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Evaluation of Psychology-Based Training for Improving Interoperability in Emergency Services: A Comparison of Online and In-Person Delivery Methods

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Abstract

Recent research highlights the need for a psychological understanding of interoperability in multi-agency emergency response to address ongoing issues and prevent future problems. We developed a psychology-based training to improve interoperability using theory and evidence from the Social Identity Approach. We evaluated its effectiveness and optimal delivery method with 65 emergency responders from UK Police (*N*=8), Fire and Rescue (*N*=12), and Ambulance (*N*=45) Services. Participants completed the training online (*N*=28), or in-person (*N*=37), with seven online participants completing follow-up interviews. In terms of participant satisfaction, the training was positively received and recommended by participants. They valued the psychological elements but stressed the need for accessible presentation. Interviewees preferred in-person training, but survey data showed no difference in participant satisfaction between delivery methods. In terms of knowledge gain, both delivery methods increased confidence in multi-agency teamwork, though in-person training better enhanced knowledge of specific collaborative actions. Participants highlighted the importance of understanding responders' motivations, especially regarding mandatory training. This evaluation provides insights into effective training methods and the integration of psychology into emergency service training programmes, with practical implications discussed.

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1. Introduction

For over a decade, improving interoperability (i.e., the way responders from different organisations work together) among UK emergency services has been a priority. To aid this, the Joint Emergency Services Interoperability Programme (JESIP) was introduced in 2012, offering standardised principles for joint working (JESIP, 2013; JESIP, 2021). These principles include clear communication free from technical jargon and co-locating at a single, safe location. Despite these efforts, interoperability problems persist, hindering effective collaboration (Pollock, 2017).

A review of 32 major UK incidents from 1986 and 2010, including the Hillsborough Stadium Disaster and the 2005 London bombings, identified persistent interoperability problems, such as poor communication, unclear roles, and a lack of leadership (Pollock, 2013). These issues continued in the 2017 Manchester Arena attack (Saunders, 2022a) and the Grenfell Tower fire (Moore-Bick, 2019). For example, conflicting communication during the Manchester attack prevented a multi-agency meeting point, leading Saunders (2022b) to note that "JESIP still failed on 22nd May 2017" (p.135), with responders seemingly working in silos.

These challenges are not unique to the UK's emergency response either. Internationally, multi-agency responses face similar issues. For instance, Comfort and Haase (2006) reviewed the 2005 Hurricane Katrina response in Louisiana, USA, finding limited collaboration between organisations despite guidelines to facilitate joint efforts, partly due to poor communication alignment among emergency services. The 2010 Haiti earthquake response also faced coordination issues, with excessive information sharing making identifying relevant information difficult (Arnaouti et al., 2022). Similar problems have been observed in Norway (Eide et al., 2014), Australia (Cattermole-Terzic & Horberry, 2020), and the Netherlands (Bharosa et al., 2010), demonstrating the prevalence of interoperability issues globally. Therefore, there is a clear need to better understand why interoperability challenges occur in order to inform multi-agency training and guidance, and ultimately improve practice.

1.1. Understanding interoperability

Interoperability involves responders from different organisations forming a multiteam system, where interdependent sub-teams work together as a multiteam system towards a collective goal (Mathieu et al., 2001; Shuffler et al., 2015). Each sub-team has different goals, such as neutralising threats (Police) or treating casualties (Ambulance), together contributing to the shared goal of saving lives and reducing harm (Power & Alison, 2017). However, responders often fail to collaborate as one team, instead working in silos, as seen in the Manchester attack.

To improve our understanding of multi-agency collaboration and provide insights into why interoperability challenges might persist, Davidson and colleagues recently introduced a social identity

perspective on interoperability (Davidson et al., 2022; 2023). This perspective builds on social identity research in other multiteam system domains, such as military teams (Wijnmaalen et al., 2019). Theoretically, if responders see themselves as part of a unified 'we' as emergency responders, rather than sub-team 'we's' as Police, FRS, or Ambulance responders, they are more likely to coordinate and cooperate due to a stronger sense of interconnection, shared understanding, common norms, and increased trust (Davidson et al., 2022; 2023; 2024; cf. Haslam et al., 2022; 2009).

Davidson and colleagues explored shared identity in multi-agency response through two interview studies with responders involved in the COVID-19 response in the UK (Davidson et al., 2022; 2023). They found that structural barriers, like unequal building access and different shift patterns, hindered the development of a shared identity. Despite these barriers, both studies showed that social identity processes could still arise, facilitated by a common purpose from the shared threat of COVID-19, sharing difficult experiences, and leaders emphasising shared goals. Advancing on this, discussion-based simulated exercise research with responders from the emergency services found that shared identity was associated with improved interoperability through increased motivation, confidence, trust, and respect among responders (Davidson et al., 2024). A recent systematic review supports the research of Davidson et al., identifying identity, trust, and cohesive goal setting as key psychological factors for effective interoperability (Power et al., 2023a).

