A Break from the Zoom - Using a Students Home Environment to Teach Forensic Science Interpretation during the Covid-19 Pandemic.

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Abstract: The rapid move to online learning during the Covid-19 pandemic has created the need for academics to rapidly develop new and innovative ways to deliver practical content. While many laboratory sessions have moved to online simulations these are not necessarily suitable for the teaching of the interpretation of forensic evidence. The move to online teaching and simulations can increase a student's exposure to digital devices enhancing "Zoom Fatigue". An alternative suggestion to using only online simulated laboratory practicals is to utilise the students home environment in creating datasets which then lend themselves to understanding the intricacies of forensic interpretation of evidence types. These tasks involve little or no resources on the part of the student and allow them to explore, investigate and observe factors relevant to interpretation. Student feedback showed this form of data gathering task to be a welcome break from the digital device and allow for greater and more prolonged understanding of how to interpret forensic evidence.

Keywords: Covid-19, interpretation of forensic evidence, laboratory practical, home environment

Introduction

Teaching forensic science during the Covid-19 pandemic has afforded lots of obstacles for academics. One of these obstacles is how to effectively teach what is by nature a very practical subject. Many institutions have tackled this problem by moving their laboratory practical sessions online and utilising simulated laboratory resources (1). This is an approach adopted widely within the Sciences to facilitate students learning practical skills (2 - 5). Online laboratory sessions are ideal for teaching the fundamentals of techniques but not ideal for teaching the intricacy of interpretation of forensic evidence types. Potkonjak et al (2016) also notes that finer laboratory skills are often acquired through real hands-on experience and the creation of online simulations, where nothing can in effect go wrong, can result in a lack of seriousness, responsibility, and carefulness on the part of the student (6).

In addition, the increased reliance on a digital device may exasperate the "Zoom Fatigue" some students are already suffering in a World where the majority of their time and teaching is online. Zoom Fatigue or "Computer-Mediated Communication (CMC)" exhaustion (7) is a very real problem in a Covid-19 World where University teaching is either Hybrid (a combination of online and in person) or completely online. Providing opportunities for the student to have time away from their digital device is essential in ensuring a healthy learning environment – this can be problematic when teaching relies on the student undertaking some form of prolonged simulated online laboratory session.

The approach adopted in this instance was to provide time away from the digital device in allowing students to explore their own home environment to gather data that assists in the interpretation of forensic evidence. Data collected by each student builds a larger data set which can then be discussed in online seminar sessions, providing students ownership of the discussion and thus further helping to relieve Zoom Fatigue. By ensuring students are undertaking active tasks before, during or after live sessions is one way to lessen the fatigue of online learning (8). There is also the suggestion that by teaching purely in an online one-dimensional environment, there is a lack of consideration towards the diversity of learning styles of students. Hall (2020) acknowledges that some students may need greater time to process information; whereas others may need time to write their learning down to absorb and consider it which may not be accommodated in an intense online environment (9). Moving the teaching away from the digital device, be it for a short time, helps allow students to learn at their pace and in their own manner.

In addition to allowing the students a break from their digital device, the approach adopted in this instance allows students to explore and gain an understanding of factors

that affect how a forensic evidence type is interpreted prior to a conclusion being drawn. This is a forgotten area in practical teaching with many laboratory sessions focusing on gaining the required laboratory skills of a forensic scientist. Where interpretation skills are generally incorporated into practical work is in the interpretation of a set of results from an analytical piece of equipment, thus focusing on the source level reporting aspect of forensic science rather than the more wider interpretation skills required from a forensic scientist in analysing evidence types at activity level (10).

It is worth noting that the data gathering tasks rely on no specialist equipment so are very accessible in design, yet the students still undertook key skills in experimental observation and data collection.

Teaching Methods

2nd Year BSc Forensic Science Students

Students learn about a different forensic evidence type across a two-week cycle; Week 1 was used to establish the basics of the evidence type through a series of short asynchronous lectures and an associated home environment orientated data gathering task. The task is designed to allow students to build up a data set of knowledge in a certain forensic area that would then allow for them to consider aspects of forensic interpretation in greater detail.

Week 2 allowed students to meet with others in their pre-determined groups via Microsoft Teams to discuss their findings and formulate responses to key questions set by the tutor. This was undertaken prior to discussing them with the tutor in the live seminar sessions. The aim was to encourage students to undertake a more active approach in their learning rather than receiving the knowledge through a series of lectures where their learning is passive in nature.

The data gathering tasks were all designed to allow students time away from their digital device and where no specialist equipment or expertise is required. An overview of the set tasks are summarised below:

• The interpretation of fibres as forensic evidence – Students were asked to record 15 upper garments in their wardrobe in terms of what fibre type and fibre colour they were composed of. These were then collated into a group set of results allowing the students to assess the most common fibre type and most common fibre colour in their dataset. Students were then able to compare their results with published population studies (11 - 14) and discussion in the live seminar allowed for why a database approach might differ to results found via a population study and what effect the commonness of a certain fibre type or fibre colour would have on the evidential interpretation of fibres.

