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Finding the missing and unknown: Novel educational approaches to warming up cold cases

Karsten Bettels, Dave Grimstead, Cheryl Allsop, Anna Chaussée, Rachel S. Bolton-King, Caroline Sturdy Colls, Brendan Chapman, David Keatley, Emma Tilley, Jo Turner, Samantha Spence, Annette Marquardt

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## Finding the missing and unknown: Novel educational approaches to warming up cold cases

### Title:

Finding the missing and unknown: Novel educational approaches to warming up cold cases

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### Authors:

Karsten Bettels<sup>1</sup>, Dave Grimstead<sup>2</sup>, Cheryl Allsop<sup>3\*</sup>, Anna Chaussée<sup>4</sup>, Rachel S. Bolton-King<sup>5</sup>, Caroline Sturdy Colls<sup>5</sup>, Brendan Chapman<sup>6</sup>, David Keatley<sup>7</sup>, Emma Tilley<sup>5</sup>, Jo Turner<sup>5</sup>, Samantha Spence<sup>8</sup> & Annette Marquardt<sup>9</sup>

<sup>1</sup> Polizeiakademie Niedersachsen (Police Academy Lower Saxony), Bürgermeister-Stahn-Wall 9, 31582 Nienburg/Weser, Germany, karsten.bettels@polizei.niedersachsen.de

<sup>2</sup> Locate International, Rumwell Hall, Rumwell, Taunton, Somerset, TA4 1EL

<sup>3</sup> University of South Wales, Centre for Criminology, Treforest Campus, Pontypridd, Wales, CF37 1DL (<https://orcid.org/0000-0002-8447-809X>)

<sup>4</sup> Department of Applied Social Sciences, Forensics & Politics, University of Winchester, Sparkford Road, Winchester, SO22 4NR

<sup>5</sup> Department of Society, Crime & Environment, School of Justice, Security & Sustainability, Staffordshire University, Stoke-on-Trent, ST4 2DF, r.bolton-king@staffs.ac.uk (<https://orcid.org/0000-0002-9208-7857>), c.sturdy-colls@staffs.ac.uk (<https://orcid.org/0000-0003-2942-6219>), jo.turner@staffs.ac.uk (<https://orcid.org/0000-0002-3419-4419>)

<sup>6</sup> Medical, Molecular and Forensic Sciences, Murdoch University, 90 South Street, Murdoch, Western Australia. 6150 (ORCID- Chapman 0000-0001-7518-6645)

<sup>7</sup> School of Law, Murdoch University, 90 South Street, Murdoch, Western Australia. 6150

<sup>8</sup> Department of Law and Business, School of Justice, Security & Sustainability, Staffordshire University, Stoke-on-Trent, ST4 2DF, samantha.spence@staffs.ac.uk (<https://orcid.org/0000-0003-0422-5955>)

<sup>9</sup> Staatsanwaltschaft Verden (State Attorney Department Verden), Johanniswall 8, 27283 Verden/Aller, Germany, [annette.marquardt@justiz.niedersachsen.de](mailto:annette.marquardt@justiz.niedersachsen.de)

\* Corresponding author: [cheryl.allsop@southwales.ac.uk](mailto:cheryl.allsop@southwales.ac.uk) University of South Wales, Centre for Criminology, Treforest Campus, Pontypridd, Wales, CF37 1DL.

### CRedit author statement:

**Karsten Bettels:** Conceptualization; Methodology; Formal analysis; Investigation; Project administration; Resources; Supervision; Writing – original draft; Writing – review & editing. **Dave Grimstead:** Conceptualization; Methodology; Investigation; Resources; Project administration, Supervision; Writing – original draft. **Cheryl Allsop:** Conceptualisation; Investigation; Supervision; Writing - original draft; Writing – review and editing. **Anna Chaussée:** Investigation; Supervision; Writing - Original Draft. **Rachel Bolton-King:** Investigation; Validation; Visualisation; Writing - original draft; Writing - review & editing. **Caroline Sturdy Colls:** Investigation; Supervision; Writing – original draft; Writing – review & editing. **David Keatley:** Investigation; Supervision; Writing – original draft; Writing – review & editing. **Brendan Chapman:** Investigation; Supervision; Investigation; Writing – original draft; Writing – review & editing. **Emma Tilley:** Investigation; Supervision; Writing - original draft; Writing – review and editing. **Jo Turner:** Investigation; Supervision; Writing – review and editing. **Samantha Spence:** Supervision; Writing - review & editing. **Annette Marquardt:** Conceptualization; Resources; Writing - original draft.

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#### **Abstract:**

In recent years, students in police academies and higher education institutions around the world have worked together to analyse cold cases including long-term missing persons cases in collaboration with investigators and prosecutors. In 2020, three European organisations, the Police Expert Network on Missing Persons (PEN-MP), AMBER Alert Europe and Locate International, succeeded in connecting these educational organisations enabling them to work collectively on cases and conduct cold case analyses (CCA) across international borders. The International Cold Case Project (ICCP) learning objectives were to 1) collect the necessary information about the victim, 2) reconstruct the crime, and 3) investigate trace control.

In a learning objective-based evaluation using CAWI (Computer-Assisted Web Interviewing), 76 participating students from the German and International ICCP teams were asked to complete a pre- and post-review questionnaire to self-assess their personal competence development. Participants

reported significant increases in competence in all evaluated areas, thus demonstrating that authentic and relevant collaborations can enrich the learning environment, promote the use of professional skills, and provide significant knowledge exchange opportunities between academia and industry.

Drawing on case studies of cold case missing persons investigations and unidentified found remains, this article shares how university academics, students and community volunteers can work together nationally and internationally to find out what has happened to missing people and how we can more effectively identify the previously unidentified. In so doing, we share the expertise required to progress these cold cases and provide recommendations to support other institutions and organisations in adopting this innovative approach.

**Keywords:**

Academia-industry partnership; authentic learning; cold case; international collaboration; investigation; missing persons; multidisciplinary; review

## 1. Introduction

The definition of a missing person may differ between jurisdictions, but may broadly be defined as “anyone whose whereabouts cannot be established and where the circumstances are out of character or the context suggests the person may be subject of crime or at risk of harm to themselves or another” [1]. Whilst Solymosi, Petcu and Wilkinson [2] state that the number of people reported missing to police is rising across the world each year, this statement appears to be unsubstantiated as no global estimate has been calculated and figures vary dramatically geographically. In the United Kingdom (UK) for example, the numbers between 2015 and 2020 appear to be relatively stable with approximately 161,000 ( $\pm 16,000$ ) individuals being reported missing [1], whereas in the United States of America (USA), over 480,000 missing person records were added to the National Crime Information Centre’s database in 2020 alone [3]. While the vast majority of missing persons will return within a couple of days, often of their own free will, a small proportion (1 to 3 %) are still missing after 12 months, and some will never return [4,5]. In terms of risk (the case requires an active and measured response from agencies such as the police) and duration (an individual is typically located within two days), most missing person cases in the UK are deemed to be at medium risk of coming to harm. The level of risk decided upon will determine the number of resources allocated to the case. In the UK, the realistic cost of investigating medium-risk, medium-duration cases in England was estimated at nearly £2,500 per missing person in 2012 [4,6]. This amount increases exponentially the longer an investigation continues.