1.2. Translating psychological principles of interoperability into practice

The evidence above highlights the importance of understanding the psychological aspects of interoperability. However, there is little evidence on how to apply these psychological principles in practice, reflecting a well-documented research-practice gap in emergency response (Wankhade & Murphy, 2012; 2023). Evidence of this research-practice gap in relation to interoperability can be seen in the persistent issues and repeated recommendations for improved joint working, identified following a review of 52 local response debrief reports across England, Scotland, and Wales (Pollock, 2017; cf. Coles, 2014; Pollock & Coles, 2021). This suggests that identified lessons are often not translated into learning, highlighting the need for solution-focussed approaches to facilitate knowledge transfer and address this ongoing challenge.

A successful example of knowledge transfer in emergency response is in the field of mass decontamination for chemical, biological, radiological, and nuclear (CBRN) incidents. Findings from research by Carter et al. (2013; 2014; 2015) on the psychosocial aspects of incidents requiring mass decontamination were developed into a training module that is now incorporated into UK FRS training for the management of CBRN incidents (Drury et al., 2019). This demonstrates the impact that research can have on practice when presented in an accessible way, helping to minimise the research-practice gap.

However, in terms of how training is delivered, previous research offers mixed evidence on whether online training is as effective as in-person training. Some studies suggest that in-person training is more effective at increasing knowledge (e.g., Gross et al., 2023). They attribute this to factors such as participant preparation, the physical environment (e.g., at home versus at work), and instructional materials not being properly adapted for online delivery. Conversely, other studies, such as Gallegos et al. (2021), found no significant differences between the two delivery methods.

Interestingly, Mallonee et al. (2017) found no difference in knowledge gains between online and in-person evidence-based psychotherapy training. However, participants in the online training reported lower satisfaction compared to those in in-person training. The authors speculated that this might be due to participants being more accustomed to in-person training.

With this in mind, in the current evaluation we compare online and in-person delivery methods to assess the suitability of each for psychology-based interoperability training in the emergency services.

1.3. Current UK emergency services interoperability training

JESIP models and principles set the standard for interoperability in the UK emergency services. The Joint Doctrine (JESIP, 2021) provides a standardised approach and offers training opportunities, including a one-day multi-agency training course and various awareness products (e.g., e-learning, films, mobile applications). These resources cover topics such as the need for interoperability, the impacts of declaring a major incident, and the joint working principles, focussing on practical actions like clear communication. Power et al. (2023a) argued however that psychological processes are as important as practical actions. Yet, despite this recognition, psychological processes have not yet been embedded into interoperability training. This paper aims to address this gap by i) detailing the development of a novel psychology-based interoperability training, and ii) presenting findings from its initial evaluation.

1.4. Aims and objectives

Based on key psychological principles of interoperability identified within recent research (Davidson et al., 2022; 2023; 2024), we developed psychology-based training to improve interoperability and contribute to addressing the research-practice gap within the emergency services (Wankhade & Murphy, 2012; 2023). The purpose of the current paper is to evaluate this training. Specifically, we evaluated whether responders found the psychological elements of the training useful for improving their knowledge of how to collaborate with other responders. In addition, we also explored whether there were any differences between online and in-person deliveries of the training in participants' engagement with the training and their perceived competence of working interoperably.

2. Method

2.1. Training development

The training was based on the recent application of the Social Identity Approach to interoperability (Davidson et al., 2022; 2023; 2024) and was informed by similar theory-based training programmes, such as the Mass Decontamination Instructors Course (Drury et al., 2019), the 5R Leadership Development Programme (Haslam et al., 2020), and Groups for Health (Haslam et al., 2016; 2019). These programmes emphasise 'theory-into-action', applying theoretical knowledge to real-world situations to build shared identity and enhance performance.

We chose a single-session approach, like the Mass Decontamination Instructors Course, due to time pressures and operational commitments responders often face (Tovey et al., 2018). The training was developed in a way that could be delivered online or in-person in order to explore the effectiveness of different delivery methods.

The training content included evidence of past interoperability problems in major incident responses to highlight the challenges with multi-agency collaboration. Participants were then introduced to the Social Identity Approach to understand how group psychology can improve interoperability. To facilitate this, they completed a social identity mapping task (Bentley et al., 2019; Cruwys et al., 2016), identifying groups present in a recent multi-agency incident they attended, the different groups contributions, and their interactions.