• The interpretation of glass as forensic evidence – Students were asked to walk around their local area and record what broken glass they identified on the ground as well as the area they were walking around (i.e. urban or rural area). Again, the results were collated as a group and students were asked to consider what type of glass is commonly encountered as background glass in the environment. The seminar session focused on comparing the results the students found with what is commonly encountered in casework and why background glass in the environment may differ from glass encountered in casework (generally students found mainly curved container glass sources whereas casework glass is mainly flat in nature). The students were also asked in the live seminar to consider how the commonness of glass type/composition affects the evidential interpretation of glass evidence.

• The interpretation of paint as forensic evidence part 1: - Students were again asked to walk around their local area and observe what colour the windows were painted (or record if they were double glazed and not painted). As with previous tasks, results were collated as a group and the students formed a dataset on the commonality of observed paint colours in their local environment. This allowed for comparison to published research on the most commonly encountered paint colours observed in forensic casework utilising research by Moore et al (15). In addition, in the seminar it was discussed whether paint was still a valid evidence type to search for in house burglaries when a high proportion of windows are now double glazed.

• The interpretation of paint as forensic evidence part 2:– Students were asked to form 10 of their own coloured "paint" layers using whatever pens they had in their household as shown in **FIGURE 1**. This allowed students to compare in their groups if anyone had formed the same paint layers and consider if this would potentially make paint conclusive as an evidence type in this context. The discussion in the seminar further focused on this aspect and the Moore et al. (15) research also informed the discussion.

The design of these tasks all acknowledged that the students were a group who had bonded and knew one another as a result of their onsite 1st year studies. The approach had to be altered for 1st year students who had not yet had a chance to bond as a group onsite. The approach was altered as detailed below.

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FIGURE 1 *Example of Paint Layers*

1st Year Forensic Science and Crime Scene Science Students

The notion of a break from digital delivery by utilising the home environment was incorporated into a 1st year practical. The practical looked at how the wear and damage on items of footwear might affect a forensic scientist's interpretation of the strength of evidence. Students were asked to document the wear and damage they were seeing on up to 5 pairs of their own footwear. Results were collated via a Microsoft Forms survey the students completed at the end of their examination thus negating the need for group work and reducing student anxiety.

FIGURE 2 *Example of Presentation of student data regarding the wear and damage on their footwear via Microsoft Forms*

The collection of data via Microsoft Forms had an advantage in that Forms collates the data into an appropriate format ready for teaching, saving the tutor time in preparation of material as shown in **FIGURE 2**. As with the 2nd year data gathering tasks, the results were discussed via a live seminar session which also gave the students a chance to ask questions about footwear marks as a forensic evidence type.

Discussion

Providing students with a break from their digital device during their studies is essential in the new Covid-19 era to lessen or avoid Zoom Fatigue (9). The approaches to achieving this varies from providing breaks within live sessions to asking students to participate in activities that take them away from their digital device during the lesson. Ebner and Greenberg suggest that although strategies to relieve Zoom Fatigue are effective in the short term, they may not be successful in motivating students to engage enthusiastically with their online courses and other effective interventions are required (16).

The teaching approach discussed in this paper provides students with a prolonged but active break from their digital device where they can manage their own learning at their own pace. Hall highlighted the fact that by delivering a fully online curriculum, the inclusivity of allowing students time and space to learn at their own pace can be lost (9). Feedback from students indicates that this is appreciated:

"*It was definitely a much-needed break from digital learning. It helps to refresh the mind and eyes. One more PowerPoint and I may have needed a psych evaluation. ....*"

"*I think it was very helpful for my learning to take a break from the digital and focus on something 'real'.*"

Other students drew a clear distinction between feeling actively involved in the learning activity rather than undertaking an online simulation highlighting that the practical nature of the activity helped them retain the information much better:

"*The information I got from the practicals I was able to retain much easier than what I have for practicals in other modules that have been online simulations. By having a physical practical to do, it kept my more motivated to complete my work whilst at home!* "

"*The practical was memorable, and I think due to how interactive it was-having to draw your footwear mark wear on the diagrams, this helped to retain the information better.*"

There is also a hint in the first comment, that this was also a welcome break from the digital world with the suggestion the physical nature of the practical keeping them more motivated. It was also interesting to observe that some students not only utilised their home environment in the undertaking of the tasks but their households too; counting glass or noting the paint on windows became a family affair involving the younger members of the

household who were being home-schooled due to lockdown at the time.