In such cases where it is suspected that a crime may have occurred, the individual has not been located, all viable investigative leads have been exhausted and the case remains unsolved, the (senior) investigating officer will keep the case open and categorise it as a cold case [7]. Periodically, cold cases and long-term missing persons cases are reviewed by police agencies to establish any new investigative leads and to try to locate the missing person using new sources of information and emerging technologies [8].

For some years, students at police academies and various universities across the world have been introduced to the analysis of cold cases, including long-term missing persons cases. For example, in 2014, the Cold Case Analysis (CCA) course at the <information redacted for blind peer-review> (hereafter referred to as the Police Academy) was established to promote the development of students’ professional, social and personal competences [9]. Within the framework of their professional competences, students learn the processing structure for investigations and their professional practice is tested through the close linking of theory and practice via active involvement

with real cold case reviews. In these cases, students read and analyse police case files, identifying errors in the investigation and in the file structure, and highlighting information gaps questions that need to be urgently addressed during their analysis. Example tasks include, establishing an image of the victim, asking new questions that were missed in the original investigation to clarify an alibi, and undertaking further research to identify new sources of information or intelligence to advance the investigation. In this way, students learn the real-world challenges of working on these complex and multidisciplinary cases, creating their own lived experiences that will enable them to question, improve and enhance their professional practice in the future.

Since the first cold case course at the Police Academy in 2014, the basic procedure was that the students would work on the cold cases exclusively in direct spatial contact with each other. Thus, the analysis was only possible at one study location at a time. Even cross-study cooperation at different study locations of the Police Academy was not planned. This process was also complicated by the fact that the original files made available in digital form were only assigned to the students individually by means of external, encrypted data carriers in the form of data sticks. In principle, this had the advantage that the personal, direct discussion in the cold cases was the focus of the analysis, but the integration of other students from other study locations within the Police Academy was not possible.

However, due to the Coronavirus pandemic, face-to-face teaching was converted to online teaching and the Stud.IP learning platform [10] was used at the Police Academy. The integration of this platform therefore provided the opportunity for a cross-study location cold case investigations, and the possibility for cross-educational institution and cross-state cooperation. In light of this, and following the success of the national CCA course, discussions were then held as to how this project could be developed to bring a multi-national and multiple disciplinary [11] perspective to cold case reviews, expanding the existing model to form an international collaboration. Based on the new possibilities afforded by virtual learning, the way was paved for a first international cold case cooperation undertaken in collaboration with the Police Expert Network of Missing Persons (PEN-MP), Locate International, the Police Academy and university students from the UK and Australia.

For the first time, this article shares how university academics, students and community volunteers can work together nationally and internationally to find out what has happened to missing people and how we can more effectively identify the previously unidentified. In so doing, we share the expertise required to progress these cold cases and provide recommendations to support other institutions and organisations in adopting this innovative approach.

## **2. Method**

### **2.1. Design of the International Cold Case Analysis Project**

The structure of the International Cold Case Analysis Project (henceforth ICCP) was realised under the umbrella of the PEN-MP with the cooperation of Locate International and a number of British, Australian and German universities. In order to achieve the aims outlined above, the project built on the initial experiences and learning from Germany [9] and recognised the lessons from other emerging cold case review projects led by academics and practitioners in the UK and Australia. Through its subsequent evaluation (Section 2.2), the project team also aimed to understand if and how cold cases could be progressed through the joint efforts of students from different disciplines, cultures and ways of working.

This unique cold case collaboration was piloted in November 2020. It involved 76 higher education students participating in two simultaneous courses and tasked with investigating the same case review over a one-month period. One course operated as an international collaboration, involving 43 students from five UK universities (<details redacted for blind peer-review>), two Australian

universities (<details redacted for blind peer-review>) and the Police Academy. The second course operated at a national level in Germany, involving 33 students from only the Police Academy. University students were studying a range of courses, from Bachelor to Masters level in the fields of forensic science, policing, criminology, forensic anthropology and forensic archaeology. For some university students, the activity was provided as a "for credit" opportunity within their subsequent curriculum. Other universities offered the program strictly as an extracurricular opportunity. For example, the Police Academy students undertook the exercise as part of their coursework and the duration of this exercise was four weeks. However, for those undertaking subsequent international CCA collaboration, the initial four-week project was extended to three months in duration.

Students were expected to work in groups (see below) with individuals from various cultural, institutional, and disciplinary backgrounds to facilitate student-led critical discourse [12], hopefully enriching and expanding the potential for new investigative channels. It was posited that adopting an online platform would also provide a more inclusive and accessible opportunity to enable a greater number of students to gain critical real-world insight into practical police work, significantly expanding their knowledge base enabling them to apply their curriculum learning to real-world cases within the context of other international jurisdictions, increasing their motivation for learning and course progression through the subsequent impact they may have on the potential to influence real cases [13] to locate or identify the missing. Such potential for interdisciplinary learning also encourages students to think beyond the boundaries of their own specialist knowledge [11,12] and actively learn from others' lived experiences. Students had to inevitably navigate and moderate their communication styles, leadership, and mutual expectations of each other in response to their team dynamics [14] and the case information. Such collaborative learning environments also simulate professional and goal-orientated workplaces and proactively prepare students for employment realities within the investigative sector [15,16]. In this way, various competences and subject-specific expertise are integrated in a cross-agency analysis in a way that is mutually beneficial for all involved. Students of police educational institutions learn a processing structure for their future fields of action in investigative work by accessing and analysing original files, thus deepening and applying theoretical knowledge to the cases. Students from related faculties and disciplines get to know the case-related police procedures through analysis of their files, deepening their knowledge of the police procedure in a cold case, and bringing their own expertise to the analysis on a case-related basis. In doing so, they can orientate themselves regarding the current state of research in their disciplines and develop proposals for further measures in specific cold case investigations.

Prior to commencement of the course, students were required to complete a confidentiality agreement. They were given digital access to the file components required for the analysis in a protected virtual room for the duration of the course. The cold case reviews were managed using the free online learning and project management platform, Stud.IP (German abbreviation for "Internet Support for Courses and Projects") [10], to facilitate the sharing of sensitive case-related data, whilst maintaining the security and integrity of the material.

