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Questioning Technique Review and Scenario Specification for the CF IEDD Operator Training Course

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Technical Report
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Abstract

This document presents the results of a literature review on Questioning Technique (QT) and the development of a scenario, instructional material, and evaluation criteria that support the development of an Intelligent Tutoring System (ITS). The use of QT across multiple domains was surveyed and synthesized to illustrate how this knowledge can be incorporated into an Improvised Explosive Device Disposal (IEDD) course instructional material and the assessment of student QT performance. The QT literature review demonstrated consistent themes across domains. Overlapping strategies that directly support the current teachings of the IEDD course were included as 'good practices'. Differences between current literature and the course were included as recommendations for either the course, the ITS, or both. The IEDD scenario was developed to illustrate a two-IED, domestic-oriented threat that reflects CF operational realities and supports current witness questioning and threat assessment training. The scenario used verbal and visual Situation Awareness (SA) elements to enable students to determine the correct Render Safe Procedure (RSP) for three types (i.e., timed, command, and victim) of possible IED threats. Further recommendations derived from the literature review included a proposed questioning framework tailored to an IED-specific domain and a proposed performance evaluation that rates students based on QT performance criteria.

Résumé

Le présent document fait état des résultats d'une étude documentaire que nous avons effectuée au sujet de la méthode interrogative (MI) ainsi que du scénario, du matériel didactique et des critères d'évaluation que nous avons élaborés dans le but de mettre sur pied un tuteur intelligent (TI). Nous avons synthétisé les informations recueillies sur l'emploi de la MI dans divers domaines afin d'illustrer la façon dont ces connaissances peuvent être incorporées dans le matériel didactique du cours de neutralisation des dispositifs explosifs de circonstance (IEDD) et dans l'évaluation du rendement des stagiaires sur le plan de la MI. L'étude documentaire nous a permis de dégager certains thèmes communs à plusieurs domaines. Nous avons retenu les stratégies qui revenaient le plus souvent et qui avaient un lien direct avec les enseignements actuels du cours d'IEDD pour en faire des « pratiques exemplaires ». Quant aux différences entre ce que nous avons trouvé dans la littérature et les enseignements du cours, nous les avons retenues en tant que recommandations soit pour le cours, pour le TI ou pour les deux. Le scénario élaboré met en scène une menace double à l'intérieur du pays qui reflète les réalités opérationnelles des FC et qui est pertinente dans le cadre d'une formation sur l'interrogation de témoins et l'évaluation d'une menace. Ce scénario intègre des éléments verbaux et visuels relatifs à la connaissance de la situation (CS) aidant le stagiaire à déterminer la bonne procédure de mise hors d'état de fonctionner (procédure RSP) pour trois types d'IED (dispositifs à minuterie, télécommandés et déclenchés par la victime). Parmi les autres recommandations tirées de l'étude documentaire, nous proposons un modèle d'interrogation adapté à un domaine précis lié aux IED ainsi qu'une méthode d'évaluation selon laquelle les stagiaires sont notés en fonction des critères de rendement de la MI.

Executive summary

Questioning Technique Review and Scenario Specification for the CF IEDD Operator Training Course **Ming Hou, et al. DRDC Toronto TR 2013-061; May2013.**

To support the development of an Intelligent Tutoring System (ITS), this document presents the results of a literature review on Questioning Technique (QT) and the development of a scenario, instructional material, and evaluation criteria for the Canadian Forces (CF) Improvised Explosive Device Disposal (IEDD) operator course. It expands upon previous research, which recommended selecting the CF IEDD operator course for implementing and evaluating adaptive learning and intelligent tutoring technologies. The IEDD operator course teaches CF personnel how to identify, disrupt, and dispose of IEDs. Students are also taught how to identify, recognize, and formulate an accurate threat assessment of suspected IEDs partly based on information acquired from the questioning of witnesses at the scene.

The QT literature review was conducted across the medical, professional, psychological, and police domains. This body of knowledge was collected and synthesized for the development of recommendations and best practices regarding how to integrate this knowledge into course instructional material and the assessment of student QT performance within an ITS. Recommendations included a proposed questioning framework and an enhanced performance evaluation for IEDD course instructors.

With the support of IEDD course instructors, a realistic scenario has been developed to represent current CF IEDD operational realities and complexities. The scenario has built-in verbal and visual Situation Awareness (SA) elements that allow students to determine the correct render safe procedure for three types of possible IED threats: 1) *timed*, where detonation is controlled by a timer; 2) *command*, where detonation is remotely controlled by the bomber; and 3) *victim*, where detonation is triggered by the victim's physical contact with the device.

The proposed questioning framework was derived from common themes found in other domains that use interview-style questioning, and was then tailored to fit an IED-specific context that supports current course material for building witness rapport, question specificity, and active listening strategy. The proposed Rapport, Alternate 5Ws, and Re-Evaluate (RARE) framework merges the theory and practice of IEDD QT by first appreciating the bigger picture before becoming focused on specifics, followed by double-checking one's assumptions before making a final decision. A proposed performance evaluation was created to examine more closely what constitutes good and poor QT. The proposed approach rates students on many of the individual dimensions and holistic performance scores discussed throughout this document.

These activities support the development of instructional material and performance evaluation criteria for an ITS, and help evaluate the utility of integrating ITSs into CF learning environments.

Sommaire

Questioning Technique Review and Scenario Specification for the CF IEDD Operator Training Course **Ming Hou, et al. DRDC Toronto TR 2013-061. mai 2013.**

Dans l'optique de faciliter la mise sur pied d'un tuteur intelligent (TI), nous avons conduit une étude documentaire concernant la méthode interrogative (MI) dont nous dévoilons ici les résultats. Nous avons également conçu un scénario, du matériel didactique et des critères d'évaluation pour le cours d'opérateur en neutralisation des dispositifs explosifs de circonstance (IEDD) des Forces canadiennes (FC). Comme le recommandaient les recherches antérieures effectuées sur le sujet, nous avons choisi le cours d'opérateur IEDD des FC comme outil de mise en œuvre et d'évaluation des technologies d'apprentissage adaptatif et de tutorat intelligent. Le cours d'opérateur IEDD porte sur la détection, la neutralisation et l'élimination des IED. On y enseigne également comment formuler une évaluation précise de la menace d'une présence potentielle d'IED à partir d'informations recueillies auprès de témoins sur place.

Dans le cadre de notre étude documentaire, nous nous sommes intéressés à l'application de la MI en médecine, en psychologie, en milieu professionnel et au sein de la police. Nous avons ensuite synthétisé les informations recueillies afin d'établir des recommandations et des pratiques exemplaires quant à la façon d'intégrer ces connaissances au matériel didactique du cours et de mettre sur pied un TI capable d'évaluer les compétences des stagiaires en matière d'interrogation. Nous proposons, entre autres, un modèle d'interrogation ainsi qu'une grille d'évaluation du rendement améliorée à l'usage des instructeurs en IEDD.

Avec l'aide des instructeurs en IEDD, nous avons été en mesure d'élaborer un scénario pragmatique reflétant les réalités et les difficultés opérationnelles actuelles de la IEDD. Ce scénario comprend des éléments verbaux et visuels relatifs à la connaissance de la situation (CS) aidant le stagiaire à déterminer la bonne procédure de mise hors d'état de fonctionner (procédure RSP) pour trois types d'IED, soit : 1) *les dispositifs à retardement*, qui sont déclenchés à l'aide d'une minuterie; 2) *les dispositifs télécommandés*, qui sont déclenchés à distance; et 3) *les dispositifs déclenchés par la victime*, qui sont activés par le contact physique.

Le modèle d'interrogation que nous proposons est inspiré de thèmes communs retrouvés dans d'autres domaines où l'on fait appel à l'interrogation, que nous avons adaptés à un contexte précis lié aux IED appuyant le matériel didactique en ce qui a trait au contact avec les témoins, à la précision des questions et à l'écoute active. Le modèle proposé combine les aspects théorique et pratique de la MI en IEDD en proposant de tenir compte d'abord de la situation dans son ensemble avant de se pencher sur les détails, puis de revérifier ses hypothèses avant de prendre une décision définitive. Nous avons aussi mis sur pied un modèle d'évaluation du rendement afin d'examiner en profondeur les éléments qui distinguent une bonne méthode interrogative d'une mauvaise. Selon la méthode d'évaluation proposée, les stagiaires sont notés sur une grande partie des points liés au rendement individuel et collectif dont il est question dans le présent document.

Grâce à ces travaux, nous serons en mesure d'établir le matériel didactique et les critères d'évaluation du rendement qui concourront à la mise sur pied d'un TI et d'évaluer l'utilité d'intégrer un TI dans les milieux d'apprentissage des FC.

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1 Introduction

This document presents the results of a literature and technology review on Questioning Technique (QT) and specifications to support development of the scenario and evaluation criteria for an Intelligent Tutoring System (ITS). This work was undertaken to support the Improvised Explosive Device Disposal (IEDD) operator course at the Canadian Forces School of Military Engineering (CFSME), CFB Gagetown.

1.1 Background

The IEDD operator course enables Canadian Forces (CF) personnel to identify, disrupt, and dispose of Improvised Explosive Devices (IEDs). The operator is trained to recognize and formulate an accurate threat assessment of the suspect device, and provide advice on immediate protective measures against hazards associated with Chemical, Biological, and Radiological (CBR) IEDs. However, the failure rate in the existing IEDD operator course is significantly high (approximately 40 percent). The high failure rate has been attributed to considerable time pressure and stress during situation assessment and decision-making activities undertaken in the field. As such, students are often prone to decision-making biases.

To address the high failure rate, Defence Research and Development (DRDC) Toronto investigated the challenges faced by students and determined that there were a number of issues associated with the instruction of QT. As a solution, DRDC Toronto has initiated an Applied Research Project (ARP) to investigate mechanisms to improve the efficiency and effectiveness of CF distance/e-learning capabilities. Adaptive learning and intelligent tutoring technologies are two key mechanisms that facilitate the learning experience for CF personnel.

Adaptive learning in the context of e-learning involves creating a learning experience that purposely adjusts to various conditions by adapting to an individual student's learning needs based on measures such as behaviour, workload, or performance. Similarly, ITSs are self-regulating systems for the control, delivery, and assessment of learning content. Complex algorithms are designed to rely on feedback from the learner's performance, prior exposure to knowledge, and learning rate to deliver, evaluate, and react according to pedagogical principles, goals, and implementation tools.

