after the session. Students were able to create their memes using any digital device, including mobile phone, tablet or laptop computer.

2.2. Evaluation of the process

The researchers utilised an online Microsoft Forms survey (Supplementary Material 1) to capture students’ use, impressions and experiences of meme-making anonymously; this was undertaken after the last meme-making session at each of the participating universities.

The open comments from the survey were coded and analysed using content analysis. Quantitative analysis and presentation of the results was subsequently undertaken using SPSS software (version 29.0.1.0). The Fisher-Freeman-Halton Exact Test (or Fisher’s Exact Test if 2×2 design) was used to examine the relationship between different variables including age, level of study and declared disability. Cut-off value of $\alpha = 0.05$ was used. For statistically significant results, Cramér’s V (φ_c) was calculated to establish the magnitude of the impact whereby $\varphi_c \leq 0.2$ was considered a weak effect, $0.2 \leq \varphi_c \leq 0.6$ a moderate effect and $\varphi_c \geq 0.6$ a strong effect.

3 Results and discussion

The meme-making activity was used in six universities (one in USA, three in England, two in Scotland) with undergraduate and postgraduate students on forensic science, criminal justice and chemistry degree programmes. As shown in Table 1, the activity was used in 35% of the available sessions, and between one and eight sessions within a module. The number of memes produced and shared publicly by students ranged between 2 and 23 per session. Although more memes were made, some students chose not to share them via Padlet. In total 438 memes were made and shared during this research and a selection are shown in Fig. 1. After each meme-making session, the Padlet was shared with the module cohort via the virtual learning environment (VLE). The online survey was completed by 115 students with one participant choosing not to confirm consent and therefore their responses were removed from the survey data and subsequent analysis.

This research was intended to look at meme-making for reflective class content purposes, whether this was inclusive in nature (section 3.1) and if students perceived that it improved their knowledge recall (section 3.2). The research was further designed to examine whether this activity made the classroom a more fun and vibrant atmosphere which is more conducive to class participation (section 3.2). Each of these will be addressed in turn throughout the discussion.

3.1. Inclusive nature of meme-making

In considering the effectiveness of memes within the classroom it is important to assess the impact meme-making has on the cohort including any trends associated with age, gender or declared disability. An exemplary teaching experience is one that is considered inclusive with no bias towards a certain demographic. Part of this research was to evaluate if memes are an inclusive teaching tool.

Memes are associated with a youth audience with YPulse’s Social Media survey showing that 75% of 13 to 36-year-olds (and 79% of 13 to 17-year-olds) share memes [18]. Although this fits in with demographic trends within Higher Education where 63% of undergraduate students are under 21, it does potentially limit the capability of memes as a learning tool with students outside of the 18 to 36 age demographic [19,20]. The data within this research demonstrates no statistically significant effect regarding age and engagement with meme-making ($p = .513$) (Table 2).

Two students declared themselves over 40 and both took part in the activity stating that they found it fun and of benefit to their studies with one describing it as:

“Nice to do a fun learning activity” (40+, produced 3 memes)

When we look at students between the ages of 25 and 40, all 10 of these students engaged with the activity with eight finding it a fun activity which aided learning. Interestingly comments showed a divided opinion relating to its age suitability, which was not born out in the participation data:

“I’m sure it would be fun for younger students, it’s just not my forte as I’m useless with online creativity” (18–24 years, produced 8–10 memes)

“I loved doing it, some of them are so funny and stay with me all day. They’re generation relevant and the ‘in’ thing these days. Such a good idea. It breaks the lecture up and adds a massive element of fun” (18–24 years, produced 3 memes)

Looking at the data for 18 to 24-year-olds, not all survey participants in this age category took part in the meme-making activity with 85% (87 out of 102) of survey respondents stating that they made a meme. Reasons for not making a meme tended to cluster around either a perception of a lack of creativity ($n = 4$), unable to express humour ($n = 3$) or feeling the task did not suit them ($n = 2$) as a learner:

“I’m not overly creative. I couldn’t think of anything to do. But if I did I would have participated” (18–24, no memes produced)

“I wasn’t able to think of anything funny to contribute” (18–24, no memes produced)

“I didn’t feel like it would benefit my learning more, I used that time to study and go over work” (18–24, no memes produced)

Despite not taking part in the activity, the last comment indicated that the student was still able to use the time effectively to reflect on the work. Although memes are associated with a youth audience, this



Fig. 1. Selection of reflection memes produced and shared by participants.

