

## Research Article

# Enhancing forensic science communication through the jigsaw method

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Traditional didactic approaches often fall short in preparing students for real-world minutiae, such as scientific communication. After the pandemic, it is evident students are struggling with communication skills. However, the vital skill of communication is still pertinent in academia and the workplace. This study uses the jigsaw teaching method, inspired by the jigsaw puzzle concept, to enhance communication by organizing students into groups responsible for mastering specific aspects of a case study. Despite the jigsaw methods effectiveness in various educational settings, the integration of the method into the subject of forensic science, particularly in dissecting case studies, remains underexplored. In the study, a total of 86 forensic science students across three years of study were asked for feedback (using the Likert Scale) after studying a case using the jigsaw methodology. The students indicated a positive response overall, with an average rating of 4.01 out of 5 for the six questions asked based on improvement of their skills. Notably, students demonstrated better understanding of communication in forensic science, and acknowledged the method's contribution to improving peer communication in forensic science (average rating 4.09). Student comments highlight a generally positive experience, though concerns about group dynamics and engagement surfaced. Ultimately, the Jigsaw teaching method holds promise for elevating the quality of forensic science communication in the face of evolving challenges around student engagement. Incorporating the methodology into an assessment-based practice could be the way forward to help students overcome anxiety-inducing assessments, such as traditional oral presentations, as smaller groups are used within this methodology.

Keywords: Forensic science, Jigsaw, Communication

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## 1. Introduction

In the dynamic field of forensic science, staying ahead of the curve is crucial for both educators and future professionals. As technological advancements and interdisciplinary insights continue to reshape the landscape, innovative teaching methods must be embraced to ensure that aspiring forensic scientists are well-equipped to meet the challenges of the modern world (Adams, 2015). Forensic science, at its core, requires a multidisciplinary understanding of various scientific disciplines and investigative techniques. Enhancing the communication amongst forensic science students is vital for academic success, and beyond. As the U.K. increase their in-house and larger scale provisions, police, barristers, and forensic scientists are in communication now more than ever (Hackman, 2021). Focusing on the correct information, and providing accurate information succinctly is a crucial aspect of forensic science. COVID-19 created a fracture in student engagement and learning. Students decreased in participation, leading to a loss of skills which are vital in any academic setting (oral skills, written skills, communication with peers, etc) (Dascalu et al., 2021). Getting students to re-engage, and ultimately advance these skills, is difficult to do using traditional methods, such as didactic teaching, or traditional oral presentations (Guerra-Reyes et al., 2023). The traditional didactic

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lecture-based approach, while informative, often falls short in adequately preparing students for the real-world minutiae of solving complex cases, as well as communicating cases (P. Parmar & Rathod, 2015). Communication in forensic science is crucial to advancing information and solving cases.

## 2. Background

Each student possesses unique learning potentials and different levels of motivation. Scientific education has the purpose of inducing critical thinking, information retention and literacy. Traditional didactic lectures fail to ensure universal knowledge acquisition among students, highlighting the inadequacy of current educational practices in fostering diverse learning abilities. Knowledge should be created by students from the information received, through critically analysing the information and problem solving to aid learning and understanding (Nusrath et al., 2019). Therefore, there is a need to shift from the conventional didactic teacher-oriented approach to learning, to a more student-centred learning methodology, that can facilitate enhanced knowledge retention through discussion and critical thinking. Embracing a learner-centred focus, peer tutoring and peer-assisted learning have been widely integrated into curricula (Stone et al., 2013; Williams & Reddy, 2016).