To develop an ITS for the IEDD operator course that addresses training deficiencies, the following tasks were conducted during the first phase of the ITS project:

1. *Literature Review on Suitable Learning Style for Intelligent Tutoring Technologies*. To review and identify suitable learning styles for adaptive learning and intelligent tutoring that would improve CF distance/e-learning capabilities (DRDC Toronto TR 2010-073).

2. *Literature Review on Suitable Adaptation Mechanism for Adaptive Learning and Intelligent Tutoring Environments*. To review and identify suitable adaptation mechanisms for adaptive learning and intelligent tutoring that would improve CF distance/e-learning capabilities (DRDC Toronto TR 2010-074).

3. *Requirement and Stakeholder Analysis for the CF Counter-IED (C-IED) Training Courses*. To investigate the requirements of stakeholders of the CF IEDD operator course for the development of adaptive learning technology integration and validation plans (DRDC Toronto CR 2010-059).

During the second phase of the ITS project, two further tasks were conducted and the results are summarized here:

1. *Literature and technology review on questioning technique*. To conduct a literature and technology review on QT to support the development of the CF IEDD operator course (DRDC Toronto CR 2012-010).

2. *Scenario development and baseline evaluation for the CF IEDD course*. To develop the IEDD course scenario and conduct a baseline evaluation study to support the implementation of ITS technologies for the IEDD operator course (DRDC Toronto CR 2012-009).

1.2 Scope and objectives

The first task during the second phase of the project was to conduct a literature and technology review on QT. The literature review examined questioning and interviewing techniques used in qualitative psychology, doctor-patient interviews, and police investigations for the purpose of drawing on common strengths and guidelines. It included cognitive biases that are thought to affect threat assessment and decision-making and mitigating strategies that questioners can adopt. The results of this review provided detailed requirements for ITS instructional content and QT performance evaluation. The technology review included the assessment of technical presentations and demonstrations given at the Intelligent Tutoring Systems 2010 International Conference in the attempt to integrate advanced technological mechanisms, such as eye-tracking and psychophysiological data, into an ITS for the IEDD course. However, it was found that most ITS technologies were still commercially immature and limited to very simple problems (e.g., grade school math which is different from complex concepts taught by the IEDD course). The question is what QT methods can be applied to the IEDD ITS if there is no any mature QT technology? Another question is whether there is any limitation of QT methods and how to mitigate them when using these QT methods within the auspices of the IEDD ITS scenario?

The second task during the second phase of the project was to develop the IEDD course scenario and conduct a baseline evaluation study to support the implementation of ITS. To assess the ability of ITS to improve the effectiveness and efficiency of IEDD course, an evaluation study was conducted prior to the implementation of the IEDD ITS to provide comparison or baseline data. To do so, a parallel work focused on the development of a realistic training scenario and accompanying instructional material to cover critical aspects of witness questioning that is undertaken to support the threat assessment of the suspect devices. The question is how to integrate the identified best practices of QT methods into the ITS to improve the situation assessment skills of IEDD course students.

To address the questions above, the IEDD ITS scenario needs to include the required QT teaching points in its instructional contents with the assessment of student QT performance. To achieve this objective and in consultation with IEDD course instructors, a number of technical approaches

(e.g., cognitive biases mitigation and questioning framework) was exploited for the development of instructional content and student QT performance criteria to be used by the ITS. This report is a summary of the two tasks conducted in the second phase of the project. In addition, it focuses on how identified QT techniques were integrated in the instructional contents and how the IEDD ITS scenario was specified to evaluate student QT performance and situation assessment skills.

1.3 Report structure

The structure of this document is described below:

1. *Section 1*. Presents an overview of the ITS project, together with the scope and objectives of the current report.

2. *Section 2*. Presents the results of the QT literature review and applies concepts derived from the review into an IEDD context.

3. *Section 3*. Presents the scenario and instructional content that will guide and support the development of the IEDD ITS.

4. *Section 4*. Presents detailed recommendations for a IEDD questioning framework and student QT performance evaluation criteria. These recommendations are based on the results of the literature and technology review.

5. *Section 5*. Presents overall conclusions and how the findings and specifications of scenario will be implemented into the IEDD ITS prototype.

2 Questioning technique review

2.1 Introduction

This section presents a review of QT research. The review covers possible causes of bias and common errors that separate effective and ineffective QT across multiple domains (e.g., doctor-patient, emergency response, and accident report), and then applies commonalties to what is currently taught to IEDD operators. Comparing these high-risk domains helps to create a general framework, grounded in theory and current practice, for interviewing witnesses in the IEDD setting. This framework provides the IEDD ITS the means of assessing student QT performance, as well as supporting the development of instructional material and scenario(s).

Therefore, the purpose of this section is to detail the methodology and results of QT review activities and apply the best practices derived from the review to IEDD operator course content. These results will be used to enhance the instruction of QT by the IEDD ITS. Furthermore, knowledge gained about QT will be used to evaluate the impact of adaptive learning and intelligent tutoring technologies on the quality of student QT and threat assessment. The aim is to adequately represent what is currently taught, and also to create new instructional material for the IEDD ITS scenario.

2.2 Method

This review was twofold: the first part consisted of comparing and contrasting QT across multiple domains that individuals use to obtain specific information that they do not know themselves. Key word searches including ‘questioning technique’, ‘interview skills’, ‘eye-witness testimony’ and ‘tactical questioning’ were used to locate relevant knowledge in a variety of fields. The second part involved a review and critique of the available IEDD course content and teaching structure relating to QT instruction and evaluation. The goal was to align the current IEDD course material with pre-existing, proven frameworks in other domains. Or, if no such framework exists, to combine knowledge from other domains into a framework that fits the specific needs of the IEDD operator course.

The scope of the review included military, police, medical, psychology, psychiatry, and business domains. The goal was to find commonalities, rather than provide detailed explanations on the processes used in each domain. These general guidelines were used to make specific recommendations for how QT can be taught and evaluated by the IEDD ITS. Table 1 summarizes the QT domains that were reviewed.

Table 1: Questioning technique domains

Domain	Context
Military	IEDD
Police	Interrogation, tactical questioning, hostage negotiation, accident investigation
Medical	Doctor-patient interview
Psychology/ Psychiatry	Initial intake interview, clinical therapist interview skills
Business	Project management

2.2.1 Defining questioning technique

Soldiers must consider numerous communication elements for effective and productive conversations. QT can be compared to Tactical Questioning (TQ) in the Police domain. TQ is defined as the conversational, expedient, initial questioning of individuals to obtain information of immediate value (Police Intelligence, 2006). TQ can be designed to build rapport while collecting information and understanding the environment.

As well, the distinction between interrogation and QT must be noted. Interrogation is an accusatory method of questioning subjects that combines investigative and behaviour-provoking questions in order to expedite a confession. A popular version of interrogation is the Reid technique, which consists of nine steps, including shifting blame to justify the crime, provoking the subject's admittance, and then recording their final statement of admission (Reid, 2010). While the Reid technique is taught at the Canadian Police Academy and is widely practiced in Canada and the United States, it is controversial in that it is argued to elicit false confessions.

2.3 Questioning technique strategy and terminology

Reviewing the available literature on QT revealed a number of common interviewing skills and techniques for efficient information extraction. Although nomenclature varied across domains, the underlying constructs and methods were often similar, and were thus categorized under common functions. This section describes the themes of good QT that emerged.

2.3.1 Rapport

The most prominent strategy across domains was to establish good rapport (i.e., being on the same 'wavelength' or 'page') with the interviewee. Without good rapport, the witness may be reluctant to disclose sensitive or critical information, which can delay the investigation. The Police Intelligence Operations Field Manual (2006) suggests that collecting information from the local population is more conversational in nature and not really 'questioning'. Conversations tend to be more effective and productive if the interviewer considers elements of communication such as social taboos, body language, customs, and courtesies.

Strategic interviewing (Byrnes, 2010) teaches police and military personnel to establish and maintain relationships and negotiation strategies that enable them to obtain quality information because the interviewee wants to volunteer it, not because they feel compelled to do so. Interview skills allow a true interview to take place, as opposed to an interrogation where a relationship is often sacrificed in order to obtain information. This approach ensures the comfort of the interviewer and the cooperation of the interviewee. The way a question is asked can directly influence the quality and quantity of information received; it is up to the interviewer to ascertain how much information is required from the witness at that point, and how much time and latitude one wishes to give the witness.

By establishing rapport, a skilled interviewer can gather the data necessary to decipher a complex problem. In doctor-patient relationships, establishing rapport is the first step of a psychiatric interview, and interviewers often use their own empathetic responses to facilitate the development of rapport. This can be achieved using six strategies: 1) putting the patient at ease; 2) finding the patient's pain and expressing compassion; 3) evaluating the patient's insight and becoming an ally; 4) showing expertise; 5) establishing authority as physicians and therapists; and 6) balancing the roles of emphatic listener, expert, and authority.

By replacing the patient's role with that of an interviewee or witness, these are the same basic strategies that an IEDD operator would use to maintain a positive interview climate while questioning a witness. First, to put the witness at ease, the operator should remember that not all questioning is targeted at information collection; asking questions about neutral or safe topics can help build rapport. Creating a conversational tone, such as asking about family, work, or hobbies, allows an individual to talk freely about a nonthreatening topic that they know about. These non-pertinent questions can serve as a springboard to topics more closely related to the required information, often without the individual noticing the change in topic. Evaluating the responder's insight, becoming an ally, and balancing the roles of expert and authority are all a part of the process of sustaining good rapport.

2.3.2 Asking questions

Establishing rapport is the outcome of a two-step process; first building, and then maintaining the rapport. Building and maintaining rapport during an interview is achieved using the elements of conversation. Therefore, conversation quality is determined by choosing the appropriate kind of questions to build a solid foundation of evidence.

2.3.2.1 Open versus closed questions

Open and closed questions are the two overarching types of questions that can be asked during the interview. Open questions give the responder control, while closed questions allow the interviewer to direct the topic of conversation. The order in which open and closed questions are posed can shape the information that comes back. Interviewing involves a fine balance between allowing the interviewee's story to unfold at will and obtaining the necessary data for making decisions.