Table 2
Meme-making engagement and age (27.6% [114/413] overall survey participation rate).

Age range (years)	Number of students completing the survey	Participated in meme-making activity (%)	Number of memes created per student ^a								Found meme-making activity fun (%)
			0	1	2–3	4–5	6–7	8–10	>10	Other ^b	
18–24	102	85.3	14.7	14.7	29.4	15.7	3.9	7.8	4.9	5.9	92.2
25–40	10	100	–	20.0	60.0	10.0	–	–	–	–	80.0
40+	2	100	–	–	100	–	–	–	–	–	100

^a Four students did not answer this question

^b Non-specific answers e.g. “at least 1 per lecture”, “loads”.

research indicates that the use of meme-making as a reflective tool is not limited by age; indeed, the two participants stating they were over 40 appeared to find the activity as enhancing as those typically under 24. This supports research by Staddon who stated that there does not seem to be a correlation between age and attitudes towards technology within Higher Education students [21].

Gender was also not a defining barrier with regards to the task ($p = .1$). Participation rates with the meme-making activity were comparable for female (89.4%) and male (87.5%) participants (Table 3). Participation for non-binary participants was comparably lower at 50%, but this may be an artefact of the exceptionally small sample size of students who were willing to identify with this characteristic ($n = 4$). When considering the proportions of participants that found the meme-making activity fun, slightly more male and non-binary participants did compared to female participants: female 89.4%; male 95.8%; non-binary 100%.

Finally, we investigated whether a student’s self-identification as disabled (a physical or mental impairment that has a ‘substantial’ and ‘long-term’ negative effect on ability to do normal daily activities as defined under the Equality Act 2010), influenced their participation in the meme-making activity. Fig. 2 demonstrates that a self-classification of disability has no effect on the participation rates for meme-making; 21% of students (21 of 99 students) who made memes categorised themselves as disabled compared to 20% (3 of 15 students) who did not. However, all three students who categorised themselves as disabled and chose not to take part all found the meme-making activity fun, agreed it helped them to remember content and described the activity in positive words (fun, easy, funny, informative, engaging, humorous, different, and enjoyable) suggesting that even through non-engagement with the task, the students still benefited from the activity in terms of both their enjoyment and learning.

Table 4 further suggests equality between the students identifying as disabled compared to those that do not in terms of overall engagement ($p = 1$) and enjoyment levels ($p = 1$) with percentage figures being almost identical across the two groups.

By encouraging the class to post their memes onto a shared, collaborative platform, the process naturally becomes more inclusive by incorporating those who choose not to create a meme. This collaborative learning approach helps to address three issues associated traditionally with group work: student antipathy towards group work, the selection of the groups and possible inequalities of student abilities [22]. By allowing the students to share anonymously as a whole-class, suggests even

those who do not engage directly with the meme-making process benefit. As one student summarised “seeing other people’s memes was useful as it showed a different perspective and way of thinking to mine” (18–24, produced 34 memes), suggesting a distinct benefit to a collaborative sharing approach when using meme-making.

3.2. Student perceptions on meme-making

3.2.1. Student perceptions on the activity for engagement

Post-COVID, universities in the UK and USA are experiencing a lack of student engagement [23]. This is a major concern for educators when there is such an established link between engagement and achievement [24–27]. Chandler proposes that where opportunities for class participation are provided there is more likely an improvement in class engagement and attendance and in addition, Ziv links learning with humour to greater exam achievement [28,29]. The nature of meme-making with humour at its centre suggests that it is perfect for providing an interactive class activity which aims to support student learning and engagement and has previously been shown to be effective in online discussion and learning [30,31].

This is borne out within the students’ perceptions of the activity. Fig. 3 summarises the students’ perception of the meme-making activity based on their answer to the question “In 3 words, how would you describe the meme-making activity?”. Words such as “fun”, “funny”, “engaging”, and “entertaining” feature predominantly. The predominantly larger words reflect an increasing frequency of choice demonstrating that overall students found this to be a highly positive and enjoyable experience during classroom-based learning. Memes have a long-defined association with expressing humour so participants describing this activity as fun is not unexpected [32–34].