Stud.IP is open-source software under the General Public License 2.0 and is maintained and developed by the non-profit organisation Stud.IP e.V., German universities and a community of developers. Every organisation interested can download it and use it without any restrictions for an undefined period of time and it has been used at the Police Academy since its foundation in 2007. There is no central instance for Stud.IP, so every Stud.IP installation is hosted by the organisation which uses it on their own and the platform provides a flexible and easy to customise role-based rights management. Every person therefore has a unique and personal login to the platform. Passwords are stored hashed and encrypted. Two-factor-authorisation, either via smartphone or e-mail, can be set as default for specific roles or all accounts. Accounts have to be assigned to specific courses with sensitive materials and courses can either be protected by passwords or by making them invisible. For organisations with a higher need of security, Stud.IP offers on site encryption. The free plugin "Tresor" ("Safe") uses end-to-end encryption via PGP and encrypts files in the platform. The Safe opens only for people who have

been manually assigned to the corresponding crypto-container and are in possession of the correct key. For users with access to the corresponding courses and the correct keys, Stud.IP does an on-the-fly decryption, thus being both convenient and secure. Stud.IP also has measures in place to make it harder to print and download PDFs ensuring the documents cannot be easily shared with others who do not have access to the platform. So, in essence, sensitive material is protected in numerous ways within the Stud.IP platform. The material is password-protected in itself, is encrypted within the course, the crypto-container opens only with the correct personal and hand-assigned key, can only be accessed by persons who are in specific courses/projects, the courses/projects are protected with a password within the platform, and the access to the platform requires a login secured by encrypted passwords and a second-factor authentication and happens only via encrypted communication. This platform has proved to be an asset for the international cold case analysis.

The students within the international collaboration were divided into four groups with approximately ten students per group, each group containing a mixture of students based in Australia, Germany and the UK. Incorporating the German Police Academy students across the groups was critical in bridging cultural and language barriers during the exercise. After completing an initial training exercise, groups were tasked with reviewing an unsolved attempted murder and a long-term missing person investigation. The analysis commenced with an input phase, where the students could independently familiarise themselves with techniques for cold case analysis through a special eight-hour online learning programme. Here they become familiar with specific problem areas that arise in victim image collection (victimology), crime reconstruction and investigative trace control using concrete cases from practice. Subsequently, they were tasked with independently analysing a training cold case in their respective teams. The results of the individual groups were discussed together, and a sample solution was raised. The students were given one month to complete their reviews before presenting the results to the German police and prosecutor, again through the secure case management platform, Stud.IP.

During the cold case analysis, three main outcomes were required:

1. Evaluation of a victim picture (victimology) from the existing files according to a standardised scheme with the aim of obtaining all necessary information about the victim.
2. Carrying out a crime reconstruction by analysing the pre-crime phase, main-crime phase and post-crime phase in homicides and the disappearance situation in cold cases with missing persons.
3. Evaluation of all investigation leads according to a standardised scheme with the aim of identifying contradictions or investigation leads that have not yet been completed.

The students were asked at the beginning and at the end of the course whether they know the required aspects of the focal points, understand the necessity of collecting them, can apply the aspects confidently and analyse them independently (Section 2.2).

## 2.2. Evaluation

The aim of the ICCP, and a second international cold case analyses which followed, was to promote cooperation between police educational institutions and other higher education providers that have a close connection to investigations across international borders. In doing so, this would:

1. Provide trainee police officers and students with a novel, real-world and authentic learning experience that enriches the student experience by establishing close links between theory and practice in cold case investigations
2. Provide investigating departments and public prosecutors with new ideas and approaches from the students across crime and justice related faculties to further progress investigations

3. Enhance the investigative mindsets of all participants by drawing on and learning from individuals across relevant discipline boundaries, including criminology, policing, forensic science, forensic archaeology, and forensic anthropology.

The learning objectives of the cold case analysis were to:

1. Understand the process of collecting victim image data and how to synthesise it for presentation to law enforcement stakeholders
2. Demonstrate a reconstruction of the crime, using timelines, geography and persons of interest and divide it into the pre- crime phase, main-crime phase and post- crime phase
3. Evaluate leads identified in the investigation and propose new opportunities for investigation.

To evaluate the extent to which these aims and objectives were met, a learning objective-based - evaluation of the project was undertaken using CAWI (Computer-Assisted Web Interviewing). As students themselves are the only ones who can report on the impact that this collaborative, multiple disciplinary and real-world CCA experience has had on their own learning [17], personal development and assessment of competence. The participating students were asked identical questions before and after completion of the course and were asked to assess and self-report on their perceptions under the areas of remind, understand, apply and evaluate (Supplementary Material 1). Responses were collected on a six-part scale from "1 (fully agree) to 6 (fully disagree)". To maximise participation in the evaluation, the questionnaire was electronically distributed in both German and English (note – only the English version is supplied in Supplementary Material 1). Overall, 91 responses were received (53 pre-CCA completion and 38 post-CCA completion) comprising of students from both the international and national CCA courses working in parallel).

Due to the data being unpaired, unequal in sample size and not normally distributed, the data were analysed using the Mann-Whitney U test to establish any statistically significant differences between pre- and post-course self-evaluations using SPSS version 27. Effect sizes for all statistically significant results were calculated using the correlation coefficient  $r$  (Equation 1), where  $z$  is the standardised score and  $N$  is the total number of observations on which  $z$  is based. Interpretation of  $r$  is based on Cohen's guidelines where a small effect is 0.1, a medium effect is 0.3 and a large effect is 0.5 [18].

$$r = \frac{|z|}{\sqrt{N}} \quad (1)$$

### 3. Results

The survey participation rate was 67.9 % (n= 53) at the beginning of the course and 48.7 % (n= 38) at the end of the course. Student self-assessment showed statistically significant increases in their perceived competence between pre- and post-course datasets across all statements (Figure 1 and Table 1). Notwithstanding the limitations of self-assessment data including the potential for bias and over-confidence in the respondent's own abilities [19], and in respondents providing what they consider to be socially acceptable responses, this trend was consistent at all levels (knowing, understanding, applying and evaluating) for the victim image, crime reconstruction and investigation lead control.

<Insert Figure 1 here>

Figure 1 – Results of students' evaluations pre-course (n=53) and post-course (n=38) with 95% confidence interval (CI).



<Insert Table 1 here>

Table 1 – Key statistical outcomes and interpretation of effect size for students' perceived competencies listed in descending order.

<Insert Figure 2 here>

Figure 2 – Frequency of overall student satisfaction after course completion (n=37).

It is interesting that participants' ability to "understand" the importance of creating a victim image, reconstructing a crime, and investigating trace control is affected to a lesser extent through their participation in the ICCP compared to the other three types of question; "know", "apply" and "evaluate". As supported by the ratings given in Figure 1, this outcome could be explained by the fact that the students, with their investigative study background, already feel they have a good basic understanding of the necessity of a victim image, a crime reconstruction and an investigative lead control prior to commencing the ICCP. However, they felt they did not have the breadth or depth of knowledge for the critical factors associated with a victim image, how they could apply their existing knowledge within the forthcoming cold case analysis, or how confident they felt about their ability to independently and autonomously assess the factors in practice. This suggests that participating in the ICCP is particularly beneficial to the students in their transition from 'safer' educational settings into the realities of real casework.