Three focus points, based on theory and evidence, were provided to guide actions for improving interoperability. The first focus point, 'build relationships with other services' was based on the concept of identity 'impresarioship'. This idea suggests that shared identity is fostered through shared experiences, such as attending real-life incidents or training events, which help group members coordinate and succeed together (Haslam et al., 2020). Evidence from interoperability research supports this concept by showing that positive contact among emergency responders can help facilitate a sense of shared identity (Davidson et al., 2022).

The second focus point, 'use your shared frame of reference' was based on the concept of identity enactment, which suggests that viewing oneself and others through a shared identity leads to a cognitive shift that shapes behaviour (Haslam et al., 2012). Those who undergo this shift adopt a common frame of reference rooted in group norms and values (Haslam & Reicher, 2012). This shared perspective can explain behavioural differences across groups with distinct identities and similarities within groups sharing the same identity. Research on identity and interoperability supports this, showing that shared frames of references, like JESIP or intrinsic motivations, helped develop a shared identity between responders from different services (Davidson et al., 2023; 2024).

The final focus point, 'make your common purpose clear' was based on the concept of collective agency, which suggests that a shared identity helps internalise shared goals and enhances expectations of support, motivating group collaboration (Drury et al., 2019b). Research on identity and interoperability also supports this, showing that a shared threat can foster shared identity among responders from different services (Davidson et al., 2023). Additionally, responders having a shared understanding of roles and responsibilities and having shared goals were found to be crucial for effective teamwork between responders from different services (Davidson et al., 2023; 2024).

Before the evaluation, responders from the three emergency services contributed to the development of the training. Eight responders provided feedback before the training was finalised. Feedback from responders is detailed in Appendix 1.

2.2. Delivery methods

The training was designed to be delivered either online or in-person, with both methods featuring identical content and structure. For the online delivery, the first author recorded a 30-minute video presenting the training. The video included 'stop and think' sections, where participants were asked to pause and reflect on specific topics (e.g., teams typically involved in a multi-agency response).

For the in-person delivery, the first author presented the training directly to responders, with the session lasting approximately 45 minutes. Although the content was the same, the 'stop and think' sections in the in-person format included facilitated discussions, allowing participants to share their thoughts with each other and provide feedback to the researcher and the larger group. Additionally, participants could ask questions to the researcher or their peers at any time during the session.

2.3. Evaluation design

The evaluation used a mixed methods design and both quantitative and qualitative data was collected. Quantitative data was collected through a questionnaire that participants completed before and after completing the training. Qualitative data was collected through semi-structured interviews with a subset of participants after completing the training.

2.4. Participants

Participants were recruited through opportunity sampling via social media, emergency service contacts, and word of mouth. Sixty-five participants from the Police (*N*=8), FRS (*N*=12), and Ambulance Service (*N*=45) completed the training evaluation, either online (*N*=28) or in-person (*N*=37). All in-person participants were from the Ambulance Service. Eligible participants were current or former operational, tactical, or strategic commanders in the UK emergency services. Participants had a range of experience, with most reporting being 'very' or 'extremely' familiar with JESIP (see Table 1 for participant information). Prior to participation, participants confirmed they had not previously viewed the training video. At the end of the online delivery, participants indicated if they were willing to complete a short follow-up interview, of which seven agreed (Police, *N*=2; FRS, *N*=3; Ambulance, *N*=2).

Table 1. *Participant information provided in frequency (percentage)*

Organisation	
Police	8 (12.31%)
FRS	12 (18.46%)
Ambulance	45 (69.23%)
Command level	
Operational	10 (15.38%)
Tactical	25 (38.46%)
Strategic	6 (9.23%)
Operational and Tactical	10 (15.38%)
Operational, Tactical, and Strategic	5 (7.69%)
Other	9 (13.84%)
Sex	
Male	54 (83.08%)
Female	7 (10.77%)
Not stated	4 (6.15%)
Years in service	
0 – 5	2 (3.08%)
6 – 10	7 (10.77%)
11 – 15	12 (18.46%)
16 – 20	13 (20.00%)
21 – 25	15 (23.08%)
26 – 30	8 (12.31%)
31+	4 (6.15%)
Not stated	4 (6.15%)
Familiarity with JESIP	
Moderately familiar	1 (1.54%)
Very familiar	22 (33.85%)
Extremely familiar	38 (58.46%)
Not stated	4 (6.15%)

2.5. Materials

2.5.1. *Pre-training questionnaire*

This questionnaire included four questions about participants' perceived competence working interoperably (e.g., "I think it is important to work with responders from other services"), rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). See Supplementary Materials 1 for the full questionnaire.

2.5.2. *Post-training questionnaire*

This questionnaire included the same four questions as the pre-exercise one, plus nine additional questions about participants' engagement with the training (e.g., "I think that this training has improved my knowledge on interoperability"). Participants rated each statement on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). See Supplementary Materials 2 for the full questionnaire.