It is worth noting that some of the students who did not participate in the meme-making gave reasons such as “I don’t find myself funny” (18–24, no memes produced) and “Can’t really make jokes about a real-life homicide case” (18–24, no memes produced) indicating that for some there was greater emphasis on the need for the meme to be funny, rather than an image and text-based summary of a key learning point. We as educators need to be very aware of how and when we introduce and deploy the use of memes with our learners. We need to ensure we remain respectful and consider the sensitivities associated with both our learners’ lived experiences and the topic of study. There will be subject matter within forensic science where this task is not considered appropriate, such as reflections of learning from homicide cases. Previous

Table 3
Meme making engagement and gender (27.6% [114/413] overall survey participation rate).

Gender ^a	Number of students completing the survey	Participated in meme-making activity (%)	Number of memes created per student ^b								Found meme-making activity fun (%)
			0	1	2–3	4–5	6–7	8–10	>10	Other ^c	
Female	85	89.4	10.6	17.6	35.3	16.5	2.4	4.7	3.5	4.7	89.4
Male	24	87.5	12.5	8.3	29.2	12.5	8.3	12.5	8.3	8.3	95.8
Non-binary	4	50.0	50.0	–	25.0	–	–	25.0	–	–	100

^a Only those categories with more than one participant included.

^b Four students did not answer this question

^c Non-specific answers e.g. “at least 1 per lecture”, “loads”.

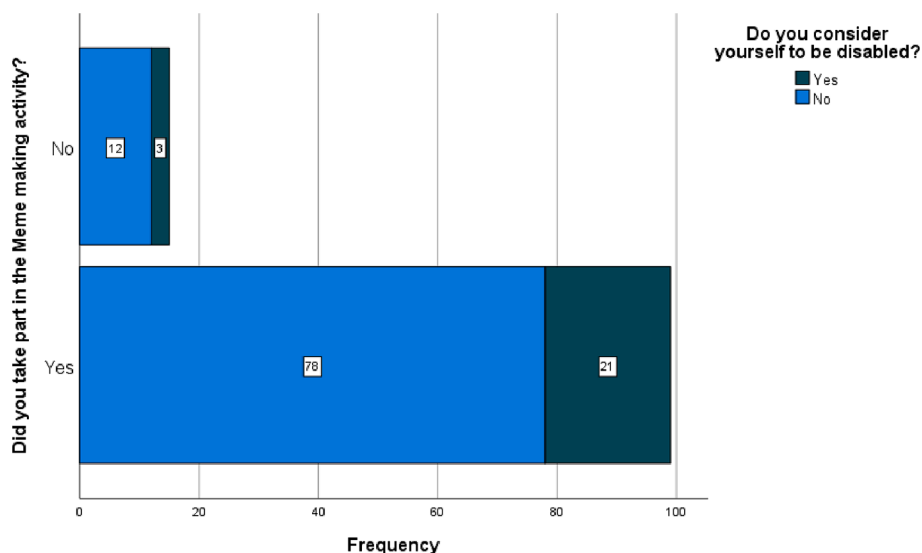


Fig. 2. Comparison of students who identify as disabled with those who do not in terms of making memes. Note – frequency refers to the number of survey responses.

Table 4
Meme-making engagement and disability (27.6% [114/413] overall survey participation rate).

Consider they have a disability	Number of students completing the survey	Participated in meme-making activity (%)	Number of memes created per student ^a								Found meme-making activity fun (%)
			0	1	2–3	4–5	6–7	8–10	>10	Other ^b	
Yes	24	87.5	12.5	8.3	25.0	25.0	4.2	4.2	–	12.5	91.7
No	90	86.7	13.3	16.7	35.6	12.2	3.3	7.8	5.6	3.3	91.1

^a Four students did not answer this question

^b Non-specific answers e.g. “at least 1 per lecture”, “loads”.

work has also cautioned that there is a risk of misinterpretation of memes and highlights the need to manage student expectations, emphasising that learning is the focus of the task rather than humour [35,36]. This evidently means that when setting the task, the educator needs to be mindful of ensuring that the students are focussing on the task for learning rather than a task to appear humorous, the humour is the tool for learning not the focus.