In the authors' opinion, these findings therefore provide strong support for how authentic and relevant international collaborations can enrich the learning environment, promote the use of professional skills, and provide significant knowledge exchange opportunities between academia and industry. A detailed discussion and wider consideration of these results are explored in Section 4.

## 4. Discussion

The aim of the current study was to showcase the advantages of a multiple disciplinary [11], international cold case collaboration in terms of students' and cadets' ability to work effectively on cold cases. Over the past few decades, the modest case study featured within lectures has extended into more immersive and dynamic case-focused workshops, role-play, and crime scene simulations, both physical and virtual [20,21]. However, it is often difficult to realistically replicate criminal and forensic investigative challenges through case studies and crime scene simulations alone. Spiro et al. [22] recognised the 'conspiracy of convenience' that impacts the creation of effective learning environments. Time pressures and other curricula concerns may lead to problems that are too well-defined, oversimplified, or learners come to expect immediate and pre-determined solutions undermining the realities of professional practice.

Authentic learning developed from the apprenticeship models of the 1980s and is recognised as enhancing learning by encouraging learners to practice solving problems readily encountered in the real world [23]. The authentic learning pedagogical model provides a framework for immersing learners in real-world situations beyond formal education settings [24-26]. At its core is the requirement to create a learning environment that replicates how knowledge is constructed and applied in real life. A primary feature is that intended learning outcomes are aligned to the vagaries of real-world problems by supplying genuine tasks and activities. The model requires learners to

exercise their analytical thinking skills to articulate problems and dismantle them into constituent tasks [24]. Encouraging the articulation and analysis of problems is achieved through introducing intentionally ill-defined problems which require learners to consider multiple interpretations and extract meaning [27]. The educator adopts a supporting role in responding to the needs of learners as they collaborate with their peers to construct knowledge using communication technology [28]. Importantly, learners rather than the tutor decide how best to navigate and approach the problems they perceive. Learners are further supported through access to experts assisting them in recognising and applying specialist knowledge. The model provides opportunities for learners to scaffold understanding and explore it through multiple dimensions, disciplines, and perspectives. The verification of learning occurs through self-reflection and the provision of an authentic assessment which is integrated into the overall task.

Authentic learning requires the meaningful assessment of learning outcomes embedded within genuine opportunities for demonstrating knowledge and higher-order cognitive skills [23,24,29-31]. Meaningful opportunities exist for self-reflection, peer-to-peer decision-making and prioritisation, and knowledge exchange with specialists and stakeholders allowing learners to demonstrate analytical thinking, critical evaluation, and creative problem-solving skills. For this initial ICCP there was some disparity identified in student involvement. For the Police Academy students their work was assessed as part of their degree programme, whereas the international students' involvement was extra-curricular and thus their final assessment could be considered as the real-world impact of the cold case review on the family of the missing or unidentified person. Based on the extra-curricular nature of the international collaboration, the project was extended from the initial four weeks to three months. This did not mean an increase in the workload for the students, but rather it provided them more flexibility to work on the tasks and assignments while still balancing their other study needs. As a result, some inequality remained between those on the national and international courses; due to the increase in course duration, some Police Academy students had to continue in an extra-curricular capacity for an additional two months.

Criminological and forensic education is enhanced by exploring real complex problems, adding authenticity to learning [27,32] and producing graduates with important employability skills. Across the world, particularly in Germany, Australia, the UK and USA, cold case units have begun operating within universities, giving students the opportunity to work alongside staff and subject experts on unsolved murders, missing person cases and unidentified found remains. While there is no universally accepted definition of a cold case it is largely accepted that a case becomes cold when all reasonable lines of enquiry have been explored and it is considered that there is nothing further that can be done to progress the investigation at that time [7,33]. This then gives students an opportunity to review these cases to see if new lines of enquiry can be established. This in turn can support the police service who often must make difficult decisions about which cases to prioritise and act on [34]. In the UK alone, at a conservative estimate there are around 1500 unsolved murders<sup>1</sup>, 4500 people who have been missing for more than 12 months, and over 1000 unidentified found remains [4]. At a time when policing resources are stretched, these cases often do not get the focused attention that are required to resolve them. There is then both a pedagogical value to university cold case teams, and a practical one, enabling students to put the theory learned on their degree courses into practice. It must also be considered that any case left gathering dust by law enforcement agencies, stands only to benefit from the fresh eyes of a trained and carefully supervised university team.

The value of engaging in real, in-depth, and critical evaluation imparts agency and responsibility on the learner, with emphasis placed upon what, why, and how decisions are reached. Learning takes

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<sup>1</sup> It is hard to pinpoint the exact number given the variance in records held in this regard across the police service.

place in an environment that replicates some of the pressures of dynamic case review as information sometimes develops unpredictably and out of anticipated sequence. Criminal investigation requires agility of thought which is difficult for students to practise in tutor-designed linear simulations and workshops. The undertaking of closely supervised, real, investigative learning occurs under a range of imperfect conditions shattering the naive and idealised notions of criminal investigation inherited from portrayals of fictionalised and televised “true” crime.

Similar authentic learning initiatives exist, such as ‘Innocence’ projects, closely associated with law, criminology, and forensic programmes in USA and UK universities. While Innocence projects offer insights into the procedures for appeal, defence work, and investigative shortcomings, they necessarily focus on reviewing substantive issues to assess potential grounds for appeal and less on how case intelligence is developed. The review skills used within Innocence projects are not the same as investigative review, which instead aims to identify missed opportunities, and lines of enquiry associated with complex cases that remain unsolved [35]. Students working on both types of ‘failed’ or flawed cases are experiencing first-hand the challenges faced by investigators and legal professionals, drawing on their skills and experience, to identify new ways of progressing these cases. For cold case reviews of missing people and unidentified found remains in particular, students are encouraged to think of new and innovative ways of progressing an investigation that may not have been considered before. Universities are at the forefront of new and emerging analytical techniques as part of their active research programs and have arguably better insight into advances in forensic science than practitioners may have. Of course, it is notwithstanding that it is often the most straightforward techniques that can yield success.

This has been evidenced in the UK in a missing person investigation. Students reviewing the case of a 16-year-old boy missing since 1996 discovered that his DNA had never been taken. While a composite DNA profile was held on record, it was insufficient for comparisons with unidentified found remains and searches of international DNA databases. Through conversations with his mother, it was established that she had retained a number of her son’s items including his baby teeth, from which a DNA profile could potentially be obtained. This in turn can then be used to cross reference the profile with any found remains.

Similarly, crowd sourcing information using social media to help to identify previously unidentified found remains has yielded results. In one case, students working alongside Locate International volunteers were able to request help from the public by publicising the details of a poignant inscription etched onto a gold band, believed to be a wedding ring, found on unidentified remains washed up in the UK in 1979. The location of where the remains were found along with other information known about the remains was shared widely on social media, and in other media appeals. This led to numerous leads from members of the public resulting in the likely nationality being established, enabling further media appeals to take place in his country of origin.