2.5.3. *Interview guide*

The interview guide included similar questions to those in the post-training questionnaire (see Supplementary Materials 3 for the interview guide).

2.6. Procedure

Online participants completed the evaluation via Qualtrics from 25th February to 6th April 2023. They received an information sheet explaining the evaluation and they provided consent before completing the pre-training questionnaire. They then watched the training video before completing the post-training questionnaire. At the end, participants indicated if they wanted to take part in a follow-up interview. These interviews were conducted by the first author on Microsoft Teams from 23 March to 12 April 2023 and lasted an average of 37 minutes.

In-person participants took part on 26th May 2023 during an Ambulance Commanders Development Day. They completed the pre-training questionnaire then received a 45-minute training session delivered by the first author. After the training, participants completed the post-training questionnaire.

2.7. Analysis

2.7.1. *Questionnaire data*

The quantitative questionnaire data was analysed using SPSS 28.0.1. One-sample *t*-tests were conducted to explore participants' engagement with the training by comparing participants' average score to the midpoint value of 3 on the Likert scale. Independent samples *t*-tests were conducted to compare participants' engagement between online and in-person deliveries. Paired samples *t*-tests were conducted for comparing pre- and post-training scores for perceived competence in both delivery methods.

A post-hoc effect-size sensitivity analysis was conducted to explore if we had enough power to detect effects (Giner-Sorolla et al., 2022). Sensitivity analyses were conducted for each statistical test

using G*Power (Faul et al., 2007). Results show the analysis was partially underpowered (see Appendix 2).

2.7.2. *Interview data*

Interview data were analysed using semi-deductive thematic analysis (Braun & Clarke, 2006). The first author transcribed and read the interviews, noting points relevant to the evaluation objectives. These notes were used to develop codes and relevant data extracts were categorised accordingly. After discussing the codes with the research team, themes were identified and defined. The first author then re-read the transcripts, organising data into these themes. The final analysis was reviewed and agreed upon with the research team. Four themes were identified: inclusion of psychological theory, delivery method, importance of collaboration, and motivation for training.

3. Results

3.1. Questionnaire data

For participants' engagement with the training, one-sample *t*-tests revealed that overall, participants rated the training positively – responses to questions asking about participants ability to follow the information in the training, whether participants understood the training, whether they found the training helpful, and whether they would recommend it to others were significantly above the midpoint value of 3 (see Table 2). No significant differences were found in participants' engagement with the training between the online and in-person delivery (see Table 3).

Table 2. *Combined online and in-person one sample t-test results for participants' engagement with the training*

Item	Mean (standard deviation)	*t* statistic	Standard error
Found it helpful	4.28 (.70)	14.79**	.70
Liked training	4.25 (.71)	14.20**	.71
Improved knowledge	4.02 (.72)	11.40**	.72
Will improve skills	4.03 (.71)	11.76**	.71
Will improve others' ability	4.18 (.58)	16.37**	.58
Think training is important	4.28 (.65)	15.85**	.65
Recommend training to others	4.34 (.62)	17.42**	.62

** *p* <.01

Table 3. *Independent sample t-test results comparing online and in-person training for participants' engagement with the training*

Item	Mean (standard deviation)		*t* statistic	Standard error
	Online	In-person		
Found it helpful	4.36 (.68)	4.22 (.71)	-.81	.70
Liked training	4.36 (.68)	4.16 (.73)	-1.10	.71
Improved knowledge	4.04 (.74)	4.00 (.71)	-.20	.72
Will improve skills	3.96 (.79)	4.08 (.64)	.66	.71
Will improve other's ability	4.21 (.69)	4.16 (.50)	-.35	.59
Think training is important	4.29 (.66)	4.27 (.65)	-.09	.66
Recommend training to others	4.50 (.58)	4.22 (.63)	-1.87	.61

For those who completed the online training, paired samples *t*-tests revealed a significant increase in participants' perception of their ability to work effectively in a multi-agency team as well as participants' confidence to be able to effectively work in a multi-agency team, after taking part in the training compared to before. No significant differences were found in participants' knowledge of actions they could take to facilitate an effective multi-agency response and their perception of the importance of working with responders from other services before completing the training compared to after (see Table 4).