Cooperative learning, mostly fostered through active engagement methodologies, engages students by enhancing group work. This sets students into a group with a common goal – usually to understand an area of a certain subject (Davidson et al., 2014). This can improve engagement amongst students who are not forthcoming following didactic methods, such as answering questions in-class. Also notably improved through co-operative learning is students critical thinking skills, as well as skills such as communication and teamwork. In forensic science, this is often fostered through modules on crime scene investigation, where heavily practical elements rely on teamwork to process a crime scene (Byrne, 2018; Lacks, 2007). There is very little based on practices in teaching through forensic science. Given the salient nature of the subject, it is argued that more work would be reviewed within this field (Carlylse-Davies, 2022)

The jigsaw technique, conceptualized in 1971 at the University of Texas, Austin by Elliot Aronson, aimed to foster an inclusive classroom dynamic amidst the backdrop of recently integrated schools (Aronson & Patnoe, 1997, 2011). The concept itself was inspired by a jigsaw puzzle concept. The method allows for organising the students in a manner in which they depend on each other in order to complete the task. In this approach, students are organized into random groups and are responsible for understanding a specific aspect of a subject (such as DNA analysis, fingerprinting, crime reconstruction, etc). Through focused study, the student becomes proficient in understanding that particular area of a subject. However, the communication aspect of the technique lies in the reconfiguration of groups. Each newly-formed group comprises members who have become proficient in knowledge within different areas. This arrangement sparks an engaging exchange of knowledge, as each student contributes their specialised information to the collective understanding the subject areas as a whole by putting the pieces together, hence the name, jigsaw method (Goolsarran et al., 2020; Lalit & Piplani, 2021). Aronson's subsequent extensive exploration of the jigsaw method emphasized its role in mitigating hostility and fostering collaboration among students. As result of widespread positivity, the Jigsaw approach has been used in teaching for many years since in various forms, such as larger scale student projects (D. R. Parmar & Parmar, 2020) to smaller sessions using the technique (Lalit & Piplani, 2021). All of which, prove to be effective in enhancing student communication and learning. Reviews into the use of the Jigsaw method have been shown to be positively received by students (Chopra et al., 2023; Cochon Drouet et al., 2023). However, little use has been applied to forensic science to allow students to dissect and evaluate case studies. This methodology could revolutionise how forensic science is taught by placing collaboration, communication, and active engagement at the forefront (Aronson & Patnoe, 1997, 2011). This method nurtures collaborative skills essential for effective teamwork and communication in professional forensic settings, mirroring the collaborative efforts required in actual crime scene investigations (Yoshida, 2018).

This study aims enhance student communication, critical thinking, and encourage collaborative learning. As the jigsaw method has shown to enhance students skills by putting responsibility of learning in the hands of the students, it is presumed that this would be a suitable method to use to enhance communication, whilst simultaneously teaching students the importance of said communication and critical thinking (Chopra et al., 2023; Cochon Drouet et al., 2023; Yoshida, 2018). The study will assess the effectiveness of the method in a university level educational setting, specifically in forensic science where communication amongst different disciplines is vital for understanding a case. The use of collaborative methods has been used in forensics, but tend to focus on specific disciplines, such as medicine (Parmar & Parmar, 2020; P. Parmar & Rathod, 2015). However, these have not be used generally for modules forensic science courses. Using parts of a case study,

students will evaluate a section of a case and then disseminate this section to a small group of their peers, facilitating active engagement in the case study. The method stimulates critical thinking as students must synthesize information from peers to develop a comprehensive understanding of a case study. However didactic teaching may have aged, it is still a useful and practical tool for teaching, and will play a role at the end of the Jigsaw method to summarise the collective understanding of the students understanding (Rodriguez Sandoval et al., 2022). In addition, this study will also look at the response rate to look at the applicability of using the Jigsaw Method as a route for assessment, which would negate students problems with anxiety and general presentations by minimising the number of people involved, and making their communication more salient for the passing of the module (Cochon Drouet et al., 2023).

### 3. Method

#### 3.1. Research Design

Students were not aware of the task at hand prior to the session, which destined that they were likely to sit with friends/close peers in the first instance. The task itself took place in four stages:

*Stage 1* - Students were then moved to tables of six and each provided with a number from 1-6, which corresponded to certain sections of a case study. The students were then provided with their sections and given time to study the information (around 10-15 minutes). Each section was no more than one A4 page of text, with an average of 584 ( $\pm 37$ ) words.