The handling of cold cases in police investigations depends on several factors, such as the number of investigators assigned to them, whether there are firmly established cold case units in the organisation and how their tasks are described [8]. On the other hand, the number of cold cases is usually of a magnitude that hardly allows for a simultaneous analysis of the cases as well as concrete investigative measures, so that classifications of the cold cases and triage and prioritisation criteria must be found to process the cases in a certain order. Criteria such as the availability of evidence for a renewed forensic investigation with modern methods can increase the priority of a case within a department. Other triggers for considering investigation of cold cases include upcoming statute of limitations of the crime as well as recognised contradictions in statements, false alibis or unfinished investigation leads. Theoretically, all file components of all cold cases within a cold case unit would need to be read and analysed before a thorough prioritisation could be made. This is, however, impractical, as it would take years to decades given most jurisdictions caseloads. A casefile for an unsolved homicide often comprises of several thousand to ten thousand pages. This means that once time is invested in

reviewing a cold case file, it makes just as much sense to continue investigating that case that for new investigative approaches, and not to put it aside again. This is where the strength of a larger workforce (i.e. group of trained students) can make the task more manageable.

This dilemma can be mitigated by having parts of the analysis and initial assessment in cold cases, as well as obtaining new leads in the cases, done through support services and preliminary work by third parties. This is not a new concept and has been discussed within scholarly literature by Chapman et al. [8], Stupperich, Bettels and Marquardt [9], Davis, Jensen and Kitchens [36] and the US Department of Justice [37]. This can greatly facilitate the work of cold case investigators if this work is done in a relatively short period of time and enables the investigators to continue working with the obtained results in a timely manner.

From this innovative project a number of distinct advantages can be identified both for the police and prosecutors (Section 4.1) and for the students (Section 4.2) involved in these initiatives.

#### **4.1. Advantages for the police and prosecutors**

In a course, up to 80 students usually analyse four cold cases with a file of more than 40,000 pages in four weeks. The results obtained are presented to the investigators in a presentation at the end of the course. All of the documents developed are made available in writing. The documents to be prepared by the students are divided into a structured creation of a victim picture, a reconstruction of the crime in the pre-crime, main-crime and post-crime phase or the disappearance situation in the case of a missing person's case as well as providing investigation leads by analysing all traces available in the case according to a structured procedure [38]. Crucially, 80 students working on the cases corresponds to more than 10 full-time investigators per year in terms of working time alone. With two courses per year, the students' preliminary work can supplement the work of more than 20 investigators for one year.

There are great advantages for the investigators and prosecutors involved. They receive a structured presentation of the cold case with a comprehensive victim picture as well as a reconstruction of the pre-crime phase, the main-crime phase and the post-crime phase based on hypotheses, as well as a complete evaluation of all investigative leads. This enables the investigators to get a quick overview of all investigative leads; identified contradictions and problems with alibis, cross-references between investigative leads and suggestions for measures that can still be taken today or that no longer seem possible, identified from the complete data set of the cold case. In addition to dealing with the content of the analyses presented by the students, the investigators can also use this material provided to quickly familiarise new investigators with the case or for their own presentations of the case.

The students' work is a basis for looking at multiple cases in prioritisation based on the entire body of data within each case, in addition to assessing the remaining forensic or investigative opportunities within each case. This reduces the likelihood of missing something in a case if the entire data set is not read. This was evidenced in a case of a murdered female hitchhiker that the students analysed in 2018, one of the most important investigative leads still to be followed today was a reference to a male in the trace file of 1068 out of a total of 1176. This clearly shows the importance of analysing the file in its entirety as it is often the most insignificant details that are recurrently missed.

For the <redacted for blind peer-review> Prosecutor's Office, 13 cold cases have so far been fully analysed by the students between 2014 and 2021. This makes prioritisation in processing in coordination with the responsible investigators much easier. Accordingly, investigators and public prosecutors see advantages in working with the students as they use the results of the analyses and the processing of the entire file inventory for decisions on their further course of action in the specific cold cases, as well as for prioritisation decisions as to which cases to pursue within the framework of their limited personnel resources. Moreover, the analysis by the students enables the public prosecutors' offices, sometimes with different objectives, (for example complete case analysis,

analysis of press coverage in the weeks after the crime, victim analysis, preparation of overviews of witness statements at the time), to effectively prepare the subsequent investigations even before a homicide squad is established to commission further expert opinions.

By outsourcing this basic work in a cold case, investigators and public prosecutors can obtain a complete analysis of up to five-figure volumes of investigative files in just a few weeks and then critically examine the results. This can focus further work on cold case investigations because police and prosecutors can pool their limited resources. In the past years, more than 30 cold cases have been analysed in 10 courses so far in the national framework.

Due to the nature and purpose of the evaluation presented in this article, it is unclear as to whether this approach achieved multidisciplinary, interdisciplinary and/or transdisciplinary outcomes within each group or as a collective [11]. As a result, further research is needed to understand and evidence the type and extent of disciplinary collaborative working in the context of international cold case reviews.

#### **4.2. Advantages for the students**

In Germany, the Police Academy has had experience in cold case analysis with students since 2014. The Bachelor's degree programme <redacted for blind peer-review> there is a professionally oriented, practice-integrating degree programme that combines theoretical-scientific with application-oriented courses.

The study programme focuses on the acquisition of science-related and practice-based knowledge and methods, and in particular establishes a link to practical professional skills and abilities. This leads to a move away from traditionally teaching-oriented knowledge transfer towards learning-oriented knowledge acquisition [39]. Through this paradigm shift and the use of new media, e.g. a digital learning platform, learners are given more responsibility for their own learning process. At the same time, this is intended to promote the skills for lifelong learning.

Moreover, they expand their personal competencies by, among other things, putting themselves in the shoes of their parents or grandparents in cold cases when they were young and had to communicate without a smartphone, as well as by improving their ability to concentrate through the necessary intensive focus on extensive case files. Personal responsibility is also strengthened because only part of the files are read by all students and thus corrections of individual performances are still possible, while in the file components such as investigative trace files they are completely solely responsible for evaluating the contents. At the same time, the high workload in the course, in addition to the performance of other student tasks, is well suited for students to learn to remain calm and work through their tasks step by step. Their social skills are influenced in the course by the fact that they discuss results in groups and hone their interpersonal skills in order to reach results together. They are also responsible as a group for the overall result and have to present it to the responsible investigators and prosecutors.

Regarding missing persons cases, the students also realise how important it is to develop a question structure during the first interrogations, which they need to ascertain indicators and motives for the reason a person is missing and to lead to further immediate measures to be taken, such as securing objective traces, even if the existence of a criminal offence is not objectively recognisable as the reason for being missing. It is precisely the omission of immediate measures in the first days of a missing person's case that cannot be remedied in the case of a homicide that is not recognised until later [40].