Open-ended questions should allow the interviewee to speak as much as possible in their own words. Open questions encourage the interviewee to expand on their responses. For instance, in

hostage negotiation open questions are used to decrease emotionality and bring the person in crisis to a more rational level (Vecchi, Van Hasselt, & Romano, 2005). In an IEDD context, asking open-ended questions helps establish rapport by empathizing with the interviewee's emotional state. Asking "can you tell me about what you saw?" allows the witness to recap their knowledge in their own words, allowing them to feel more comfortable divulging answers to specific, closed-ended questions later. However, when time is constrained, open questions must be used selectively to avoid letting the conversation digress.

Skill is required in asking the right open questions in the right circumstances. For instance, in a counselling session, 'what' questions are the least threatening because they seek understanding about behaviour and the environment, such as "what were the circumstances?", "what did you think?", and "what can we do about it?". For IEDD operators, this could translate into 'what' questions about the device that are fundamentally more objective than simply exploring insurgent motivation. 'How' questions are slightly more threatening as they seek understanding about actions and capabilities such as "how did it happen?" Care must be taken with the use of 'why' questions since they seek to understand a person's values and start to pry at their identity. For example, asking "why did you do it?" as the first question is likely to provoke a negative response.

Closed-ended questions are directive questions that ask for specific information that will likely be one or two-word answers. Closed questions can be effective for quickly generating specific responses about a clearly delineated topic. They are used to elicit facts and specifics because they are easy and quick to answer and allow the interviewer to keep control of the conversation. However, closed questions must be used with caution because they place the prime responsibility of talking on the interviewer and run the risk of biasing the response (to be discussed later in Section 2.3.4).

It is sometimes preferable to ask closed questions. For instance, when closing a sale, asking "would you like that delivered tomorrow?" will elicit agreement or objection to the sale, which the sales person can use to further understand the customer's needs. Asking an open question is less likely to draw an objection. Planning to ask 'what' questions first, followed by 'how' questions and then 'why' questions, if necessary, gets better results than an unplanned mix of open and closed questions. This logical flow is very useful when extracting information across a range of environments including sales, counselling, or understanding the scope of a project.

2.3.2.2 Funnelling

Funnelling is a strategy that involves moving from open to closed questions, or closed to open questions in order to elicit varying degrees of detail. Within funnelling, probes are used to elicit further detail about something the witness has said. Probes tend to be more on the open-ended side of questioning, but use precision words, such as "specifically" and "actually" to gain more detail in a particular direction. For instance, a witness may say that they went home after lunch, which the interviewer could probe by saying "when exactly did you go home?" Funnelling with decreasing detail is used to broaden the scope of conversation, which may facilitate a change in topic. For example, when the interviewer is looking to move on from the current conversation, they may ask "what other things did you do that day?"

According to funnelling strategy, an ideal interview begins with broad, open-ended questioning, continues by becoming specific, and closes with detailed, direct, closed-ended questions. One example is the Cognitive Interview (CI), which trains police investigators to use funnelling techniques that rely on open-ended questions during unstructured (i.e., no pre-defined set of questions) interviewing (Geiselman et al., 1985). The CI focuses on two major problems related to interviewing witnesses: memory and communication. In other words, problems may be associated with how the witness communicates and the way in which this information is understood and noted by the interviewer. The interviewer's task is to help the witness by guiding them with appropriate questions targeted at specific areas of memory where different pieces of information may be encoded. Using these two principles, the QT used within the CI incorporates a four-step process to guide memory retrieval (Geiselman et al., 1985):

1. *Report all details*. Regardless of their apparent importance, the witness should give a free and complete account of the event, including information they may consider insignificant, inconsistent, or disordered.

2. *Reinstate the context*. The witness should relive the offence mentally in the personal and environmental context in which the event occurred.

3. *Change sequence of recall*. The witness should describe the event in various orders (e.g., reverse chronological).

4. *Change perspective*. The witness should describe the event from a different perspective, such as the victim, security camera, etc.

The CI style uses open-ended questions because they allow more elaborate and extensive answers. Open questions allow the speaker to feel comfortable reporting all possible details. The CI also suggests avoiding: 1) closed-ended questions because they require precisely defined answers; 2) multiple-choice questions because they limit the number of alternative answers; 3) complex questions because they likely contain many compound questions; 4) grammatically-complex questions because they are difficult to understand; and 5) suggestive questions because they can lead the witness.

2.3.2.3 Questions to avoid

In addition to considering whether questions are open or closed, the interviewer must also consider how question content may influence responses. The way in which a question is asked can impact how the responder understands it, how they respond to it, and how that response is interpreted by the interviewer. The following questioning habits are cautioned against, regardless of the context:

- *Leading questions*. Biased questions tend to produce biased answers. This can occur when questions are phrased as statements, such as "did you see any wires?" instead of asking "what did you see?"
- *Compound questions*. Too many questions asked at once will put the witness on the defensive. It may also shift control from the responder to the interviewer, which can limit the amount of information dispelled. For example, asking "where were you going after work and who were you meeting there?" may result in only one question being answered.

- *Double negatives*. These questions contain negative words and can be confusing. For example, asking "didn't you go to the warehouse first?" as opposed to just asking "did you go to the warehouse first?" Double negatives can frustrate the witness, and may result in inaccurate responses.
- *Jargon / technical terms*. Speaking in shorthand (e.g., acronyms), slang, or any other type of domain-specific language creates a barrier between the interviewer and interviewee. The goal is to establish good rapport; using language that may not be understood does not help put the witness at ease.
- *Interruptions*. Asking a witness another question before they have finished answering the first one may cause them to lose their train of thought, omit details, and inhibit details for future responses.

2.3.3 Active listening

Active listening is a way of showing explicit attention and interest to the interviewee. This interview strategy uses positive verbal and non-verbal encouragement to help the interviewer maintain rapport and probe for further information. Active listening can be in the form of minimal encouragers or probes, enticing the responder to continue speaking or provide more detail on a particular subject, or reflection, ensuring that the interviewer is correctly interpreting what the witness has said.

2.3.3.1 Probes

Probes and minimal encouragers (e.g., Vecchi et al., 2005) help the speaker continue by providing verbal and non-verbal cues that encourage them to keep talking. The interviewer helps the other person to speak by using attentive body language such as eye contact, non-threatening stances (i.e., being aware of weapon placement), and smiling when appropriate. Encouraging words and sounds such as 'uh-huh' and 'yes' help to indicate that the interviewer is paying attention to what is being said. If the responder is having trouble finding the right words, the interviewer can also use silent attention to give the space and time to find the words. Silence can be enhanced with other non-verbal cues like eyebrow raises and head nodding to maintain a supportive environment that allows the responder to contemplate and think, so that not every moment must be filled with conversation.

2.3.3.2 Attentiveness

While active listening helps emphasize the interviewer's interest, the interviewer may not be fully paying attention. It is equally as important to truly listen during an interview as it is to appear to be listening attentively. The following examples of poor listening habits can contribute to cognitive biases in QT that hinder decision making. *Initial listening* occurs when the interviewer attends to just the first few words then starts to think about what to say in return (i.e., looking for a point to interrupt), causing a shift in focus to rehearsing what to say next instead of what is currently being said. Similarly, s*elective listening* occurs when the interviewer only attends to particular things and ignores others. *Partial listening* may occur as a result of the interviewer attempting to process cues and formulate new questions while the person is still responding, therefore missing important information. To mitigate partial listening, interviewers can help

themselves remain present in the conversation by occasionally reiterating or reflecting on the gist of what the person is actually saying.

2.3.3.3 Reflecting

Reflecting helps the interviewer stay actively engaged in the current conversation by assuring a mutual understanding and interpretation of the exchanged dialogue. Reflecting is not an exact repetition, but a personalised summary stated back to the other person that demonstrates your level of understanding. This can be accomplished through paraphrasing or mirroring. *Paraphrasing* involves restating the content of what the subject said in the interviewer's own words. This is an attempt to take the perspective of the interviewee. *Mirroring* refers to repeating the last few words that were spoken, which demonstrates attentiveness to the interviewee.

2.3.4 Biased questioning

Although questioning techniques and procedures are trained, experienced operators maintain that most decisions are based on intuition. While there are many examples of successful decisions made on the basis of intuition, cognitive bias is a downside to this phenomenon.

Cognitive bias is essentially an inclination toward a position or conclusion, or any preference for one choice or response over other choices. Cognitive bias is believed to be linked to the high failure rate of the IEDD operator course (see Banbury et al., 2010). These biases are believed to be largely caused by cognitive overload and can adversely affect decision making. Cognitive overload leads people to use heuristics (mental shortcuts that facilitate making decisions). In safety critical environments such as IEDD, heuristics can cause distortions in perception that adversely affect the decision-making process. Numerous types of cognitive bias exist because different heuristics are used for different reasons.

2.3.4.1 Confirmation bias

Confirmation bias describes the decision maker's tendency to seek new information that supports the currently held hypothesis, ignoring information that conflicts with this hypothesis. Human beings have a fundamental tendency to seek information consistent with their current beliefs, theories, or hypotheses, and to avoid the collection of potentially falsifying information (Plous, 1993; Oswald & Grosjean, 2004). As a result, people gather evidence and recall information from memory selectively, and interpret it in a biased way. In particular, biases appear for emotionally significant issues and for established beliefs. For example, if an IEDD operator is told that wires were seen near the suspected IED site, they may be biased towards confirming the existence of a command-wire (i.e., a wire connecting the IED to a remote detonator) device.

Confirmation bias also includes interpreting ambiguous evidence to support an existing position. For example, if the witness was unsure if they saw a wire or a string, the operator may assume a wire if they already believe the device is command-wire. As a result, they will seek only information that supports this belief, while ignoring information that does not. Similarly, *interpretive bias* and *hypervigilance theory* (Eysenck, 1991, 1997) refer to the tendency to interpret ambiguous stimuli and situations in a threatening fashion. This can result in a kind of 'false-positive', where operators inaccurately conclude that an IED is present.

Confirmation bias can stem from *salience bias*, which occurs when a decision maker is assimilating multiple sources of information to formulate a hypothesis. There is an inclination to concentrate on the most salient (e.g., the loudest, brightest, or most noticeable) cues, as opposed to those which may be most informative. In IEDD, salience bias tends to occur when the operator first arrives on scene and is given the initial summary of the situation from the OSC. If this information contains salient cues that indicate a certain type of device, the operator may become fixated on this and seek other supporting evidence instead of exploring the big picture.