Table 4. *Paired sample t test results for perceived competence working interoperably, separated by delivery method*

Item	Mean (standard deviation)				*t* statistic		Standard error	
	Online		In-person		Online	In-person	Online	In-person
	Pre	Post	Pre	Post				
Ability to work in multi-agency team	4.21 (.83)	4.43 (.92)	4.03 (.44)	4.08 (.44)	-2.27*	-1.00	.50	.33
Confidence working in multi-agency team	4.21 (.83)	4.43 (.88)	3.97 (.44)	4.19 (.46)	-2.27*	-3.15**	.50	.42
Importance of working in a multi-agency team	4.71 (.81)	4.75 (.80)	4.84 (.37)	4.73 (.45)	-1.00	1.43	.19	.46
Know what actions to take to facilitate multi-agency working	4.46 (.84)	4.57 (.84)	3.92 (.55)	4.19 (.52)	-1.36	-3.65**	.42	.45

* *p* <.05, ** *p* <.01

For the in-person delivery, paired-samples *t*-tests revealed significant differences in participants' confidence to be able to effectively work in a multi-agency team, as well as their knowledge of actions they could take to facilitate an effective multi-agency response, with participants reporting significantly higher agreement scores after taking part in the training compared to before. No significant

differences were found in participants' perceived ability to work effectively in a multi-agency team, or in their perceptions of the importance of working with responders from other services before completing the training compared to after (see Table 4). In addition, no significant differences were found in the amount of change of these variables between online and in-person groups.

3.2. Interview data

This section presents the results from interviews with a subset of participants who completed the online training delivery. Results are separated into four themes: inclusion of psychological theory, delivery method, importance of collaboration, and motivation for training (see Table 5).

Table 5. *Thematic framework for analysis*

Theme	Description	Example quote
Inclusion of psychological theory	Participants' thoughts on the psychological-base for the training tool	"You kind of hit both like opposite ends of the continuum in terms of how you justify what you're talking about, you've given the applied procedural case studies [...] the other end of the continuum is that when you talked about academic research" (P2)
Delivery method	Participants' preferred delivery method for training, such as in-person, online, or blended.	"Ultimately, it's always, it's always going to be better if it's presented in person, but if that's not practical, then you just tailor the content to suit" (P2)
Importance of collaboration	Discussions around the importance of training with responders from other organisations.	"I felt quite isolated, it was like, it was easy to get distracted in those moments, if that makes sense with everything else that's going on and I think it'd be helpful to sort of maintain engagement with people by collaborating with the video erm whether that was like a Teams meeting with other people in a room potentially, or if it was in a live room, a physical room, that'd be better" (P6)
Motivation for training	Discussions around the reasons why people complete training and what might prevent them completing training.	"The roadblock that will come up against is the same as for everything else. Unless it's a statutory requirement, or it's some kind of mandatory requirement placed on them, ambulance crews for our service when we run at something like 92 to 95% utilisation rates every day, and so trying to get people to leave their day jobs for 20 minutes to watch a video is a massive challenge, and it's almost like you've got to compel people to do it er and to take crews away for that 20 minutes, it's 20 minutes where we haven't got that crew on the road. So there's competing pressures all the time" (P4)

3.2.1. *Inclusion of psychological theory*

Nearly all participants expressed appreciation for the psychology and science components of the training. They valued the evidence and reasons provided for following JESIP, noting that previous training lacked this evidence base, for example "every programme I've been on tells us the practical, this is what you should do [...] but no one has ever really explained the science [...] but now I understand that there is science behind it" (P5).

However, three participants raised concerns about certain aspects of the psychological theory presented. One felt the training was more academic than others they had experienced and stressed the need to make it accessible to all participants by simplifying the language and the content. Another participant echoed this, suggesting that less academic language would prevent creating "unhelpful barriers" when trying to engage responders with the training.

Despite these concerns, two of the participants who critiqued the content also mentioned they would have liked to see more psychology included, as it made the training unique. Another participant agreed, stating that the psychology elements addressed a "gap in the market" for interoperability training and expressed a desire for even more psychological content.

3.2.2. *Delivery method*

Most participants said they preferred in-person training over online delivery. However, many acknowledged the value of online training when in-person sessions are not feasible. They recognised that different people have different learning styles and that a "one-size-fits-all" approach is not ideal. These participants stressed the importance of tailoring online training to its specific format, considering that participants cannot ask questions directly.

Some participants highlighted the advantage of online training in reaching a larger, more geographically dispersed audience quickly. One participant noted, "for what you have, the massive audience that you've got to try and reach, and the geographical spread of it, I think [online delivery] is a really good solution, and it's a practical solution" (P5).

Two participants suggested the training should ideally be offered both in-person and online to reinforce learning. They felt that in-person training would allow for follow-up on the information provided, while online training would offer flexibility in when and where participants could engage with the material.

3.2.3. *Importance of collaboration*

Several participants highlighted that one of the main advantages of in-person training over online delivery is the opportunity for networking and collaboration with responders from other organisations. One participant expressed feeling "quite isolated" during the online training they received during the study and believed that engaging with others in a physical or virtual room would have improved their experience and maintained their attention longer.