Working with the original files with the aim of further supporting the investigations with one's own ideas also leads to an intensive study of the contents of the files and the realisation that in part the data needed today has not been collected. This leads to special learning effects as students want to surpass that which they have experienced in their case files.

By bringing in intercultural aspects such as OSINT (open-source intelligence), research students can provide investigators with additional valuable clues. This was exemplified in a homicide of a 52-year-old Turkish man, where the perpetrator apparently left a writing on a wall. A student of Turkish origin succeeded in interpreting this writing seriously for the first time after 17 years: it was a Turkish phrase, which was phonetically written in Latin letters [9]. In two other homicides, case-relevant information was also obtained through internet research.

The students of the participating faculties also benefit in the application of their theoretical expertise to the cold case, deepening their knowledge by looking further into the pertinent issues and conducting extensive literature research. The benefits of a cross-cultural exchange between students cannot be understated either. As members of a global community, gaining understanding of policing and investigation practices from other jurisdictions allows students to increase their employability within regions outside of their native country.

Following the success of the first ICCP, a second commenced in June 2021 and again ran for three months. This project involved 151 student participants (80 in the national course and 71 in the international course) split into eight groups working on either the case of a missing or an unidentified person. It is evident from running these two successive projects that numerous advantages are evident for police, prosecutor's, universities and students who engage in national and international collaborations such as this. However, it was noted that there was often a gender imbalance in the course cohort, with significantly more females participating than males. Such imbalance has therefore raised the question as to what the main cause of this imbalance may be and whether specific recruitment strategies should be investigated and adopted to promote and balance equality, diversity and inclusion moving forwards. As a result of the authors' experience, a number of recommendations are proposed in Section 4.3 to summarise key points of learning to continue to embrace and enhance in future ICCP.

### 4.3. Recommendations

The following recommendations are made to establish, grow and sustain such collaborative cold case initiatives:

- Build partnerships between investigators, public prosecutor's police training institutions and universities
- Coordinate the objectives of the cold case analysis with all parties involved at an early stage
- Prepare the casefiles accordingly for the analysis. Access to full-text searchable pdf documents is advantageous wherever possible
- Gain experience by starting the analysis small, preferably with only one cold case and a select group of students. Later you can enlarge the analysis with multiple groups and cases
- Ensure there is a security agreement in place both to prevent unauthorised access to the files and in terms of behavioural instructions to the participating students for handling the files as well as the content gained from the cold cases, including beyond the end of the course
- Provide a suitable learning platform on which the analysis can take place, where corresponding preparatory courses are digital, and which also prevents unauthorised access to the files or work with encrypted data carriers
- Involve specialised personnel with appropriate experience in processing and analysing cold cases. Depending on the content of the case, there may be different expertise required
- Establish a processing structure in the analysis with a schedule and corresponding training modules as well as imparting basic knowledge to the participants in order to sensitise them for the later analysis

- Adopt a recruitment strategy that promotes equality, diversity and inclusion within course participation.

## 5. Conclusions

Authentic learning experiences provide opportunities to replicate real-world tasks and challenge preconceived ideas. The ICCP model encourages learners to practise higher-order cognitive skills that are needed to support agile investigative thinking. Authenticity in learning enhances student engagement and perceptions of credibility and satisfaction because outcomes are embedded within meaningful outputs which directly support graduate aspirations.

This article demonstrated how university academics, students and community volunteers can work together nationally and internationally to find out what has happened to missing persons and how we can more effectively identify the previously unidentified. In so doing, we shared the expertise required to progress these cold cases and provide recommendations to support other institutions and organisations in adopting this innovative approach.

In order to conduct a national or international cold case analysis with students, considerable preparation is required. The starting point should be simple, with a small number of students, a limited number of cold case files and the restriction to one case. In this way, initial experience can be gained, which can then lead to an increase in scope in further analyses. It is also a good idea to conduct an initial independent analysis in a national context before expanding internationally.

Another possibility is to participate in the international cold case analysis presented here. There has been experience since 2014 in carrying out the analysis in both national and international formats, and the learning platform has demonstrated its appropriateness for carrying out the analyses with security and data protection aspects also being addressed. A third ICCP will take place from December 2021 to February 2022 with a focus on children as missing persons and unidentified victims of homicide. For this reason, in addition to a missing person case of a seven-year-old girl from 1995, an analysis of currently three unidentified baby corpses from <location redacted for blind peer-review> is planned. The objective is to approach the phenomenon area by integrating the different perspectives of the participating faculties and, in addition to a respective case-specific consideration, to develop cross-case approaches and to compile the current state of research for the investigators and public prosecutors involved.

Finally, it is also possible to participate in the international cold case analysis with only a few students at the beginning and thus minimise the effort for one's own organisation. In this way, experience can be gathered regarding how participation could take place at national and international level in the future.

## References

- [1] National Crime Agency (NCA), *Statistics Tables for UK Missing Personals Data Report, 2019/2020*. <https://www.nationalcrimeagency.gov.uk/who-we-are/publications/503-uk-missing-persons-unit-statistics-report-2019-2020-1/file>, 2021 (accessed 29 October 2021).
- [2] Solymosi, R., O. Petcu, J. Wilkinson. 2021. "Exploring public engagement with missing person appeals on Twitter." *Policing and Society* 31 (7): 798-821. <https://doi.org/10.1080/10439463.2020.1782409>.