The element of fun felt by students is further expanded upon in the free text survey comments:

“love it absolutely amaze balls” (25–40, made 3 memes)
 “Great, didn’t fall asleep once in these lectures. Always felt engaged!” (18–24, made 3 memes)

Although students found this enjoyable and fun, this does not necessarily provide a direct link to student engagement. However, within the free text, there was an indication that this activity encouraged students to attend and engage with their studies:

“it made people want to come to the lectures and get more involved” (18–24, made 5 memes)
 “It’s something to look forward to at the end of the lecture and promotes me to go” (18–24, made 4+ memes)
 “It actually makes the lectures engaging” (18–24, produced 10 memes)

It is worth noting that not all students found the activity to their taste but with 86.8% of students that completed the survey participating in meme-making and 91.2% of the students stating they found the meme-making activity fun, it has a largely pleasing nature.

3.2.2. Student perception on the activity for learning retention

The meme-making activity was designed to improve retention of knowledge by allowing students to reflect on their learning. Memes have

been previously identified as a tool that can promote retention of key information and concepts because of their visual and often humorous nature [35,37]. A similar approach by Tidy et al. used Sketchnoting to facilitate knowledge retention, which suggested links between participation and improved cohort achievement [38]. It is near impossible to pinpoint one aspect of a learning and teaching plan as improving retention of knowledge, and the researchers have not attempted this within this research, but have instead focussed on whether the participants perceived that the meme-making aided their retention of knowledge.

85% of participants indicated that the process of making the memes to reflect on their learning content was beneficial in remembering class content as shown in Fig. 4, with free text survey comments supporting this belief:

“i didn’t think it would help with retaining information as much as it actually has - and has reduced the time i need to study for the final exam as recall is much much easier” [sic] (18–24, produced numerous memes)
 “It’s good revision tool as well for immediate recollection” (18–24, produced 10 memes)
 “I remember so much more from lectures because of the memes, makes info easier to remember and learning fun” (18–24, produced 4 memes)

It is interesting to note that almost all of those students (99.0%) who felt that the meme-making activity had benefit in helping them to remember the content of the lesson also found the meme-making activity fun, compared to 47.1% of those who did not find the meme-making beneficial to learning. This data suggests that there is a significant relationship between enjoying the activity and a perception of retaining the information ($p < .001$; $\phi_c = 0.654$).

All but one of the participants ($n = 113$) saw other participants’



Fig. 3. Word cloud summarising students' three-word descriptions of the meme-making activity (created from 108 responses, with the word 'and' excluded for a total of 295 words).

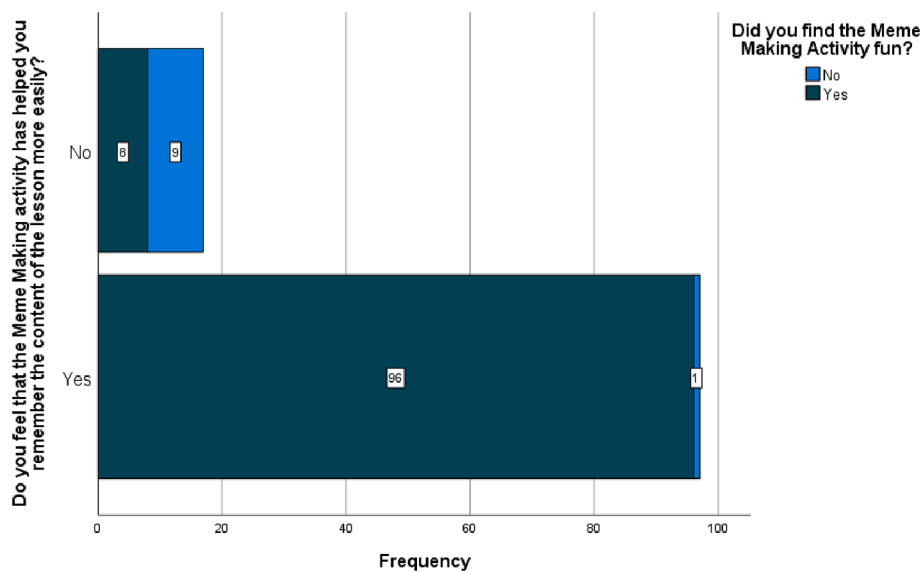


Fig. 4. Examination of the relationship between meme-making activity enjoyment and perception of knowledge retention. Note – frequency refers to the number of survey responses.

memes and of these, overall, 84.1% said that students perceived that seeing other peoples’ memes helped them to remember information from the lesson. This illustrates the benefits of collaborative learning and that even if students are not able to participate in the process of meme-making in a session, e.g., due to technical issues or feeling of lack of creativity, they can still engage with the materials to their benefit suggesting this approach helps students gain understanding even when not making a meme. This also aligns with previous observations of the discussion and analysis of memes, which provides an education opportunity [4].