*Stage 2* - Following stage 1, students were asked to move to a table with the people who studied the same section (i.e. students who read section one was placed with the other students who read section one, section two with section two, and so forth). Students were given 10-15 minutes to discuss what they had read, and correspond their thoughts on this and what it means.

*Stage 3* - Finally, students were then asked to sit back at their original table, where one person from each section (1-6) was present. The students were then asked to discuss the case, starting from 1 through 6, spending a few minutes detailing what they had studied about the case and their overall thoughts. Students were given around 15 minutes to do this.

*Stage 4* - This did not require participation from the students, but participation was encouraged. A lecture was run for around 10 minutes, bringing together the information learned, and the following events on the case.

The case chosen for study was the murder of Stephen Lawrence, due to it being a widely communicated case, and a case that shaped some of the reform and changes that are seen today. The case was split into the following sections for student dissemination:

1. Murder of Lawrence: Circumstances of the night of the murder
2. Witnesses and Investigation: Investigation and arrest of perpetrators (and ultimate release)
3. Prosecution and Case Review: Private prosecution from the Lawrence Family and 2006 cold case review
4. 2011-2012 trial: Trial of Dobson and Norris following the cold case review
5. Complaints and mishandling: Officially filed complaints from the Lawrence family and police failures
6. Macpherson report: Summary of the events around the report by William Macpherson in 1999

#### 3.2. Participants

The only inclusion criteria for participation was that participants were enrolled on the BSc forensic course at The University of Hull. This comprised of conducting the study over each of the current year groups enrolled onto the course.

#### 3.3. Data Collection

Questionnaires were handed out at the end of the session, which were to be submitted anonymously. These can be found in Table 1. Students were also invited to leave any further comments on the session or the methodology used to dissect a case study. The responses from each group were analysed using the 5-point Likert Scale (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly agree) to assess the students experience on their learning and communication skills from the jigsaw task (Sullivan & Artino, 2013).

Table 1  
*Questions on the questionnaire provided to students following the jigsaw session*

Questions	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
The aims and objectives of the task were made clear					
I learned more about the case study from discussion with my peers than lecture material					
The jigsaw method aided my understanding of peer communication in forensic science					
This jigsaw method was helpful in improving my communication skills					
This jigsaw method was helpful in improving my learning					
I would like case studies to be discussed in this manner, rather than lecture format/research					

### 3.4. Data Analysis

The feedback from the students were analysed by counting the average rating of each question. The responses were to be marked on a 5-point Likert scale. The percentage of students/faculty with each response was calculated and analysed.

### 3. Results

A total of 86 students across the three years of study provided feedback. Most of the participants were observed in the first year of study, consisting of 63% of the total participants (n=54). Year two consisted of 18 participants (21%) and year three consisted of 14 participants (16%). The student's feedback about their perception and experience across all three years can be found in Table 2. The average rating was 4.01, which primarily is in the 'agree' category. The minimum average score was 3.73, which was for question 6 relating to the use of this method in future. The maximum score was 4.59 for question one, relating to the understanding of the task. The remaining results are in the range of 3.92-4.09, indicating an overall 'agree' in the remaining questions.