- [3] National Crime Information Centre (NCIC), *2020 National Crime Information Center (NCIC) Missing Person and Unidentified Person Statistics*. <https://www.fbi.gov/file-repository/2020-ncic-missing-person-and-unidentified-person-statistics.pdf/view>, 2021 (accessed 29 October 2021).
- [4] National Crime Agency (NCA), *UK Missing Persons Unit Missing Persons Data Report 2019/20*. <https://www.nationalcrimeagency.gov.uk/who-we-are/publications/501-uk-missing-persons-unit-data-report-2019-2020/file>, 2021 (accessed 29 October 2021).
- [5] Bundeskriminalamt (BKA), Die polizeiliche Bearbeitung von Vermisstenfällen (the police processing of missing persons cases). <https://www.bka.de/DE/UnsereAufgaben/Ermittlungsunterstuetzung/BearbeitungVermisstenfaelle/bearbeitungVermisstenfaelle.html;jsessionid=5EABED527E86363FB6708DB412364684.live611?nn=30666#doc19618bodyText3>, 2021 (accessed 29 October 2021).
- [6] Shalev Green, K., F. Pakes. "The Cost of Missing Person Investigations: Implications for Current Debates." *Policing* 8 (1): 27-34. <https://doi.org/10.1093/police/pat036>.
- [7] Pettem, S., *Cold case research resources for unidentified, missing, and cold homicide cases*, CRC Press, Boca Raton, 2012.
- [8] Chapman, B., D. Keatley, G. Oatley, J. Coumbaros, G. Maker. 2019. "A review and recommendations for the integration of forensic expertise within police cold case reviews". *Journal of Criminal Psychology* 10 (2): 79–91. <http://dx.doi.org/10.1108/JCP-09-2019-0038>.
- [9] Stupperich, A., K. Bettels, A. Marquardt. 2017. "Cold Case Investigation in Educational Settings in Germany". *Forensic Science Policy & Management* 8 (1-2): 38-46. <https://doi.org/10.1080/19409044.2017.1343409>.
- [10] Stud.IP, *Stud.IP homepage*. <https://www.studip.de/>, 2021 (accessed 31 October 2021).
- [11] Choi, B.C.K, A.W.P. Pak. 2006. "Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness." *Clinical and Investigative Medicine* 29 (6): 351-364.
- [12] Holley, K.A.. 2017. "Interdisciplinary curriculum and learning in higher education." *Oxford Research Encyclopaedias*. <https://doi.org/10.1093/acrefore/9780190264093.013.138>.
- [13] Simsek, A., Transformational Learning, in: N.M. Seel (Eds.) *Encyclopedia of the Sciences of Learning*, Springer, Boston, 2012.
- [14] Saint-Charles, J., P. Mongeau. 2006. Fondements d'un modèle communicationnel du groupe: structures et fonctions, in: J. Saint-Charles, P. Mongeau, *Communication: Horizons de pratiques et de recherches* 2: 191-208. Québec: Presse de l'Université du Québec.
- [15] Green, W., S. Hammer, C. Star. 2009. "Facing up to the challenge: Why is it so hard to develop graduate attributes?" *Higher Education Research & Development* 28 (1): 17–29. <https://doi.org/10.1080/07294360802444339>.
- [16] Herrington, J., J. Parker, D. Boase-Jelinek. 2014. "Connected authentic learning: Reflection and intentional learning." *Australian Journal of Education* 58 (1): 23-35. <https://doi.org/10.1177/0004944113517830>.
- [17] Linse, A.R.. 2017. "Interpreting and using student ratings data: Guidance for faculty serving as administrators and on evaluation committees." *Studies in Educational Evaluation* 54: 94-106. <http://dx.doi.org/10.1016/j.stueduc.2016.12.004>.



- [18] Fritz, C.O., P.E. Morris, J.J. Richler. 2012. "Effect Size Estimates: Current Use, Calculations, and Interpretation," *Journal of Experimental Psychology: General* 141 (1): 2-18. <https://doi.org/10.1037/a0024338>.
- [19] Carter, T.J., D. Dunning. 2008. "Faulty self-assessment: why evaluating one's own competence is an intrinsically difficult task." *Social and Personality Psychology Compass* 2 (1): 346-360. <https://doi.org/10.1111/j.1751-9004.2007.00031.x>.
- [20] Harrison, K., C. Morgan, Simulation, Immersive Gameplay and Virtual Realities in Forensic Science Education, in A. Williams, J. Cassella, P. Maskell (Eds.), *Forensic Science Education and Training: A Toolkit for Lecturers and Practitioner Trainers*, Wiley, Chichester, 2015, pp. 163-175.
- [21] Barton, K., P. McKellar, P. Maharg. 2007. "Authentic fictions: Simulation, professionalism and legal learning." *Clinical Law Review* 14: 143-193.
- [22] Spiro, R.J., W.P. Vispoel, J.G. Schmitz, A. Samarapungavan, A.E. Boeger., Knowledge acquisition for application: Cognitive flexibility and transfer in complex content domains". In: B.K. Britton, S.M. Glynn (Eds.), *Executive control processes in reading* 31: 177-199. Lawrence Erlbaum Associates, Hillsdale, NJ, 1987.
- [23] Karunanayaka, S. P., S. Naidu. 2021. "Impacts of authentic assessment on the development of graduate attributes." *Distance Education* 42 (2): 231-252. <https://doi.org/10.1080/01587919.2021.1920206>.
- [24] Herrington, J., Introduction to Authentic Learning, in: V. Bozalek, D. Ng'ambi, D. Wood, J. Herrington, J. Hardman, A. Amory (Eds.) *Activity Theory, Authentic Learning and Emerging Technologies: Towards a transformative higher education pedagogy*, Routledge, London, 2014.
- [25] Herrington, J., R. Oliver. 2000. "An instructional design framework for authentic learning environments." *Educational Technology Research and Development* 48 (3): 23-48. <https://doi.org/10.1007/BF02319856>.
- [26] Herrington, J., T.C. Reeves, R. Oliver, *A guide to authentic e-learning*, Routledge, London, 2010.
- [27] Lombardi, M., *Authentic Learning for the 21<sup>st</sup> Century: An Overview*, EDUCAUSE learning Initiative. [https://library.educause.edu/resources/2007/1/authentic-learning-for-the-21<sup>st</sup>-century-an-overview](https://library.educause.edu/resources/2007/1/authentic-learning-for-the-21st-century-an-overview), 2007 (accessed 30 October 2021).
- [28] Parker, J., D. Maor, J. Herrington. 2013. "Authentic online learning: Aligning learner needs, pedagogy and technology." *Issues in Educational Research*, 23 (2): 227-241. <http://iier.org.au/iier23/parker.pdf>.
- [29] Shaw, A., *Authentic assessment in the online classroom*, Wiley Education Services, Centre for Teaching and Learning, 2019. <https://ctl.wiley.com/authentic-assessment-in-the-online-classroom/> (accessed 29 October 2021).
- [30] Conrad, D., J. Openo. 2018. *Assessment strategies for online learning engagement and authenticity*. Athabasca: Athabasca University Press. <https://doi.org/10.1080/01587919.2020.1821608>.
- [31] Mueller, J.. 2005. "Authentic assessment toolbox: Enhancing student learning through online faculty development." *MERLOT Journal of Online Learning and Teaching*, 1 (1). [https://jolt.merlot.org/documents/vol1\\_no1\\_mueller\\_001.pdf](https://jolt.merlot.org/documents/vol1_no1_mueller_001.pdf)
- [32] Brookfield, S., *The skillfull teacher: On technique, trust, and responsiveness in the classroom*, Jossey-Bass, San Francisco, 2015.

[33] Allsop, C., *Cold case reviews: DNA, detective work and unsolved major crimes*, Oxford University Press, Oxford, 2018.

[34] Allsop, C.. 2013. "Motivations, money and modern policing: accounting for cold case reviews in an age of austerity." *Policing and Society* 23 (3): 362-375. <https://doi.org/10.1080/10439463.2013.782211>.

[35] Henneberg, M.. 2017. "Worlds apart: Cold case reviews and investigations into alleged wrongful convictions in England and Wales." *Journal of cold case review* 3 (1): 24-37.