There was a significant relationship between taking part in the meme-making activity and the feeling that the activity helped with remembering the content of the lecture more easily ($p = .002$) with a moderate effect size ($\phi_c = 0.347$). The award type also appeared to influence whether students perceived that it enabled them to remember lesson content more easily with 96.7% of Postgraduates indicating it does compared to 81.0% of Undergraduates (Table 5; $p = .04$; $\phi_c = 0.194$). This trend was also observed when comparing undergraduate and postgraduate perceived helpfulness in only those institutions (University A and D) where the meme-making activity was used with both award types (70.8% of undergraduates compared to 96.7% postgraduates). It is worth noting that the Postgraduate sample size was considerably smaller than the Undergraduate one and therefore this preliminary finding needs further exploration.

The university of study also impacts on the student’s perception of whether the meme-making helped to remember lesson content (Table 6; $p = .02$; $\phi_c = 0.378$) suggesting that the person, the material delivered, or the number of sessions employed influence the student’s perception of meme-making for retention of knowledge. It should, however, be noted that there is large variation in the number of students completing the survey, between the different universities of study and differences in type of award as outlined in Table 1. As a result, a more controlled study exploring the relationship between student self-perception and their assessment outcomes (summative or formative) would be worth conducting. Such a study could aim to explore whether meme-making does in fact aid their ability to recall information in assessed and applied contexts.

This research focussed on the use of a survey to collate students’ feedback and perceptions on meme-making. This research could be further enhanced by student interviews to delve deeper into a students’ perception of meme-making as an aide for both student engagement and for knowledge retention.

There is still a further range of students not currently considered in this research, for example, no consideration was made for whether this approach suits part-time and distance learning students or those that are visually impaired. Gleason et al. present two methods of making memes more accessible for the visually impaired, but whether these would work within the context of this practice needs to be further explored [39].

It is also worth reflecting on the suitability of the learning environment from a practical standpoint prior to deploying within a classroom. For example, is there sufficient Wi-Fi connectivity for the activity to run effectively and are the initial instructions to the students developed enough for those with low digital capability. Lastly, and possibly, the

most important consideration is whether the instructor delivering the session is fully invested in the process – lack of enthusiasm will be reflected within how the students themselves approach the task.

With these in mind, it is pertinent to consider the following when developing meme-making as a reflective practice within the classroom:

- Develop instructional materials to ‘train’ staff before and students during the first session.
- Ensure there is a tested process for creating and sharing the memes.
- Consider what the students are reflecting on – have the question ready. In this research the students were asked to reflect on the lesson content and represent this knowledge in a meme, but the question could be more specific than this.
- Reflect and refine the process.
- Be invested; staff enthusiasm is a driving factor.

4. Conclusions

Meme-making is a contemporary, innovative way to introduce technology and humour into Higher Education while letting students reflect on their learnt knowledge. Within this research, most students found the activity to be both fun and relevant while helping them remember and reflect on class content.

Although this research was restricted to forensic science content, this application of meme-making is multi-disciplinary as no specialist forensic science knowledge is required to run the activity as an educator. In addition, this research demonstrated that the concept of meme-making as an activity is applicable across all academic levels and is inclusive of age, gender and disability.

In an era where class participation can be difficult, this method demonstrates that as educators we need to innovate in our approaches and consider trying new methods for engagement, even when they are not within our own cultural experiences. However, it is worth noting though, that the educator needs to be prepared to embrace and invest in this approach, both in terms of preparation and openness, for it to be fully effective.

Novelty statement

Focus and novelty of this study was on using memes as a new mechanism to enhance engagement, learning and the broader student experience in the classroom as well as a method of fostering knowledge retention through the emerging area of edutainment. Also, this study aimed to prompt new areas of research and development of pedagogic practice within forensic science.