Table 2  
*Likert rating of student's feedback*

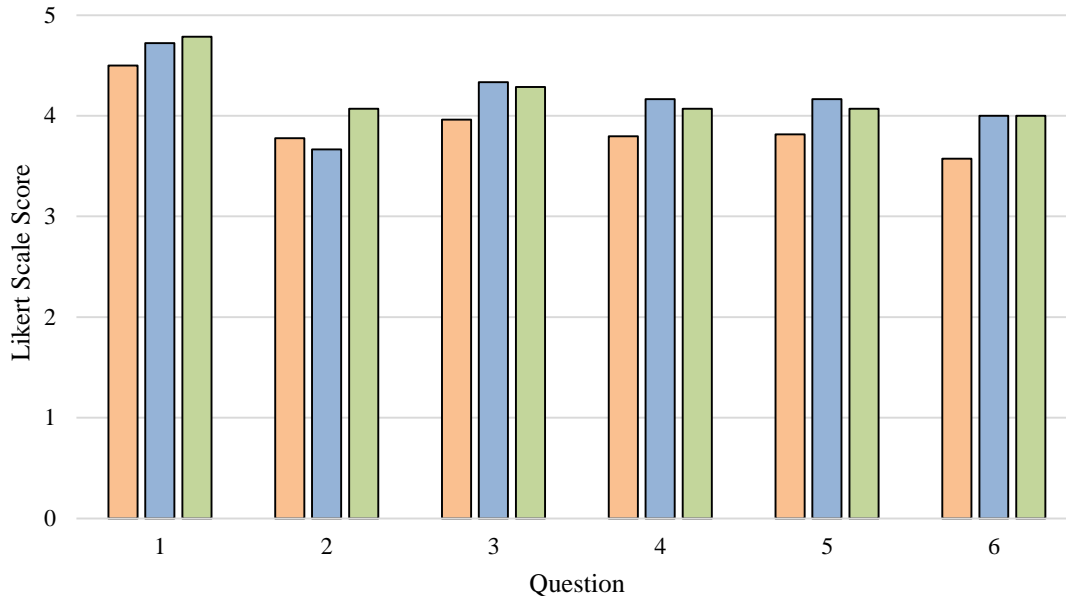
Q.No	Question	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Average
1	The aims and objectives of the task were made clear	0	0	4	27	55	4.59
2	I learned more about the case study from discussion with my peers than lecture material	0	9	25	26	26	3.80
3	The jigsaw method aided my understanding of peer communication in forensic science	1	2	12	44	27	4.09
4	This jigsaw method was helpful in improving my communication skills	3	6	9	45	23	3.92
5	This jigsaw method was helpful in improving my learning	1	4	17	42	22	3.93
6	I would like case studies to be discussed in this manner, rather than lecture format/research	3	9	22	26	26	3.73

### 3.1. Year of Study Comparison

When broken down into different years, there is little differences between average responses, but some differences are clear (Figure 1). The responses from year one was consistently scored lower (average: 3.90), with the exception of question 2, where second year students gave the lowest score (year 1= 3.78; year 2= 3.67). The lowest score for the 3rd years was given for question 6, where asked if they would like to see more of this method in the future (4.00). This was also observed in the first year's feedback, who gave the lowest score of 3.57 on average. Throughout all years, the average for question one was the highest, which shows the students understood the methodology. With the exception of question one, the responses for question three was shown to be the highest amongst all of the years, particularly with the third years (4.29).

Figure 1

Average Likert scale results from each of the years of study.



### 3.2. Participant Feedback

The final question on the questionnaire asked for students to give comments, positive or negative, on the technique used in the session. These comments are shown in Table 3. Of the comments, most of which were positive, but most came from the first year of study. In particular, students said they enjoyed the session, but a few did comment on the group work not being 'fun' or how they did not like it. Another comment, which could be concerning, was that some students missed sections of the case due to some students not engaging. This led to one student asking for more or a summary in the mini-lecture at the end. If students are not as engaged in some aspects of this, then the jigsaw methodology does not work as a whole.

Table 3

Students comments on the jigsaw methodology

Year	Comment
1	I do enjoy other people's input in this way and how we can all take on board other people's thinking
1	Case studies are fun, but not in groups with random people
1	Enjoyed Learning the methodology
1	Enjoyed
1	More engaging
1	Preferred this method of teaching rather than the lectures. I felt more engaged and enjoyed it more
1	Fun way to learn case studies rather than lectures - meant we actually read it all and listened to other people to find out more information
1	Good - Fun to do
2	Actually engaging
2	Lecture was informative but didn't like the group work. The group work is a good introduction to the case. But the lecture was more enjoyable