2.3.4.2 Cognitive tunnelling

The concept of *cognitive tunnelling* was popularized from the literal sense of allocation of visual attention in aviation: if a pilot's attention becomes locked on one source of information, such as superimposed head-up displays in the cockpit, and neglects to scan the scene out of the window, their overall awareness of the situation is reduced (Foyle et al., 1993). Cognitive tunnelling can also refer to a narrowed focus on a particular piece of information, limiting one's grasp of the 'big-picture' and other information links. For example, during an investigation, interviewers may become fixated on a particular source of evidence, while neglecting new information that may negate earlier-drawn conclusions.

IEDD operators may succumb to cognitive tunnelling during threat assessment, especially when the initial situation assessment is consistent with the partial information available at that early stage of the incident. For example, if a witness claims to have seen wires on the ground, the operator may frame all subsequent information as suggesting a command-wire device. A common source of error in dynamic domains is a failure to revise situation assessment as new evidence comes in. As the operator collects and compares further evidence such as intelligence reports, eyewitness recall, and visual observations within a potentially hostile scene, the formulation of a single situation diagnosis under stress and high cognitive workload becomes challenging. The assumption that the device is command-wire may distract the operator from noticing that the wires were not actually connected to anything because the device is in fact a timed IED (i.e. set to detonate at a specific time). As the incident evolves, there is a failure to revise assessments in response to new evidence that indicates an evolution away from the expected path.

2.4 Questioning technique in the IEDD operator course

QT is the cornerstone of IEDD operations. Effective use of QT enables the IEDD operator to gather, assimilate, and analyze important IED information and thus determine an appropriate Render Safe Procedure (RSP). When an IED type is identified, the operator can plan and conduct the RSP in accordance with IED principles and best practices.

QT is currently based on CF Operating Procedures for the Conduct of Improvised Explosive Device Disposal Operations (2006). This doctrine was derived from lessons learned from CF and allied nations operational experience. Equipment and procedures are continually being evolved to meet developing threats in deployed locations, but the fundamental IEDD doctrine remains the same wherever the theatre.

Within the CF doctrine, QT procedures are presented in two sections. The first section details the information content that needs to be elicited during questioning in order for the operator to

deduce the device type. The second section outlines the actual style and coordination of questioning. QT is believed to ultimately influence the quality of witness responses. Without the appropriate level of response detail, it is virtually impossible for an operator to make decisions based on their assessment alone.

2.4.1 IEDD-specific questions

Before any type of questioning can occur, it is important to consider the activities that must be completed at the suspect IED location. CF operating procedures outline the essential information that needs to be obtained to diagnose a device, and much of this information comes from witnesses. Once the initial IEDD response team arrives at the accident/incident site, the IEDD operator needs to coordinate the following 'housekeeping' items with the area commander or civilian authorities:

- *Priorities*. What needs to be done and in what order? For example, removing the wounded and fatalities, preventing loss of life and property damage, and removing hazardous munitions or explosives.
- *Area security*. What needs to be done to prevent further loss of life or injury (e.g., publications, explosives, and procedures)?
- *Medical support*. What is needed?
- *Firefighting support*. Will firefighting support be needed?
- *Other*. What else is needed? Is there a need for heavy equipment, access equipment protective works, or communications?

According to CF doctrine, once the IEDD operator has confirmed the appropriate cordon and evacuation procedures, operators should question witnesses, separately where possible, and allow them to tell their own story. This aspect of QT is similar to that of the CI, where the witness is encouraged to disclose as much information as possible. The difference is that the IEDD operator does not have the luxury of unlimited time as might a police investigator. Once finished, the operator may further question witnesses to fill in any gaps, while being firm and friendly but showing no hostility. This mannerism is comparable to establishing rapport with the interviewee.

The only QT framework taught in the IEDD course is the 5Ws (see Table 2). The 5Ws are used to house a series of different questions that surround the IED itself (e.g., Where is it? What is it? When was it placed/found there? Why was it placed there? Was anything seen or heard?). The following information, modified from the area clearance chapter of the Global Security field manual (n.d.), summarizes the meaning of each of the 5Ws in relation to IEDD operator course materials.

2.4.1.1 Where (is the device)?

It is not unusual for deployed security forces to be too close to the device. For this reason, "where is it?" is the first question asked. This will allow the security cordon to be moved back if necessary. The general location may already be firmly established before an IEDD operator arrives at the scene. However, in certain circumstances the precise location of the device may be

required so that the soldier can determine if robotics can be used (e.g., “are doorways wide enough?” or “are there any steps to negotiate?”).

The precise location is also required in a manual approach, so that less time is spent searching. A useful way to pinpoint the precise location is to have a diagram drawn and have it confirmed in detail during independent questioning of witnesses. It may also be necessary to find out the position of the device (e.g., “is it near toxic, flammable, or chemical materials?”) If it is, these materials (e.g., petroleum oil, lubricants, fertilizers, or hazardous waste) may add to the effect of the device should it function. A subsequent, related question should be: "Has anyone been up to and returned from the device?" If so, they have inadvertently established cleared paths for IEDD teams to use.

2.4.1.2 What (is the device)?

Specific evacuation action often depends on the device’s size and the amount of explosives present. Witnesses may be able to tell what the device is constructed of. This may also help the operator select the appropriate tools. For instance, the operator can ask about the shape, colour, and size, and if there are any lights, switches, markings, wires, or other features.

2.4.1.3 When (was the device placed, thrown or dropped)?

Establishing when the device might be placed assists estimate of possible explosion if the device was a timed IED. If the operator cannot accurately establish the true time of IED placement, the team leader must begin the waiting period from when security forces arrived on site and guaranteed that no one since has tampered with the IED.

2.4.1.4 Why (was the device placed, thrown or dropped)?

The answer to a ‘why’ question (i.e., the reason for targeting) may indicate the source of the device. If it is an IED, it may indicate the method of operation and degree of sophistication used in the construction of the device. Conversely, the IED may be a trap (i.e., a hoax or “come-on” tactic) with the real target being the IEDD response team. Therefore, the possibility of a secondary device must be explored.

2.4.1.5 Was anything seen or heard?

Witness accounts of an insurgent’s words or actions may give an indication as to how the IED is intended to function (e.g., the type of fuse). For example, an account that a terrorist left the room and was away for a few minutes could indicate that an additional device was place somewhere in the building. In this situation, the terrorist often gives only a warning without specifics. If security forces enter the building to investigate after the first device functions, they are at risk because there may be a second, unreported device.

2.4.2 Threat deduction tools

IEDD operators are trained to use the Timed (T)/Command (C)/Victim (V) table (see Figure 1) as a *threat deduction tool*, designed to help determine the type of device threat used. As each question is asked, the operator makes a check or an X to represent the device they believe to best represent the information contained in the witness' answer. For example, when exploring the possibility of a victim IED the operator should check for evidence that the insurgent could take advantage of a target's predictable daily routine to strike, without having to be present to detonate the IED themselves. As such, the operator may ask about any publicly known routines of the target, such as certain access points or approach patterns. Confirmation of this clue would support a victim IED, but still would not be enough evidence to be certain since this also supports a timed device. When done correctly, the column with the most responses specific to it after the interview should (in theory) have the highest threat probability.

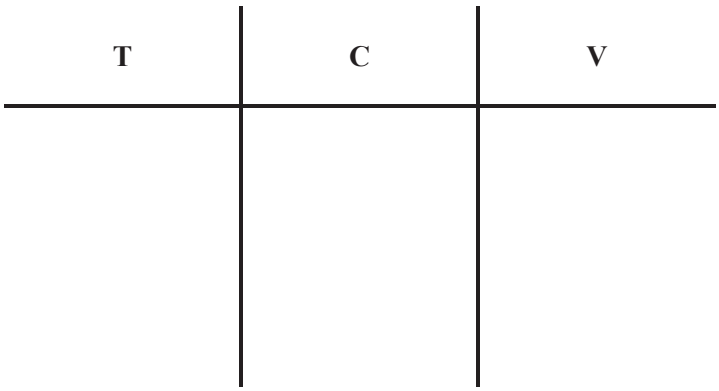

Figure 1: Timed (T) / Command (C) / Victim (V) threat tool

Problems occur when students are unable to solicit sufficient information, or misinterpret the information acquired from the witness. Incorrect interpretation of cues, or the inability to link related information, is not necessarily because students do not know the appropriate RSPs for each device in isolation. In complex and high-threat IED environments, cognitive overload can ultimately lead to use of heuristics, cognitive biases, and erroneous decision making.

2.4.3 Issues in IEDD operator questioning technique

Despite the IEDD operator course content describing specific lists of device-related questions, instructors report that the actual skill involved in good QT cannot be taught because there is no "one-right-way" to question a witness; how students most effectively reach conclusions is for them to figure out. Furthermore, they report that the few who are immediately successful are "naturals", while the rest manage to pick it up after multiple practice scenarios. The remaining students who do not learn how to conduct effective questioning will more than likely fail the course.

One problem with QT instruction is the detachment of theory from practice. The level of domain-specific detail that is needed for device disruption is not linked with general interviewing skill guidelines. The 5W framework is based on information requirements from the interviewer's perspective, not from the witness' ability or willingness to recall this information in that same priority. The generic 5W framework (which is more easily recalled than the notion of open, closed, biased questions, etc.) emphasizes tangible evidence found within straightforward answers to closed-ended questions. The focus is on the 'where' and 'what' of the IED itself, since this information is needed to determine if the operator is positioned far enough away from the suspect device during questioning. However, once this high-level information is known the operator needs to return to a broader style of questioning that explores the 'who' and the 'why'. Problems arise when operators do not make that shift into tunnelling-style questioning, and as a result fixate on shallow questions such as device appearance (which may be deceiving) and forget to inquire about the target. At this point, they may become cognitively tunnelled by trying to extract more information than is actually available about the details of the device. A more experienced operator would know to ask a wider variety of questions, instead of just a drilling further into the same topic to elicit more information.

When this type of cognitive tunnelling occurs, the operator's prior content expertise about IED mechanisms and disposal doctrines can trump their more recently acquired QT. In such cases, an IEDD operator may try and identify all of the content, such as the materials making the device itself, while neglecting crucial peripheral information. They know what information they need to acquire, so they direct questions to specific content areas. As a result, they achieve specific answers to specific questions, yet do not receive unsolicited information; this makes it much more difficult to link key cues together and solve the problem.