Ethical statement

This project was approved by the Teesside University Ethics Board reference: 2023 Feb 14353 Tidy. All participating students provided their consent to support the anonymous evaluation of this initiative, including use of any free text statements in the publication.

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Table 5

Perceived helpfulness of memes to remember content and award type. Note – survey participation rate is calculated using the total number of students in the module cohort (UG = 372 and PG = 41).

Type of award	Number of students completing the survey	Survey Participation Rate (%)	Participated in meme-making activity (%)	Number of memes created per student ^a								Felt meme-making activity helped to remember content of lesson more easily (%)
				0	1	2-3	4-5	6-7	8-10	>10	Other ^b	
UG	84	22.6	84.5	15.5	9.5	29.8	13.1	4.8	9.5	6.0	7.1	81.0
PG	30	73.2	93.3	6.7	30.0	43.3	16.7	3.3	–	–	–	96.7

^a Four students did not answer this question

^b Non-specific answers e.g. “at least 1 per lecture”, “loads”.

Table 6

Perceived helpfulness of memes to remember content and university of study. Note – survey participation rate is calculated using the total number of students in the modules’ cohorts.

University of Study	Number of students completing the survey	Survey Participation Rate (%)	Participated in meme-making activity (%)	Number of memes created per student ^a								Found meme-making activity fun (%)	Felt meme-making activity helped to remember content of lesson more easily (%)
				0	1	2–3	4–5	6–7	8–10	>10	Other ^b		
A	11	16.2	90.9	9.1	27.3	63.6	–	–	–	–	–	90.9	90.9
B	25	31.6	76.0	24.0	–	12.0	16.0	–	16.0	12.0	12.0	100.0	84.0
C	16	30.2	100.0	–	12.5	50.0	–	25.0	–	–	12.5	87.5	93.8
D	43	55.8	83.7	16.3	25.6	34.9	20.9	2.3	–	–	–	88.4	83.7
E	13	54.2	100.0	–	7.7	15.4	7.7	–	30.8	15.4	7.7	100.0	100.0
F	6	5.4	83.3	16.7	–	50.0	33.3	–	–	–	–	66.7	33.3

^a Four students did not answer this question

^b Non-specific answers e.g. “at least 1 per lecture”, “loads”.

CRedit authorship contribution statement

Helen Tidy: Conceptualization, Methodology, Formal analysis, Investigation, Project administration, Visualization, Resources, Writing – original draft, Writing – review & editing. **Rachel S. Bolton-King:** Methodology, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. **Ruth Croxton:** Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Carrie Mullen:** Conceptualization, Methodology, Writing – review & editing. **Leisa Nichols-Drew:** Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Felicity Carlyle-Davies:** Methodology, Formal analysis, Writing – review & editing. **Kimberlee S. Moran:** Methodology, Writing – review & editing. **Joanne Irving-Walton:** Methodology, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.scijus.2024.03.004>.

References

[1] R. Dawkins, *The Selfish Gene: Fortieth Anniversary Edition*, fourth ed., Oxford University Press, Oxford, UK, 2016.

[2] L. Shifman, *Memes in Digital Culture*, The MIT Press, 2013, doi: 10.7551/mitpress/9429.001.0001 (accessed 14 March 2024).

[3] B. Levy, Growth Trends 2023: To Meme or Not to Meme, <https://wavemakerglobal.com/uk/growth-trends-2023-to-meme-or-not-to-meme/#:~:text=Memes%20go%20mainstream.,that%20were%20shared%20in%202018>, 2022 (accessed 30 August 2023).

[4] G. Bini, O. Robutti, A. Bikner-Ahsbahs, Maths in the time of social media: conceptualizing the Internet phenomenon of mathematical memes, *Int. J. Math. Educ. Sci. Technol.* 53 (6) (2022) 1257–1296, <https://doi.org/10.1080/0020739X.2020.1807069>.

[5] A. Kyrpa, O. Stepanenko, V. Zinchenko, H. Udovichenko, L. Dmytruk, Integration of internet memes when teaching philological disciplines in higher education institutions, *Adv. Educ.* 20 (2022) 45–52, <https://doi.org/10.20535/2410-8286.235947>.