Whereas it was clear that students appreciated the break from their digital device, the aim of the data gathering tasks was to ensure students were able to gain an understanding of how varying factors affects the interpretation of forensic evidence. This was achieved by the tasks being used to gather datasets which then allowed for discussion on how this data affected the interpretation of a particular forensic evidence type: for example, what would be a common fibre colour/type and how does this than affect the interpretation of fibre evidence. The concept of how forensic interpretation is affected by multiply factors is one that is sometimes difficult for students to grasp. Allowing them to be active in the collection of data that then demonstrates how commonness of a certain fibre type or paint colour affects the interpretation of that evidence and provides an active approach to teaching these concepts. One student commented that the task really helped to not only to understand but also consolidate the knowledge:

"*I really enjoyed them and it was definitely helpful to consolidate concepts not only for the exam, but also for future projects, work and such. I felt like I didn't have to study as much; everything was and still is so fresh in my mind because of those weekly practicals. It was a great experience in my opinion.*"

The advantage of the tasks in developing an understanding and retention of factors significant to forensic science interpretation was further echoed by other students:

"*I really enjoyed the practicals for **** and have been the most enjoyable for me this academic year. ………. plus it helped me lots in understanding the interpretation as well.*"

"*Our footwear examination practical was quite helpful in the understanding of how footwear can be affected in similar ways, yet still hold unique characteristics.*"

"*This practical was very good and it forced me to think about the importance of wear and damage on items of footwear and the significance of these pieces of evidence.*"

"*The practical was memorable, and I think due to how interactive it was-having to draw your footwear mark wear on the diagrams, this helped to retain the information better.*"

When the examination marks for the 2nd Year students were compared to previous years, it was observed that there is a marked difference in achievement. The cohort this academic year achieved a mean exam grade of 60% whereas the previous two years the mean exam score

was 52% (2018) and 47% (2019). **FIGURE 3** provides a further analysis of grade achievement, showing a higher attainment of marks for those students undertaking the data gathering tasks to support their seminar sessions in 2020 compared to previous years.

The examination focuses on knowledge of key evidence types combined with questions on the interpretation of these evidence types. The marked difference in average grades for the 2020 cohort compared to previous years suggests a better retention and understanding of factors affecting the interpretation of forensic evidence. Interpretation of forensic evidence has always been an area of forensic science education that students find difficult; it is something that cannot easily be acquired from a textbook but it a crucial skill in becoming an effective forensic scientist.
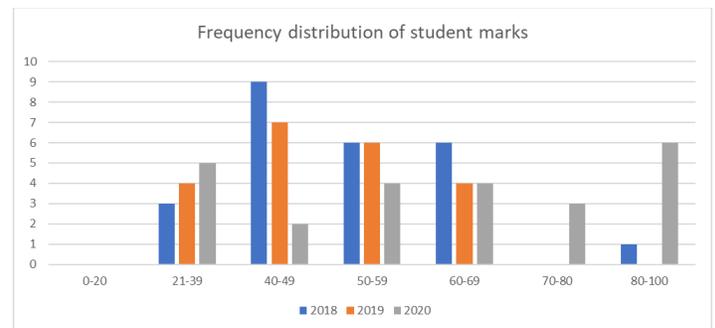

FIGURE 3 *The frequency distribution of exam grades for students studying the same module over the previous 3 years*

In addition, engagement with online learning was measured within the 1st year module where a combination of home data gathering tasks and online simulated practical sessions were utilised. It was noticed that where online laboratory simulations were used alone, engagement was much lower than when used in conjunction with the interpretative home data gathering tasks were used.

For example, an online microscope simulation 24 students were observed to be actively engaging with the task, whereas the footwear marks practical using a home-based data gathering task showed 42 students to be actively engaging. This clearly suggests that the use of a home-based data gathering task aided engagement and it was also noted that the level of observations and discussion was of a level more consistent with students more advanced in their studies.

The advantages of these types of practical are clear, the active component makes them more memorable for students as well as providing a much-needed break from their digital devices. In addition, allowing the students to have ownership of their learning in creating their own datasets allows them to see how factors affect forensic

science interpretation more clearly and retain this knowledge for longer.

Conclusions

It is important as educators we understand that students require a break from their digital devices in order to lessen the effects of Zoom Fatigue, but this cannot be at the expense of effective learning strategies. The approach adopted in this instance was to use a student's home environment to allow them to gather datasets that help them gain a better understanding of the interpretation of forensic evidence types.

Feedack from students indicated that they appreciated the break from online learning and the ownership and active nature of the tasks helped them gain a better understanding of the concepts which underpin the interpretation of forensic evidence. In addition, the nature of the tasks helped them retain the information more easily. Empirical data also suggests that these tasks improve student knowledge and engagement.

These data gathering tasks while developed to fit the online learning environment forced onto higher education by Covid-19 are also appropriate for non-pandemic times as preparation for onsite seminars allowing students to have ownership of their learning and a more authentic learning experience.

Acknowledgements

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