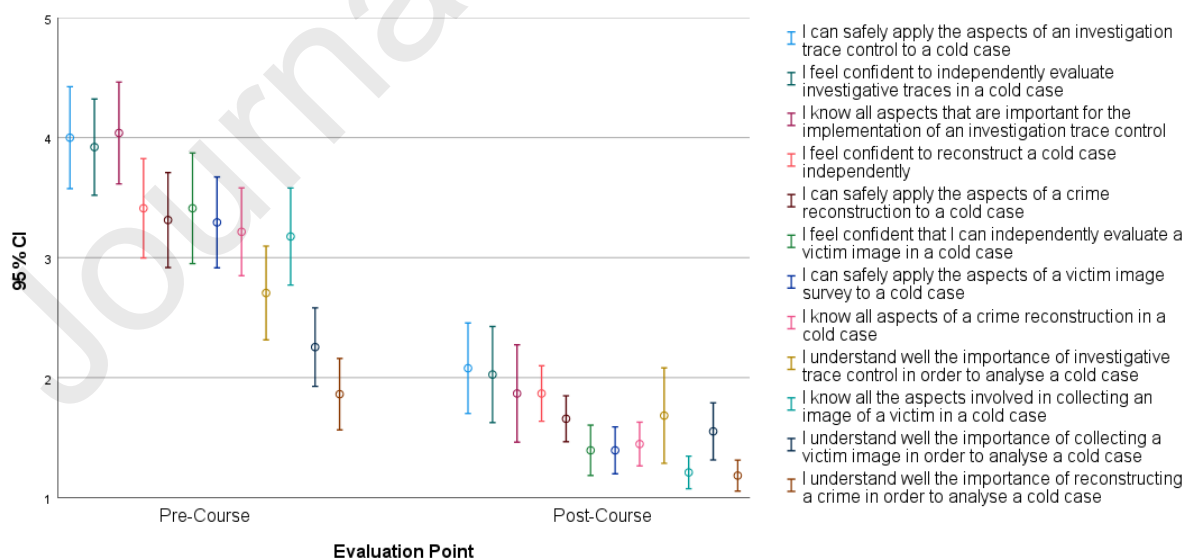
[36] Davis, R.C., C. Jensen, K.E. Kitchens, *Cold-Case Investigations: An Analysis of Current Practices and Factors Associated with Successful Outcomes*, RAND Center on Quality Policing, Santa Monica, CA, 2011.

[37] US Department of Justice, Office of Justice Programs, Bureau of Justice Assistance, *Promising Strategies for Strengthening Homicide Investigations*. <https://bja.ojp.gov/library/publications/promising-strategies-strengthening-homicide-investigations-findings-and>, 2018 (accessed 30 October 2021).

[38] <reference redacted for blind peer-review>

[39] <reference redacted for blind peer-review>

[40] DiBiase, T.A., *No-Body Homicide Cases: A Practical Guide to Investigating, Prosecuting, and Winning Cases When the Victim is Missing*, CRC Press, Boca Raton, 2015.



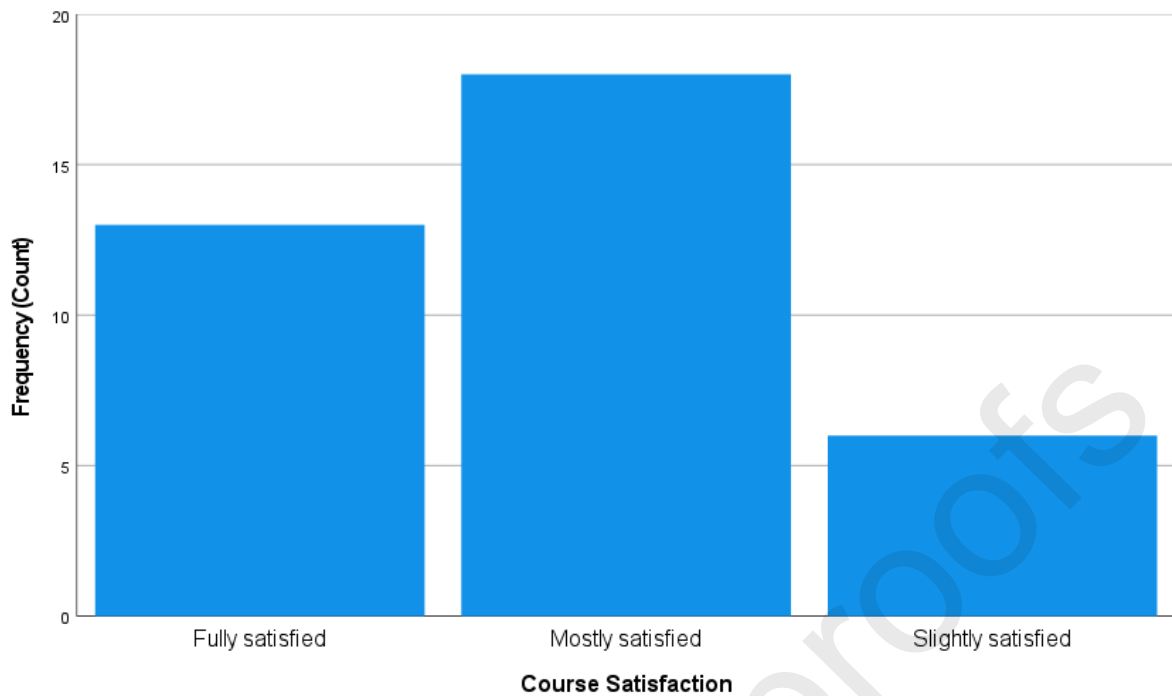


Table 1 – Key statistical outcomes and interpretation of effect size for students' perceived competencies listed in descending order.

Statement	N	Significance (p-value)	<i>r</i>	Effect Size
I know all the aspects involved in collecting an image of a victim in a cold case	91	0.000	0.703	Large
I can safely apply the aspects of a victim image survey to a cold case	90	0.000	0.689	Large
I know all aspects of a crime reconstruction in a cold case	91	0.000	0.686	Large
I feel confident that I can independently evaluate a victim image in a cold case	91	0.000	0.641	Large
I know all aspects that are important for the implementation of an investigation trace control	91	0.000	0.626	Large
I can safely apply the aspects of a crime reconstruction to a cold case	91	0.000	0.614	Large
I feel confident to independently evaluate investigative traces in a cold case	91	0.000	0.607	Large

I can safely apply the aspects of an investigation trace control to a cold case	89	0.000	0.594	Large
I feel confident to reconstruct a cold case independently	91	0.000	0.548	Large
I understand well the importance of investigative trace control in order to analyse a cold case	91	0.000	0.435	Medium
I understand well the importance of reconstructing a crime in order to analyse a cold case	91	0.000	0.418	Medium
I understand well the importance of collecting a victim image in order to analyse a cold case	91	0.004	0.303	Medium

**Highlights:**

- International academia-industry teams can advance missing persons investigations
- This innovative model actively supports knowledge exchange between all involved
- Students develop key skills through an authentic learning environment
- New investigative leads are initiated, and police resources optimised
- Recommendations are made to support others seeking to adopt a similar model