[6] Á. Antón-Sancho, M. Nieto-Sobrinó, P. Fernández-Arias, D. Vergara-Rodríguez, Usability of memes and humorous resources in virtual learning environments, *Educ. Sci.* 12 (3) (2022) 208–223, <https://doi.org/10.3390/educsci12030208>.

[7] C. Boyle, How do you meme?: using memes for information literacy instruction, *Ref. Libr.* 63 (3) (2022) 82–101, <https://doi.org/10.1080/02763877.2022.2084210>.

[8] E.D. Romero, J. Bobkina, Exploring critical and visual literacy needs in digital learning environments: the use of memes in the EFL/ESL university classroom,

Think. Skills Creat. 40 (2021) 100783, <https://doi.org/10.1016/j.tsc.2020.100783>.

[9] T. Tammi, P. Rautio, “It was funny at first” exploring tensions in human-animal relations through internet memes with university students, *Environ. Educ. Res.* 29 (3) (2023) 539–551, <https://doi.org/10.1080/13504622.2022.2073972>.

[10] A.G. Taylor, P. Stump, Arts-based feedback: using memes for midterm evaluations, *Commun. Teach.* 37 (3) (2023) 182–187, <https://doi.org/10.1080/17404622.2023.2182901>.

[11] K. Ask, C. Abidin, My life is a mess: self-deprecating relatability and collective identities in the memification of student issues, *Inf. Commun. Soc.* 21 (6) (2018) 834–850, <https://doi.org/10.1080/1369118X.2018.1437204>.

[12] G.W. Maples, High impact, low mood: an analysis of graduate student attitudes and perceptions through PHD memes, *Int. J. Dr. Stud.* 18 (2023) 1–23, <https://doi.org/10.28945/5075>.

[13] K. Craik, A.J. Collings, A preliminary study into the impact of using three-dimensional models in forensic anthropology learning and teaching, *Sci. Justice* 62 (6) (2022) 814–821, <https://doi.org/10.1016/j.scijus.2022.04.006>.

[14] B.J. Jones, K. Sturrock, Just by being here, you aren’t halfway there: structured active learning and its integration in virtual learning environments and assessment, *Sci. Justice* 62 (6) (2022) 691–695, <https://doi.org/10.1016/j.scijus.2022.05.005>.

[15] N. Kummer, O. Delémont, R. Voisard, C. Weyeremann, The potential of digital technologies in problem-based forensic learning activities, *Sci. Justice* 62 (6) (2022) 740–748, <https://doi.org/10.1016/j.scijus.2022.04.005>.

[16] K.S. Moran, The web of plenty: leveraging the abundance of free, on-demand online forensic content, *Sci. Justice* 62 (6) (2022) 778–784, <https://doi.org/10.1016/j.scijus.2022.04.003>.

[17] J.K. Pringle, I.G. Stimpson, A.J. Jeffery, K.D. Wisniewski, T. Grossey, L. Hobson, V. Heaton, V. Zholobenko, S.L. Rogers, Extended reality (XR) virtual practical and educational eGaming to provide effective immersive environments for learning and teaching in forensic science, *Sci. Justice* 62 (6) (2022) 696–707, <https://doi.org/10.1016/j.scijus.2022.04.004>.

[18] YPulse, 3 Stats that show what memes mean to gen z & millennials, <https://www.ypulse.com/article/2019/03/05/3-stats-that-show-what-memes-mean-to-gen-z-millennials/>, 2019 (accessed 30 August 2023).

[19] S. Hubble, P. Bolton, *Mature Higher Education Students in England*, Briefing Paper No 8809, House of Commons Library, London, UK, 2021.

[20] T. Broady, A. Chan, P. Caputi, Comparison of older and younger adults’ attitudes towards and abilities with computers: implications for training and learning, *Br. J. Educ. Technol.* 41 (3) (2010) 473–485, <https://doi.org/10.1111/j.1467-8535.2008.00914.x>.

[21] R.V. Staddon, Bringing technology to the mature classroom: age differences in use and attitudes, *Int. J. Educ. Technol. High. Educ.* 17 (1) (2020) 1–20, <https://doi.org/10.1186/s41239-020-00184-4>.