This problem is not unique to IEDD students. For example, Kenny et al. (2007) designed a virtual patient training program to teach general interviewing skills to novice clinical therapists. The program aimed to train the intake interview, which is the first interview that a clinician conducts with a patient. The clinician may have some knowledge of why the patient is there (e.g., from referral), but needs to ask further questions to obtain a detailed history, in order to narrow down the problem for diagnosis and treatment. To receive a passing grade, the interviewer needed to elicit information regarding a variety of symptom categories. The virtual patient provided all the necessary information, as long as the right questions were asked.

Similar to issues in the IEDD course, the results of the Kenny et al. (2007) study indicated that participants were cognitively tunnelled and tended to focus on a single area (i.e., the 'what' and 'where'), rather than asking questions that would allow them to have a broad understanding of the patient's psychiatric history (i.e., the 'how' and 'why'). By not asking the appropriate breadth of questions, they were not able to elicit information regarding the other general symptom categories prevalent in the given disorder, and were unable to prompt the system to offer the correct responses. Novice clinicians, like IEDD students, sought a quick diagnosis with detailed information on a limited set of symptoms. However, more experienced clinicians (or operators) sought a full clinical picture (or IED threat assessment) by probing further than just the obvious symptoms presented. Doing so exemplifies the difference between data-driven and hypothesis-driven questioning.

2.4.3.1 Data-driven versus hypothesis-driven questioning

The current problem solving approach taught to IEDD operators is based on *data-driven* methods of collecting data through questioning. This approach involves collecting data and facts related to the problem of establishing the device type and threat level. The aim is to gather as much information as feasible within the allocated budget, in order to facilitate the development of a solution (i.e., RSP). It is likely that this approach was intended to mitigate cognitive bias by having students objectively examine each piece of evidence without any kind of confirmation bias about a certain device type. The problem is that by focusing on the small pieces of the puzzle, the student quickly loses sight of the big picture, thereby experiencing difficulty interpreting and linking the clues without sufficient contextual information. This ambiguous strategy may be what leads students to latch onto concrete facts such as the 'where' and 'what', as opposed to seeking less tangible information like the 'why'.

Data-driven questioning is inductive; the information elements extracted from the witnesses and the environment are entered into the appropriate device column. Towards the end of the interview, the device with the most evidence should indicate the most likely device. The problem is that this technique requires operators to amalgamate a large quantity of information from different sources, including visual cues from the scene itself, and auditory and short-term memory from witnesses and other CF personnel, all within the scope of trained procedure recalled from long-term memory. While an experienced operator may be able to filter complex data into the key elements and their relations, this is undoubtedly a huge amount of information for novice students to handle. As a result, students can become overwhelmed with the amount of information available, which could explain why they fixate on immediate, surface level details.

This type of cognitive tunnelling is illustrated in Figure 2. The arrows represent hypothetical examples of the questioning patterns of novice (round dotted lines) and more experienced (solid lines) IEDD operators. In this example, while both novice and experienced operators follow the funnelling technique of open to closed, the novice operator is quickly stuck in the 'what' aspects of the devices, likely inquiring about the appearance and construction of the device and surrounding scene. This limits their ability to extract important peripheral information. Conversely, the experienced operator not only funnels questions, but links to other appropriate questions by alternating among the 5Ws.

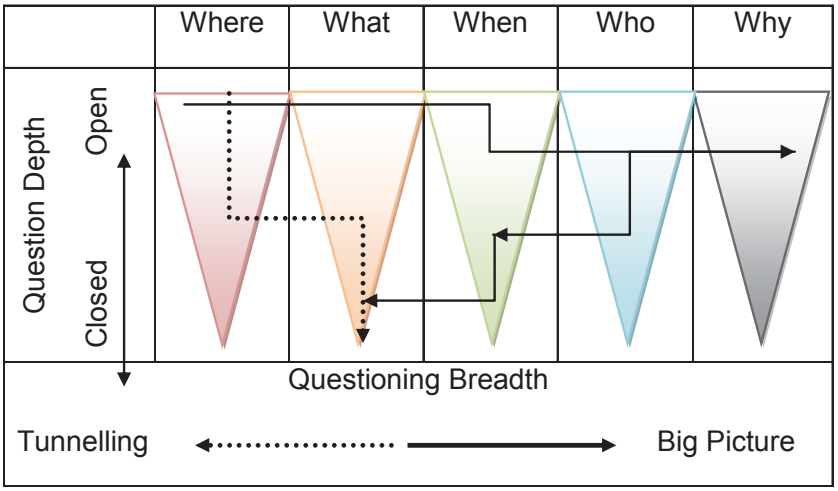

Figure 2: Illustration of cognitive tunnelling using data driven technique

The other issue is that data-driven questioning prompts the operator to seek evidence that supports each device, but does not encourage any type of re-evaluation to critique one's own decision-making process. If operators only seek information to support their hypothesis, biased decision-making (i.e., cognitive tunnelling and confirmation bias) will likely occur. For instance, although numerous clues support one type of device, a single critical clue may supersede all others, thus cancelling the possibility of that device. By not acknowledging that crucial piece of information, incorrect decisions are unknowingly made.

Alternatively, a *hypothesis-driven* approach offers a means of strategically seeking information to support or reject a specific assumption instead of passively categorizing all the information up front. This method is based on the generation of alternative hypotheses and on their subsequent validation or refutation through the use of data (Liedtka, 2008). The hypothesis-driven approach involves breaking down a problem into its key components and leveraging a minimal amount of data and facts to formulate a conceptual solution to the problem; this becomes the hypothesis against which all succeeding efforts are benchmarked. Hypothesis generation brings relevant data to bear on the analysis and allows the interviewer to adjust initial assumptions without forfeiting their ability to explore new ideas.

For the IEDD operator, a hypothesis-driven approach provides a flexible framework in which to start the interview. For novices, the mere challenge of prioritizing and analyzing disparate forms of information on-the-fly may be inhibiting a wider breadth of questions. If this source of cognitive overload causes students to regress to only querying the surface level information they are most familiar with, hypothesis-driven questions offer at least a more concrete starting point to help organize thoughts and direct questions, which can be altered at any point in time.

Ironically, this method appears to encourage confirmation bias or cognitive tunnelling by starting off the interview with a device already in mind. However, because hypothesis-driven questions seek to test the strength of one's argument by actively attempting to disprove it, the operator is consciously engaging in temporary tunnelling with the intent to explore other alternatives. Being conscious of this technique is the key differentiator between unintentional biases and hypothesis-

driven questioning. By re-evaluating their decision-making processes by attempting to disprove their own reasoning, operators can actively investigate cues elicited from the witness that could possibly confirm or discredit their hypothesis, thereby avoiding bias.

The issue thus arises of how to frame questioning in the guise of hypothesis formulation. In the realm of experimental research, hypothesis formation is generally based on a series of findings and theories from other studies within peer-reviewed literature. Expected findings of a new study are based on what has been found in the past, and usually altered in some manner to represent a new way of analyzing the data. Similarly, although the IEDD operator cannot feasibly conduct a literature review on-scene, they may be able to take advantage of helpful prior known information such as recent insurgent or IED activity in the area. If no such information is available, the operator could take the approach of assuming the highest-threat device first. For instance, if the most dangerous device is considered a timed threat, questions should be based first around all of the qualities of a timed device. If the evidence is not conducive to a timed device, the questions can then shift to the next highest threat. Or, if the evidence seems to support the device, the operator would then try and fit that evidence into other device categories to test if other options were still possible.

3 Scenario specification

This section specifies the scenario and instructional content that will guide and support the development of the IEDD ITS within the context and constraints of the current IEDD operator course.

3.1 Introduction

The scenario and instructional content of the IEDD ITS are guided by a systematic development plan derived from the recommendations of the stakeholder analysis report, which recommended selecting the IEDD operator course for implementing adaptive learning and intelligent tutoring technologies. Furthermore, this report included recommendations for a specific scenario design within the context of questioning witnesses during IED threat assessment. The scenario and instructional content development process is illustrated in Figure 3.

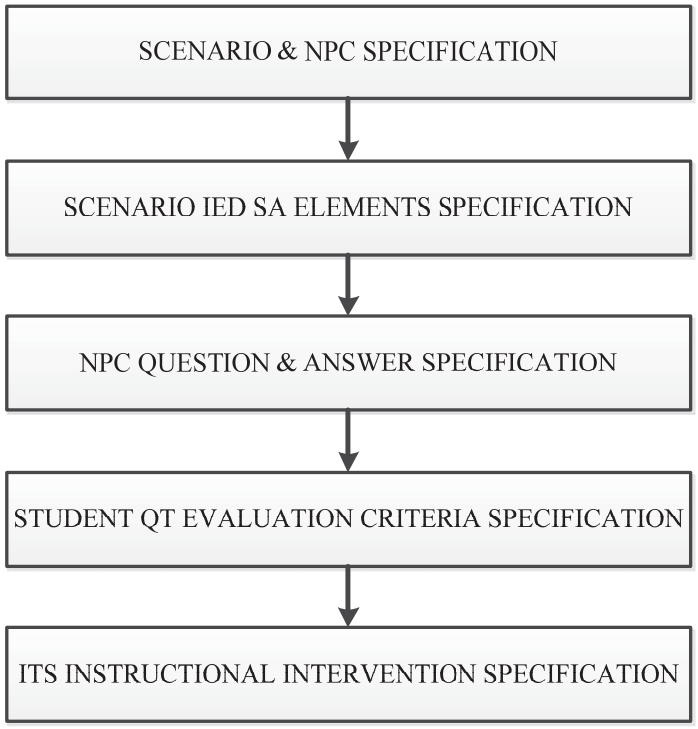

Figure 3: The relationship between tasks (and previous research)

The systematic decomposition of the scenario into component parts (e.g., from scenario to device elements, and then to Non-Player Character (NPC) knowledge, and so on) mirrors the "IEDD ITS Development Road-Map" identified in the stakeholder analysis report. This process has also been used as follows to organise this section of the report:

1. *Scenario and NPC specification*. This work describes a scenario for the IEDD ITS in which students question a number of NPC witnesses in order to make a threat assessment of two suspect devices. This description includes a scenario timeline and a detailed 'story' leading up to the event for each NPC (Section 3.2).