Table 3 continued

Year	Comment
2	Missing some key evidence in our group, as one person clearly wasn't engaged and didn't read their section properly.
3	Good method of learning
3	A new approach that I really liked
3	Needs a mixture of jigsaw and more of the details in the lecture format on the case, as some students were not as confident which made them miss information for other people
3	Jigsaw method was much easier to understand than a lecture

#### 4. Discussion

Overall, students showed positive perceptions of the jigsaw case study that was presented to them. The study itself was designed to get students to critically analyse their sections of a case, and properly communicate that to people who had some knowledge of the case, but not the full picture. This makes the students accountable for their own learning and their own understanding of the full case, based on their own communication. The methodology used in this study proved effective in provoking discussion about the case presented. This was due to each section containing salient information about the case, so every student had something to learn, and something to provide to their group. Students were mostly engaged in the activity, talking throughout the entire session about the case and asking each other questions. The core concept of the jigsaw method lies in offering a learning experience that involves reading, critical observation and communication with peers. Ultimately, this leads to students teaching others, enhancing communication and understanding. This has clearly been taken on by the students with an average score of 4.01 across all questions.

Perhaps the most pertinent questions to answer the research question was questions 3 and 4, regarding the understanding of communication in forensics (question 3) and if students felt this improve their communication (question 4). Question 3 scored an 'agree' overall, with an average of 4.02, showing that the students clearly understand the importance of communication within this field. The improvement of their communication scored a little lower, with students giving an average of 3.92, with many of the students giving an 'agree' (51%) or 'strongly agree' (31%). This shows that most of the students (82%) felt that their communication skills were enhanced through this methodology. It appears further the students are in their studies, the more they seem to appreciate, or enjoy, the jigsaw activity. This is likely because these students have been taught case studies through the more traditional didactic methods of teaching. This way, students are more engaged. Another reason may be that students have had more time to get to know one another over the years, so may be more confident in getting into these groups and discussing the case.

It is possible over a longer time, as in the study conducted by (D. R. Parmar & Parmar, 2020) would engage more as they have to go and do their own research, rather than having the information in front of them to disseminate. This study has overall shown that more engagement amongst the students has some influence on their learning. However, the comments from some of the students clearly shows they are uncomfortable with the communication aspect of this jigsaw method. This is unsurprising following the lack of oral and social skill development following the COVID-19 pandemic (Hartz et al., 2023; Pierce et al., 2020). Driving communication amongst students may make them uncomfortable, but is salient in forensic science in order to enhance information regarding cases. Using this method with fewer people enhances the student's ability to communicate over tradition methods of oral assessments, such as presentations. Arguably, this methodology is more robust, as the students who struggle with this aspect of any degree programme, can discuss an aspect of something only they have researched, thus feeling more vital to the process, and there are less people for the students to disseminate information to. In terms of assessment, this is likely to reduce anxiety due to less people being present, and enhance engagement (Davidson et al., 2014). Therefore, using this methodology as an assessment driven practice would be beneficial to the students, enhancing their communication skills over the anxiety-driven traditional methodology. This could be integrated into other modules that students are learning on, such as chemistry, or biological based modules, which allow the students to use their scientific knowledge to solve case studies, rather than just discuss and learn about them (Teixeira et al., 2023).

#### 5. Conclusions

There are numerous teaching and learning methods available for teaching forensics, but following the COVID-19 pandemic, social and learning skills seem to have declined amongst students. By promoting

active participation and responsibility for learning, the Jigsaw Method enhances student motivation and engagement, resulting in a deeper and more enduring grasp of the subject matter. The responsibility of peer teaching in the forensic case-study Jigsaw approach motivates students to effectively communicate their findings to a smaller audience, encouraging participation in order to fully understand the case as a whole. An additional advantage of this method is the cultivation of social skills in the Jigsaw educational environment, creating a refreshing and positive impact. Future use of this methodology may be better implemented from an assessment-based approach, reducing anxiety for students who tend not to favour well in traditional presentations. Therefore, this method is likely to be salient in enhancing participation and is therefore likely to increase the skills of students, and therefore, academic success in an undergraduate setting.

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