Participants criticised online training for missing out on key opportunities to communicate with responders from other organisations and learn from their experiences. They felt that considering the context of the training through the perspectives of others in the room, not just their own experiences, was crucial. As one participant noted, "when we're talking about like different agencies working […] with each other, I think it really helps when you're able to speak to people that are a similar level to you like peers, people you're likely to come into contact with operationally as well […] so you're […] able to collaborate. [During online training] you miss out on a lot of those […] incidental conversations and sharing of experiences, and what that allows to happen is for […] that arrogant perspective of what we do is right […] it stops that happening because it allows people to break down their experiences and consider […] their own experiences and opinions against the context of the people sat next to them" (P6).

Additionally, participants found that receiving training alongside responders from other organisations allowed them to practise the collaboration techniques being taught. One participant mentioned, "If you've got a room full of police, fire, and ambulance, then having someone deliver it […] you could […] practise what you preach in terms of making that interoperability and making people sort of share learning and talk to each other" (P7).

3.2.4. *Motivation for completing training*

Nearly half of the participants discussed their motivations for completing the training. Some felt that online training packages are not considered important among their peers and are often completed

just to check a box, rather than for genuine learning. They argued that making training mandatory is not the most effective way to motivate people to complete the training. One participant noted, “a lot of people don’t pay the learning packages […] the importance that they actually are, they think […] because it’s just mandatory […] they get it out of the way for a couple of years […] rather than wanting to learn from it” (P1).

However, other participants believed that due to competing pressures in the emergency services, making the training mandatory is essential for ensuring its completion. For example, one participant said, “we’ve got lots of competing pressures in different services, particularly ambulance and fire sectors. Having something quick and accessible […] because commanders all have to maintain their competency in currency through [continuing professional development] activities” (P3).

4. Discussion

This paper evaluates a psychology-based training programme developed using the Social Identity Approach to enhance interoperability among emergency services. The study aimed to understand whether responders found the psychological elements of the training useful for improving their knowledge about how to facilitate a more effective multi-agency response and to explore participants' engagement with the training and their perceived competence working interoperably, specifically comparing online and in-person delivery methods.

Overall, participants’ perceptions of the training were very positive. In particular, participants praised the inclusion of the psychology underpinning effective interoperability in the training. They appreciated understanding the psychological reasons why certain actions are important and how these actions can enhance collaboration. A recent review emphasised that considering the psychological processes of embedding interoperability in response organisations is as crucial, if not more so, than the practical arrangements currently prioritised by JESIP (Power et al., 2023a). This aligns with recent research highlighting the importance of social identity processes in understanding the ongoing challenges with interoperability and how these psychological processes can help improve it (Davidson et al., 2022; 2023; 2024). However, while participants recognised the importance of psychology-based training, they also stressed the need for content to be presented in a jargon-free, accessible format to avoid any barriers to understanding.

Regarding participants’ engagement with the training, nearly all participants both online and in-person found the training easy to follow and understand. In addition, most participants considered the training important and would recommend it to others. Whilst interview participants expressed a preference for in-person over online training, survey data revealed no differences in participant satisfaction between the two delivery methods. Interestingly, this is in contrast to previous research that shows that participant satisfaction for online training is lower than for in-person training (Mallonee et al., 2017). The findings in the current study could be explained by the widely recognised problems with interoperability (Pollock, 2013) and the focus on interoperability in recent incident inquiries (Saunders, 2022a; Moore-Bick, 2019). Therefore, given the well-documented problems with interoperability, any training, regardless of the delivery method, may be likely to be seen as beneficial by responders.

In terms of perceived competence working interoperably, participants’ confidence working within a multi-agency team increased following both the in person and online training. Notably, following the online training, participants felt more capable of working in a multi-agency team, but their knowledge of specific actions to implement an effective multi-agency response did not improve. Conversely, participants who undertook the in-person training showed an increase in knowledge about actions they could take to enhance multi-agency collaboration. This is not in line with previous research that shows that there were no differences between delivery methods for knowledge gain (Mallonee et al., 2017). However, this could be because the training in the current study was on collaboration, therefore participants having the opportunity to interact with responders from other organisations and discuss potential collaborative actions in the in-person delivery may have facilitated greater knowledge gain than in the online delivery. In line with this, when exploring the differences between online and in-person training in the interviews, participants discussed the importance of in-person training for providing opportunities for collaboration between responders from different organisations. For example, participants said that in-person training provides an opportunity for responders to put into practice some of the collaboration techniques that are taught in the training and therefore helps reinforce the lessons from the training.

In the online delivery, most participants believed the training would benefit others’ ability to implement effective multi-agency responses more than their own. Notably, nearly all participants were already ‘very’ or ‘extremely’ familiar with JESIP before the evaluation, indicating their existing knowledge of interoperability. Conversely, participants in the in-person delivery showed a smaller gap in perceptions between their own ability and others’. The reasons for this disparity are unclear, but as discussed above, the in-person format allowed for extensive discussions among participants during the training, potentially prompting more reflection on individual experiences and capabilities, as well as experiences and capabilities of others.