2. *Scenario IED SA elements specification*. This work specifies Situation Awareness (SA) elements that must be known in order to correctly deduce the type of IEDs in the scenario. Given that the scenario specifies in detail the actions and motivations of the bomber, these SA elements provide the ground truth of the scenario. This specification includes the information gained from questioning NPCs, together with information that can be acquired from visual inspection (Section 3.3).

3. *NPC question and answer specification*. This work specifies questions and related answers (e.g., SA elements) for all NPCs (Section 0).

4. *Student QT evaluation criteria specification.* This work specifies how a student's QT should be assessed, based on the literature and technology review, discussions with Subject Matter Experts (SMEs) from the IEDD operator course, and the method used to measure the QT performance of course students prior to the implementation of the IEDD ITS (Section 3.5).

5. *Instructional intervention specification.* This work specifies intervention by the ITS based on proper or improper QT. The design is guided by a *taxonomic framework*, illustrated in Figure 4 and as recommended by the stakeholder analysis report (Section 3.6).

In order to create the taxonomic framework for the IEDD ITS scenario, the following factors were defined:

- The learning objectives for each learning point in the scenario.
- The instructional intervention required to teach or evaluate student competence for each learning point. Instructional intervention can be broken down into adaptive learning (i.e., hinting or influencing) and intelligent tutoring (i.e., explicit coaching).
- The technological requirements needed to implement the instructional interventions identified for each scenario's learning points. These interventions include adaptation mechanisms, such as eye tracking, psychophysiological response, etc.
- The requirements for evaluating the utility of adaptive learning and intelligent tutoring technologies for each learning point. These requirements describe the measures of performance used.

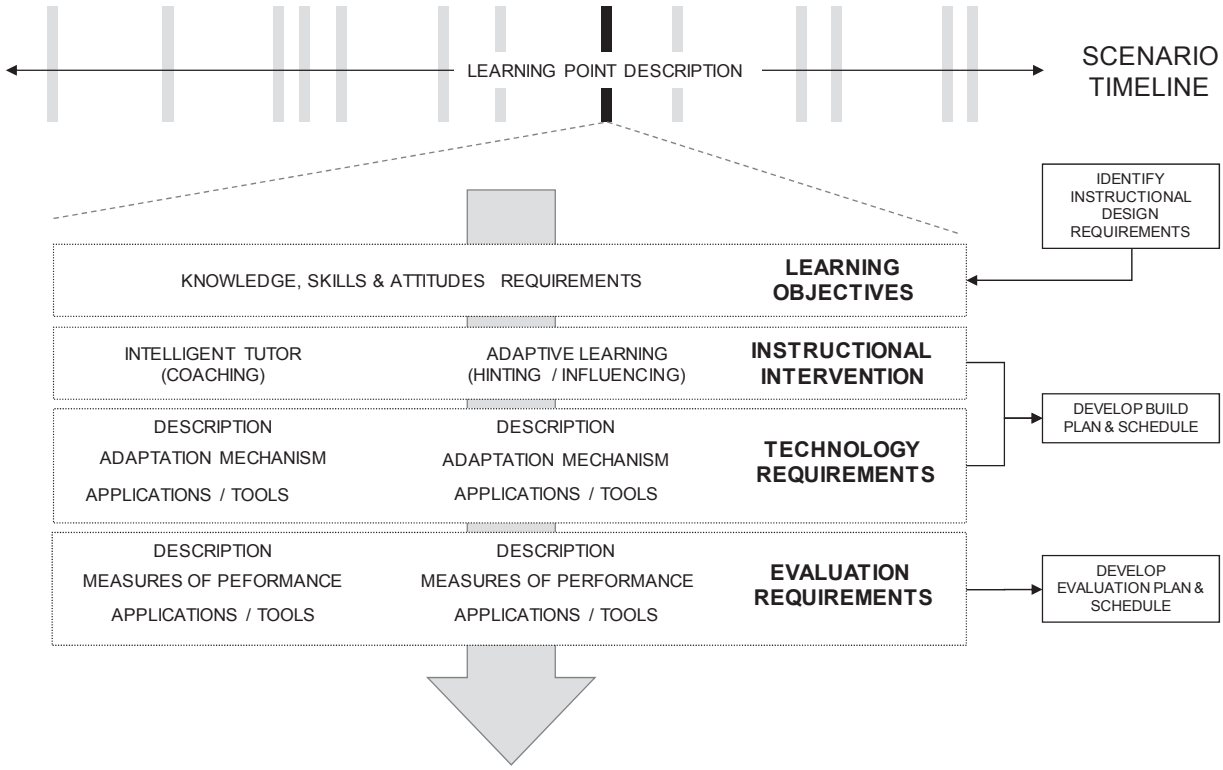

Figure 4: Notional taxonomic analysis framework for IEDD ITS (DRDC Toronto CR 2010-059)

3.2 Scenario and NPC specification

This section describes an IEDD ITS scenario in which students question a number of NPC witnesses in order to make a threat assessment of two suspect devices. This description includes a scenario timeline and a detailed 'story' leading up to the event for each NPC.

3.2.1 Background

Stakeholder meetings conducted at the beginning of the ITS project discussed the potential of adding an additional practice scenario to the IEDD operator course before the formal student evaluations. These meetings also provided guidance on how to implement an ITS within the course. Guidance from SMEs for the design of the IEDD ITS scenario was as follows:

- Students should be able to use the IEDD ITS on an individual and self-paced basis.
- The scenario should be non-permissive. In other words, students should be under some degree of time pressure to conduct witness questioning and threat assessment. The complexity of witness questioning and threat assessment required in order to determine the correct RSP should pose a significant challenge to students.
- SA elements available within the scenario should be, on the surface, conflicting and ambiguous. However, closer inspection of these elements should resolve any conflicts and ambiguities. The intention is to promote a situation in which one particular course of

action is initially evident, but if the student digs a little deeper contradictory information will be found which *should* change their planned course of action. This promotes situations in which students might demonstrate confirmation bias that affects their ability to change their planned course of action in light of contradictory information.

- The scenario needs to be realistic and relevant to current operational realities.
- The following NPCs should be present:
  - *Witnesses*. These witnesses would have observed critical SA elements that the student must find out about. Ideally, all witnesses should be kept apart to ensure the objectivity of the witnesses.
  - *On Scene Commander (OSC)*. The OSC will be the first point of contact with the CF/police patrol on arrival at the scene of the IED threat. The OSC will brief the student about the situation and identify the witnesses.

3.2.1.1 Scenario development workshop

An SME workshop was organized to agree on which scenario should be implemented in the IEDD ITS. The workshop was held on 10–11 May 2010 at the CFSME, CFB Gagetown. The workshop comprised a day session with six IEDD operator course instructors, followed by a day of observing students during classroom lectures and practice sessions on QT. The scenario described in this report was based on the material discussed during the workshop, which included course materials pertaining to a similar scenario and the criteria for classifying IED devices.

Whereas SMEs from the stakeholder analysis meetings held in January 2010 recommended an Afghanistan-oriented scenario, SMEs at the May 2010 workshop recommended a domestic-oriented threat from animal rights activists. This change in orientation was related to the anticipated transitions in Afghanistan-based CF operations over the next few years.

3.2.2 Scenario description

The scenario takes place within a psychology department on a university campus. The psychology department has large and prestigious animal testing laboratories led by Professor Smith. The laboratories are located in the sub-basement level of the building and house primates, cats, dogs, and other animal species. The laboratory is well-funded by the pharmaceutical industry; as a result, Professor Smith is able to hire several laboratory technicians to assist him with his research. Professor Smith's research is both controversial and well known, and as a result both he and his laboratory technicians have received many threats from animal rights activists. These threats so far have been in terms of graffiti on the wall outside his laboratory, abusive letters sent to his office, and student protests during his lectures.

Police were called to the psychology department following the discovery of two suspect devices placed in two separate locations within the school (Figure 5). The first device was discovered outside the office of Professor Smith on the seventh floor of the department by one of Professor Smith's students handing in his assignment. The second device was discovered next to the underground parking garage access door by one of Professor Smith's laboratory technicians. Both

devices were discovered early in the morning before most of the faculty, research, and administration staff normally arrives.

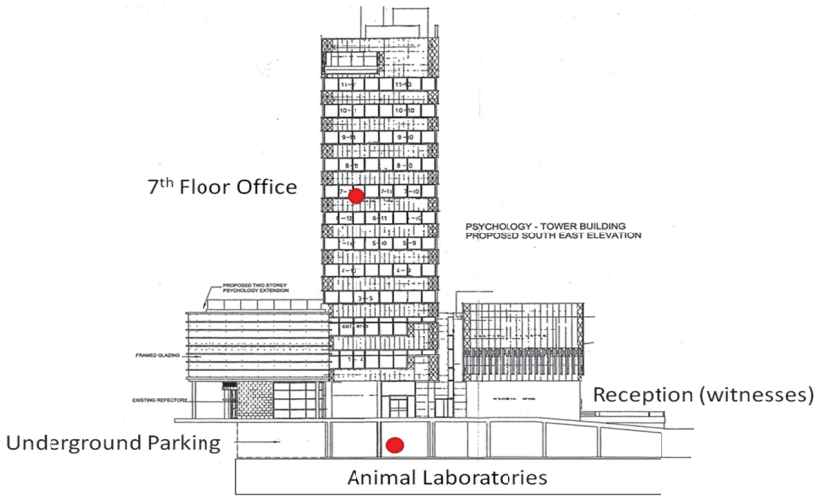

Figure 5: Locations of the suspected IED devices in the psychology department (indicated by ●)

The suspect IEDs are illustrated in Figure 6. The timed IED located outside the door to Professor Smith's office is a backpack containing explosives, a battery, a timer, and connecting wires. The command IED located next to the parking garage access door is a metal box containing explosives, a battery, an antenna, and connecting wires.