[22] T.S. Roberts, J.M. McInerney, Seven problems of online group learning (and their solutions), *J. Educ. Technol. Soc.* 10 (4) (2007) 257–268.

[23] T. Williams, Class attendance plummets post-Covid, *Times Higher Education*. [Online] 9.6.2022. <https://www.timeshighereducation.com/news/class-attendance-plummets-post-covid>.

[24] A. Aden, Z. Yahye, A. Dahir, The effect of student’s attendance on academic performance: a case study at Simad University Mogadishu, *Acad. Res. Int.* 4 (2013) 409–417.

[25] P. Massingham, T. Herrington, Does attendance matter? An examination of student attitudes, participation, performance and attendance, *J. Univ. Teach. Learn. Pract.* 3 (2) (2006) 20–42, <https://doi.org/10.5376/1.3.2.3>.

[26] D.R. Marburger, Absenteeism and undergraduate exam performance, *J. Econ. Educ.* 32 (2) (2001) 99–109, <https://doi.org/10.2307/1183486>.

[27] L. Newman-Ford, K. Fitzgibbon, S. Lloyd, S. Thomas, A large-scale investigation into the relationship between attendance and attainment: a study using an innovative, electronic attendance monitoring system, *Stud. High. Educ.* 33 (6) (2008) 699–717, <https://doi.org/10.1080/03075070802457066>.

[28] D.S. Chandler, The relational-behavior model: the relationship between intrinsic motivational instruction and extrinsic motivation in psychologically based

- instruction. ERIC Online Submission ED500815 <https://eric.ed.gov/?id=ED500815>, 2008 (accessed 14 March 2024).
- [29] A. Ziv, Teaching and Learning with humor: experiment and replication, *J. Exp. Educ.* 57 (1) (1988) 5–15, <https://doi.org/10.1080/00220973.1988.10806492>.
- [30] F. Erdoğan, Ü. Çakıroğlu, The educational power of humor on student engagement in online learning environments, *Res. Pract. Technol. Enhanc. Learn.* 16 (1) (2021) 1–25, <https://doi.org/10.1186/s41039-021-00158-8>.
- [31] X. Lin, Q. Sun, Student-generated memes as a way to facilitate online discussion for adult learners, *Psychol. Sch.* 60 (12) (2023) 4826–4840, <https://doi.org/10.1002/pits.22884>.
- [32] E. Abdou, Political humor: memes in Egyptian painting after the revolution, *J. vis. Art Pract.* 21 (2) (2022) 133–146, <https://doi.org/10.1080/14702029.2021.2022291>.
- [33] C. Vásquez, E. Aslan, “Cats be outside, how about meow”: multimodal humor and creativity in an internet meme, *J. Pragmat.* 171 (2021) 101–117, <https://doi.org/10.1016/j.pragma.2020.10.006>.
- [34] V. Taecharunroj, P. Nueangjammong, Humour 2.0: styles and types of humour and virality of memes on Facebook, *J. Creat. Commun.* 10 (3) (2015) 288–302, <https://doi.org/10.1177/0973258615614420>.
- [35] A. Cromby, A case for internet memes in education: a focus on mathematics and medical science, *Res. Teach. Educ.* 12 (2) (2022) 6–11.
- [36] R. Glenn, Brain research: practical applications for the classroom, *Teach. Excel.* 21 (6) (2002) 1–2.
- [37] V. Subbiramaniyan, C. Apte, C.A. Mohammed, A meme-based approach for enhancing student engagement and learning in renal physiology, *Adv. Physiol. Educ.* 46 (1) (2022) 27–29, <https://doi.org/10.1152/advan.00092.2021>.
- [38] H. Tidy, R. Burnham, S. Elkington, Using sketchnoting as a revision aid with forensic students, *Sci. Justice* 62 (6) (2022) 822–826, <https://doi.org/10.1016/j.scijus.2022.04.008>.
- [39] C. Gleason, A. Pavel, X. Liu, P. Carrington, L.B. Chilton, J.P. Bigham, Making memes accessible, in: J.P. Bigham, S. Azenkot, S.K. Kane (eds.), *ASSETS '19: Proceedings of the 21st International ACM SIGACCESS Conference on Computers and Accessibility*, 2019, pp. 367–376. doi: 10.1145/3308561.3353792.