An important point raised by interview participants was the importance of considering not only the delivery method of the training but also the motivations behind why people complete training. The discussions often centred on mandatory training and its role in motivating participation. However, there was no consensus on its effectiveness as a motivational tool. Recent studies have shown that many emergency responders dedicate their own time, outside of work, to engage in training (Power et al., 2023b). Additionally, a lack of operational capacity for training has been identified as a barrier to achieving necessary change (Power et al., 2024; cf. Coles, 2014; Pollock & Coles, 2021). This suggests that while mandatory training might provide responders with more opportunities to complete training in their working day, its impact on their motivation remains uncertain. Future research should explore this area to understand the reasons why people complete interoperability training, and what factors might impact this, including the effects of mandatory training on motivation.

4.1. Strengths and limitations

This paper integrates social psychology into interoperability training based on recent research which highlights the importance of role psychology plays in impacting interoperability (Davidson et al., 2022; 2023; 2024). This evaluation advances efforts to address challenges faced by emergency responders during multi-agency responses. However, there are limitations which need attention. First, the in-person sample consisted entirely of Ambulance responders, potentially skewing the results. Nonetheless, the online delivery included a near-equal mix of responders from the three services, and no significant differences were found between Police, FRS, and Ambulance Services in questionnaire responses. This suggests that the views of Ambulance responders might still represent those of other responders, though future research is needed to confirm this. Another limitation is the focus on the blue-light services, excluding other Category 1 responders like local authorities and NHS bodies. This exclusion mirrors previous research gaps in interoperability research and future training should include a broader range of response organisations. Additionally, participants’ familiarity with JESIP might limit the generalisability of the results to those less familiar with JESIP and future research should involve responders with varied interoperability knowledge. Finally, while psychological insights are important, they alone cannot solve interoperability complexities. Other factors, such as technical communication systems like those used in the Manchester Arena Attack (Saunders et al., 2022a) and the London bombings (Hallett, 2011), are also important. Thus, while psychology-based training is beneficial, other factors must also be considered to enhance interoperability.

4.2. Conclusion

This paper evaluated a psychology-based training programme developed using the Social Identity Approach to enhance interoperability among emergency responders, comparing online and in-person delivery methods. Overall, participants liked the training and appreciated the inclusion of psychological principles and understanding of how these could improve interoperability. Despite a preference for in-person training in interviews, survey data showed no difference in satisfaction between delivery methods. Both delivery methods increased participants' confidence in multi-agency teamwork, but in-person training enhanced knowledge of specific collaborative actions more effectively. The need for accessible, jargon-free content was highlighted to avoid barriers to understanding. While mandatory training could increase operational capacity, its impact on motivation remains unclear. Future research should explore this area further to optimise training effectiveness for emergency responders.

5. Practitioner points

- Training programmes which focus on improving interoperability should include psychological principles, such as social identity processes, to help emergency responders understand the reasons behind certain actions and how these actions can enhance interoperability.
- Interoperability training content should be presented in a jargon-free and accessible format. This will help prevent any barriers to understanding and make the training more accessible for all participants, regardless of their academic background.
- While both online and in-person delivery methods for interoperability training can increase participants' confidence in multi-agency teamwork, in-person training can enhance knowledge of specific collaborative actions more effectively. Training providers should therefore consider the benefits of both methods and aim to balance them, possibly integrating elements of each to optimise interoperability training outcomes.

Appendixes

Appendix 1.

Initial feedback from responders, reported as per the GRIPP2 reporting framework (Staniszewska et al. 2017)