Figure 6: Illustrations of the suspected IEDs

3.2.3 Scenario NPC description

Four NPCs have been included in the scenario description. These witnesses possess critical information (i.e., SA elements) that students must discover in order to make the correct threat

assessments for both devices. All witnesses possess a number of SA elements in common. However, each witness also possesses unique SA elements representing their differing perspective of events. The NPCs, together with a summary of their knowledge of events, are described below:

- *On Scene Commander (OSC).* The OSC is a police officer who has access to campus security personnel and resources and coordinates the emergency services. The OSC is also familiar with other on-campus incidents targeting Professor Smith and his laboratory. The OSC is also responsible for the security cordon and evacuation of personnel. Specific knowledge held by the OSC is as follows:
  - Knowledge of secondary hazards.
  - Knowledge of animal rights activist groups operating on campus.
  - Access to security video footage.
- *Student.* The student discovered Device #1 outside Professor Smith's office. The student had missed Professor Smith's assignment deadline from the day before, and was handing it in very early in the morning before Smith arrived at his office. In doing so, the student disturbed the bomber during the placement of the device. Specific knowledge held by the student is as follows:
  - Discovered and examined the bag containing Device #1.
  - Knowledge of Device #1's components.
  - Aware that Professor Smith's lectures are routinely interrupted by animal rights activists**.**
- *Laboratory technician*. The laboratory technician works for Professor Smith in his laboratory on the sub-basement level, and arrives early each morning to attend to the animals. The laboratory technician normally parks in the underground parking garage and enters the laboratory through the parking garage access door. On the morning of the attack, the laboratory technician discovered Device #2 placed by the parking garage access door. Specific knowledge held by the laboratory technician is as follows:
  - Discovered and visually examined Device #2.
  - Knowledge of Device #2's components.
  - Drives to work and parks his vehicle in the underground parking garage on the basement level. Enters the building and takes the elevator down one floor to the research laboratory.
  - Familiar with animal research conducted by Professor Smith.
  - Familiar with other animal rights-related incidents on campus relating to Professor Smith's research.
  - Knowledge of animal rights activist groups.
  - Is suspicious that the laboratory has been infiltrated by activists.
- *Professor Smith*. Professor Smith conducts well-known but controversial research using a variety of animals, including cats, dogs, and primates. There has been a history of animal rights protests against Professor Smith and his laboratory. Professor Smith arrives at

work at precisely the same time very early in the morning, parks his car in the underground parking garage, enters through the parking garage access door, and takes the elevator up to his seventh floor office where he works until the rest of the faculty arrive. He then spends the rest of the day down in the laboratory conducting his research. Specific knowledge held by Professor Smith is as follows:

- Drives to work and parks his vehicle in the basement-level parking garage.
- Arrives at precisely the same time every morning.
- Normally the first person to arrive in the parking lot.
- Enters the building and takes the elevator up to his seventh floor office.
- Conducts research on animals. Although perfectly legal, his research has questionable ethics.
- Familiar with other incidents targeting his research and teaching by animal rights activists. Recently, these incidents have been more threatening in nature.
- Knowledge of animal rights activist groups.
- Is suspicious that his laboratory has been infiltrated by activists.
- Today his car broke down, so he took a taxi to work. As a consequence, he was late, and entered the building through the front entrance.

3.2.4 Device placement and discovery timeline

The bomber is an animal rights activist from the Animal Liberation Front (ALF). The ALF is an international, underground, leaderless resistance that engages in illegal and direct action in pursuit of animal liberation. Activists see themselves as a modern-day Underground Railroad, removing animals from laboratories and farms, destroying facilities, arranging safe houses and veterinary care, and operating sanctuaries where animals can live out the rest of their lives. Professor Smith's laboratory conducts research of questionable ethics on primates, cats, and dogs. The bomber intended to target Professor Smith directly, but was also mindful of the laboratory itself and did not want to harm the animals. Therefore, the bomber's goal was to target Professor Smith when he first entered the building, and also to detonate a device outside his office to destroy his research (and target Professor Smith if the device in the parking garage failed to explode). A summary of the devices is as follows:

- *Device #1—located outside Professor Smith's office*. This was a timed IED that was intended to detonate when Professor Smith was expected to be in his office, before other faculty members arrived to work. This device was primarily intended to destroy Professor Smith's office, including his research data. It also acted as a secondary attack on Professor Smith if the device in the parking garage malfunctioned or the bomber was compromised. A timed device does not require the bomber to be present, but does require activation of the timer when the device is placed. The explosive contents of the device were intended to maim Professor Smith, rather than to kill him. Fortunately, the bomber was disturbed during the placement of the device by a student delivering his assignment to Professor Smith's office. As a result, the device was not activated and failed to detonate.

- *Device #2—located next to the parking garage access door*. This was a command IED that was intended to detonate when Professor Smith approached the parking garage access door. The parking garage is large enough that the bomber had a clear line of sight to the target, but offered enough clearance and other cars to hide behind to not be seen and avoid getting hurt. Professor Smith, without fail, arrives at the same time each morning. As such, his routine was predictable and could be exploited using a command-type device. Once again, the explosive content of the device was intended to maim Professor Smith, rather than to kill him. Fortunately, Professor Smith did not park in the garage that morning (because his car had failed to start) and the bomber left his position when other members of the department started to arrive.

Figure 7 illustrates a timeline of scenario events, including the placement and discovery of both devices along with key contextual facts and events regarding Professor Smith.

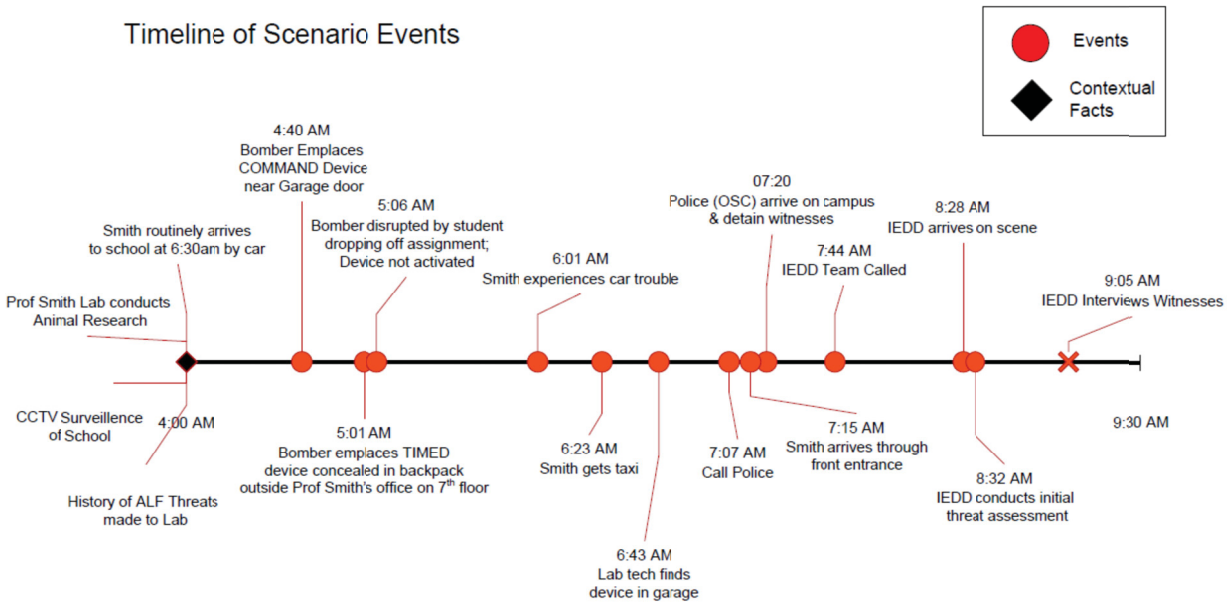

Figure 7: Illustration of the scenario timeline

3.2.5 IEDD ITS concept of operations

The objective of the IEDD ITS is to help the student effectively and efficiently question NPC witnesses in order to deduce the correct IED type(s). This is achieved by retrieving the SA elements required to establish the type of emplaced device. Students are assessed on two components: 1) their ability to ask good questions; and 2) their ability to classify SA elements to support or refute IED types. A minimum number of SA elements must be known and correctly interpreted by the student before they can select a device. In other words, they cannot just start the game and guess at random, as there are only three device possibilities (i.e., command, timed, and victim). In order for the device selection to be accepted (even if it is in fact correct) the supporting SA elements must be properly allocated to support or rule out each device. For example, if the student discovers an SA element that supports a timed device, this must only be placed in the

timed category. Furthermore, SA elements should only be able to be accessed with the use of good QT. The criteria for good or poor QT are defined in Section 3.5.

Before starting the IEDD ITS scenario, the student completes a short questionnaire to determine their dominant learning style. This information will be used by the tutor to present instructional intervention material in the most appropriate format. On scenario start, the student is presented with initial information indicating that they have been called into a university department to investigate a potential IED threat. The only information they know is that two suspicious devices were found by two witnesses. The student is brought to the reception screen, where four NPC witnesses have been detained.

The student can interact with each of the witnesses by selecting them; this provides the student with a list of questions that they can ask. Once an NPC is selected, the student then decides which 5Ws (i.e., where, what, when, why, was anything seen or heard?) area they want to begin their questioning with. By selecting one of the 5Ws, the student is then provided with question options within that line of questioning. A summary of these question categories is presented in Table 2.

Table 2: Question categories (the "Five Ws")

Question category	Description
Where?	Refers to questions about location of the device, safe routes to the device, and access points to the target area.
What?	Refers to device components (e.g., colour, shape, size, detonators, wires, batteries).
When?	Refers to questions about when the IED was emplaced, or timing of other IED activities.
Why?	Refers to who or what is the target or why have they been targeted?
Was anything seen or heard?	Refers to witness accounts of terrorist words or action. What did the terrorist do, where did he go, for how long etc.

Each time the student questions an NPC, a response is provided. That response will depend on correctness of the student's QT and will contain a dead-end answer (e.g., "I don't know"), a partial answer that requires a more specific question from the player (e.g., "I saw a bag"), or a complete answer that contains an SA element (e.g., "the bag contained wires attached to an alarm clock"). When an answer contains an SA element, the student is then asked to classify the SA element in terms of which device type(s) it is most likely to be (i.e., command, timed, or victim).

The tutor makes comments during question selection based on their QT. Each question is tagged with good or bad QT characteristics, so the selection will automatically prompt the tutor's response.