Section and topic	Item
1. Aim	To collaboratively engage responders in the initial development stage of the training.
2. Methods	The content of the training was sent in a basic PowerPoint format to eight responders from the Police (N = 2), FRS (N = 3), and Ambulance Service (N = 3). Responders provided either written feedback (N = 2) or face-to-face to the lead researcher (N = 6). Responders were specifically liked and did not like about the content of the training, what areas could be improved, whether they understood what was meant by 'shared identity, and whether there were any areas that the did not understand.
3. Results	Responders who reviewed the training content said they liked it, and it made a valuable contribution to understanding interoperability. However, several suggestions were also made to improve the training, including: more detail on where challenges arose during the Manchester Arena response and the provision of specific examples; emphasising the importance of building relationships before an incident; and making the information presented on the slides more concise. Several responders liked the psychology content and advised on the inclusion of more detail of the psychology elements to make the contribution of psychology clearer. Finally, most responders advised to run the service evaluation of the training with responders across all levels of command (operational, tactical, and strategic) because the elements included in the training are applicable across all levels.
4. Discussion	The content of the training was updated based on the feedback from responders. Specific examples where the training was updated include examples from the Manchester Arena inquiry of the delayed attendance from the FRS, adding additional slides expanding on the psychological elements of *how* a shared identity can be used to improve group working, and reducing the amount of information on the slides by breaking down sentences into short bullet points. In addition, formatting was added to the presentation, such as animations, transitions, and colour. A similar colour scheme to that used In JESIP documents and training (red, green, and blue) was used to allow for consistency with other training that responders are familiar with. The lead researcher recorded themself presenting the training, and the PowerPoint was turned into video format. The video was 29 minutes, 27 seconds in length. It was uploaded onto YouTube as an unlisted video: https://www.youtube.com/watch?v=uubrBT2rYWc.
5. Reflection	The feedback received from responders was embedded as far as possible into the training tool. Due to the near equal engagement across the emergency services, feedback from each service was able to be represented. Whilst written feedback was less comprehensive than the verbal feedback, taken together with the verbal feedback from responders several areas for change and improvement were able to be identified and implemented into the finalised training.

Appendix 2.

Post-hoc sensitivity analysis

The post-hoc sensitivity analysis using G*Power (Faul et al., 2007) indicated that while some of the statistical tests had sufficient power, others did not fully meet the required threshold for detecting the expected effect sizes. Specifically, for the paired sample *t*-test with 65 participants, the effect sizes (ds =.42,.45,.37,.44) exceeded the sensitivity threshold of d =.35, indicating sufficient power. Similarly, the one sample *t*-test with 65 participants yielded effect sizes (ds =.70,.71,.72,.71,.58,.65,.61) above the threshold of d =.35.

However, the independent sample *t*-test with 28 participants in one group and 37 in the other showed effect sizes (ds =.70,.71,.72,.71,.59,.66,.61) that partially fell below the sensitivity threshold of d =.71, indicating the test was partially underpowered. Additionally, the paired sample *t*-test with 28 participants revealed effect sizes (ds =.50,.50,.19,.42) below the threshold of d =.55 and the paired sample *t*-test with 37 participants had effect sizes (ds =.33,.42,.46,.45) below the threshold of d =.47. These results suggest that these tests were underpowered and might not detect smaller effects, potentially limiting the generalisability and robustness of the findings.

Supplementary Material

Supplementary Materials 1. Pre-training questionnaire

On a scale of 1 (strongly disagree) to 5 (strongly agree), what extent do you agree with the following statements:

- “I am able to work effectively in a multi-agency team.”
- “I am confident that I can work effectively in a multi-agency team.”
- “I think it is important to work with responders from other services.”
- “I know what actions I can take to facilitate an effective multi-agency response.”

Supplementary Materials 2. Post-training questionnaire

On a scale of 1 (strongly disagree) to 5 (strongly agree), what extent do you agree with the following statements:

- “I am able to work effectively in a multi-agency team.”
- “I am confident that I can work effectively in a multi-agency team.”
- “I think it is important to work with responders from other services.”
- “I know what actions I can take to facilitate an effective multi-agency response.”
- “I was able to easily follow the information provided in this training video.”
- “I understood the information provided in this training video.”
- “I found this training video* helpful.”
- “I like this training video*.”
- “I think that this training video* has improved my knowledge on interoperability.”
- “I think this training video* will improve my skills in implementing an effective multi-agency response.”
- “I think this training video* will help improve others’ ability to work effectively in a multi-agency response.”
- “I think this training video* is important.”
- “I would recommend this training video* to others.”

* ‘Video’ was included in the questionnaire for Part 1 of the evaluation

Supplementary Materials 3. Interview guide

Interview guide for training video evaluation

1. What did you think of the training video?
    1. What aspects did you like?
    2. What aspects did you not like?
2. Did you find the training video helpful?
    1. Did the training video improve your knowledge on interoperability?
    2. Do you think the training video will improve your skills in implementing an effective multi-agency response?
    3. Has the training video changed the way you think about interoperability?
    4. Is there anything in your work you do differently since taking part in the training video?
3. How can the training video be improved?
    1. Were there any aspects of the training video that were not clear?
    2. Do you have any suggestions on how the format of the video could be improved
        1. Speed of talking
        2. Formatting on slides
        3. How to make it more interactive
    3. Would the training video work as an e-learning module or would it have to be in-person?
4. How does this training video compare to other training you have completed?
5. Would you recommend this training video to others?
6. Do you have any other comments about the training video that we have not already discussed?

Statements and Declarations

Ethical considerations

Ethical approval was not sought for the present study because it was classed as a service development.

Conflicts of interest

The authors have no conflicts of interest to declare.

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