From the reception area, the student can move to either the garage or the seventh floor to examine

the devices. When on the seventh floor, the student can see an active object (the suspect bag) and select it using the mouse to reveal the contents, and thus SA elements about the device. When in the garage, the student can look more closely at the entrance door to see the details of the second device. For both IED locations, the student can use the mouse to select and be shown a new view of an object in the visual scene for closer visual inspection. For example, selecting the backpack shows you what is inside the backpack. Selecting an object implies that the student realises the importance of that object's presence, and a closer visual inspection allows them to extract evidence that would not otherwise be accessible. When the visual scene contains an SA element, the student is then asked to classify the SA element in terms of which device type(s) it is most likely to be (i.e., command, timed, or victim). The IEDD ITS Graphical User Interface (GUI) is presented in Figure 8.

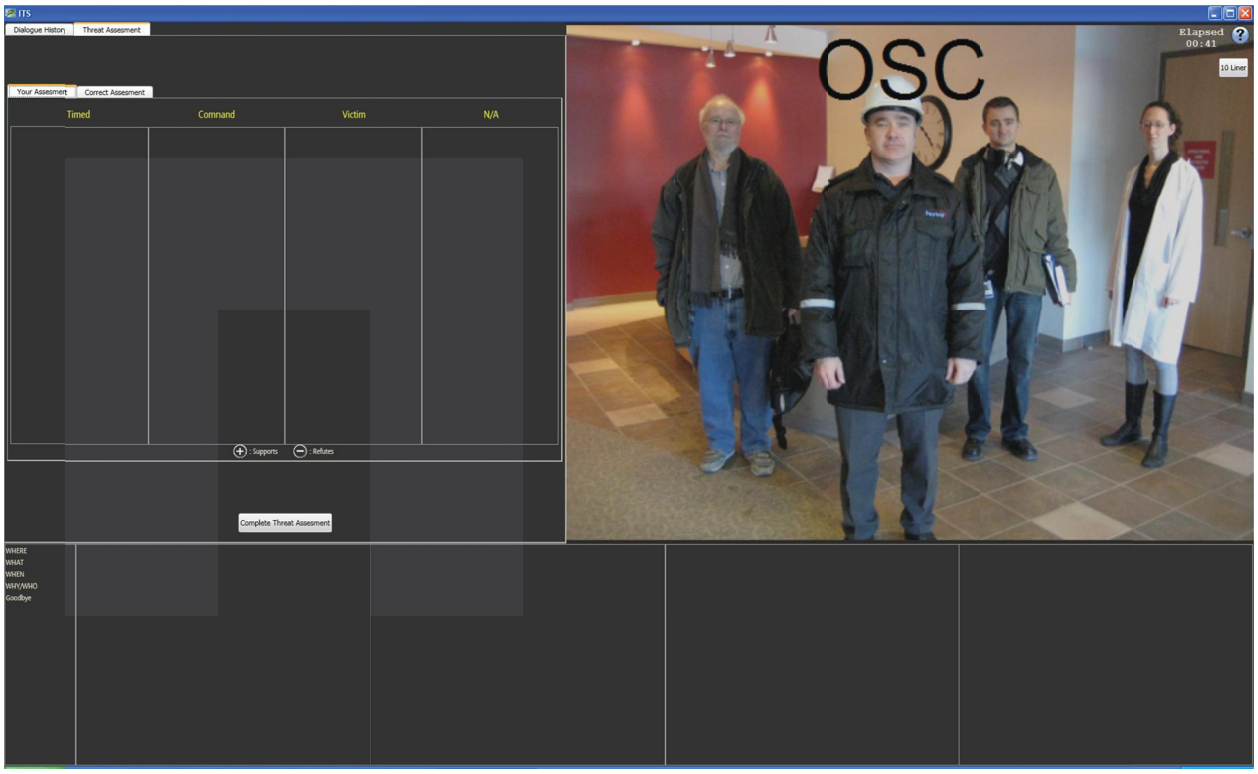

Figure 8: Illustration of the IEDD ITS graphical user interface

3.3 Scenario IED SA elements specification

This section specifies the SA elements pertaining to each IED device in the scenario. SA elements are key pieces of information derived from either questioning witness or visual inspection of the environment (i.e., clicking on the visual scene and objects within it). The student needs to access each of the SA elements to make a complete and accurate threat assessment (i.e., device-type classification). The way this information is achieved varies depending on what questions the

student poses to the NPCs and their object interaction. SA elements are present in two guises within the scenario:

- *Verbal SA elements*. These come from NPC answers to questions posed by the student. Answers are provided in written form as on-screen text; the student is then asked to classify them into one, or more, device type(s).
- *Visual SA elements*. These come from selecting objects in the visual scene, from reviewing visual evidence during an interview, in the form of security footage, or a hand-drawn map of the IED location. Visual elements include text beside the image which the student is then asked to classify into one, or more, device type(s).

There are three types of possible IED threats: command, timed, and victim. These device types are described below:

1. *Command*. Command IEDs allow the bomber to choose the optimum moment of initiation. They are normally used against targets that are in transit, or where a routine pattern has been established.

2. *Timed*. Timed IEDs are designed to function after a pre-set delay, allowing the bomber to make his escape before the explosion occurs. They are primarily used in anti-property roles, but may be used in anti-personnel roles if the bomber can predict that the target will be present at a known time. Timed IEDs vary in size from small incendiaries to large vehicle-borne IEDs. Time delays vary from seconds to several months, depending on the device make-up and aims.

3. *Victim.* Victim IEDs are an ideal way of attacking specific individuals or for use in a "come-on" (i.e., hoax or fake IED, used to attract the victim) scenario to attack security forces reacting to a real or fabricated incident. Usually, it is necessary for the IEDD operator to thoroughly search a safe route to a suspect device and the immediate area around it.

These IED types can be further described in terms of bomber and target information. This information is used to construct the ground truth of the scenario, against which the threat assessment of the student is compared. Thus, each SA element relates to the bomber's tactics and/or the characteristics of the target.

In terms of the bomber's tactics, there are two main considerations:

1. *Control of detonation*. This information is derived from knowledge about the environment that determines the bomber's ability to detonate at a chosen time. The most salient features are visible line of sight to the target and physical proximity. For example, in order to command control, the bomber would need to see the target enter the kill zone. However, the environment needs to be spacious enough so that the bomber is protected from the blast. In other words, a corridor is not ideal for a command device, but a parking garage is.

2. *Control of target accuracy*. This information is derived from knowledge about other patterns of life besides the target in the kill zone area. Target accuracy decreases as peripheral activity increases, such as the decreased ability to hit one person in a crowd. For example, it is expected that only Professor Smith will enter through his office door, so control of target

accuracy is high. However, many people enter through the car park door, so control there is low.

There are two main constraints of the intended target:

1. *Space*. This information is derived from target routine. SA elements of known target space relate to the bomber's knowledge of the target's location. For command and timed IEDs, they must have a very precise idea of the target's route so that the device can be properly emplaced to hit them as they pass by. Victim IEDs are placed so that victims stumble upon them on their daily commute. Victim IEDs are also used in conjunction with other devices or "come-on" tactics to entice the victim to disturb the IED, where they otherwise would not have. In other words, bombers do not need to know the exact location of the target; as long as they know the vicinity, they can find a way to get the victim to disrupt the device.

2. *Time.* This information is derived from knowledge of victim routine. Known target routine is desirable for all device types, but different levels of specificity for the bomber and target will determine the ideal device type for each situation. Timed devices require very accurate knowledge of a target's schedule (e.g., a scheduled event that the target will be present at); otherwise, the device could detonate and hit nothing. Command devices need to have a general idea of the target's timeframe. However, since they are activated manually at any time, an exact timeframe is not crucial. Victim IEDs are not constrained by time, as the device will only be set off upon disruption.

The SA element characteristics of the bomber and target are summarised in Table 3.

Table 3: Summary of SA element characteristics

IED type	Bomber tactics		Target constraints	
	Control of detonation	**Control of accuracy**	**Space**	**Time**
Command	Yes	Yes	Yes	No
Timed	Yes	No	Yes	Yes
Victim	No	No	No	No

3.4 NPC question and answer specification

The scenario storyline, NPC specification, and IED SA element specification described in the previous sections were used to generate the specific NPC question and answer trees that will be coded into the IEDD ITS. This specification used results from the QT review (Section 2) to generate and categorise questions in terms of examples of good and poor QT.

The complete NPC question and answer specification is presented in Table 7. This information will be encoded in an eXtensible Markup Language (XML) format that can be quickly implemented into the IEDD ITS prototype. The information presented in the table includes:

- *Task*. This classifies the NPC, question type, and the actual question posed to the NPC.
- *Answer*. Provides answers to questions posed by operators.
- *Device ID.* If applicable, categorizes the answer in terms of Device #1 and/or #2.
- *Compound word property.* Defines the type of question asked in terms of the following good and poor examples of QT:
    - *Visual aids.* A question that includes requests for maps, drawings, plans, and video footage that may describe the location and components of the IEDs and the bomber's actions. This is an example of good QT.
    - *Precision.* A question using precision words (e.g., "where did you go exactly?"). This is an example of good QT.
    - *Funnelling.* A question focusing on a particular aspect of a previous answer (e.g., "can you tell me more about the bag's position?"). This is an example of good QT.
    - *Open-ended.* A question that establishes witness rapport (e.g., "can you describe the backpack?"). This is an example of good QT.
    - *Vague*. A question that uses inappropriate and/or consecutive open-ended questions (e.g., "tell me more" in response to a prior open-ended question). This is an example of poor QT.
    - *Jargon.* A question that uses technical terms and acronyms unfamiliar to the witness (e.g., "where is the VIED?" if a Victim IED is suspected). This is an example of poor QT.
    - *Leading.* A question that leads the witness and biases their answer (e.g., "so the wires were coming out of the ground?"). This is an example of poor QT.
    - *Double negative.* A question that uses double-negative phrasing (e.g., "you weren't unable to see it?"). This is an example of poor QT.
    - *Compound.* A question that joins multiple topics together (e.g., "what did you do last night, did you go to the store, and when did you come home?"). This is an example of poor QT.
    - *Neutral.* A question that is neither a good or poor question, nor a filler question. Neutral questions are most often used to initiate or end dialogue and are not linked with any tutor feedback
- *Question type*. Classifies the question in terms of the five Ws (where, what, when, why, was anything seen or heard) and provides the answer to the question.
- *Classification phrase / Scenario device revealed*. Provides additional information about the device, bomber motivation, or target information that can be used by the student to help with their threat assessment.

3.5 Student QT evaluation criteria specification

The following QT performance evaluation criteria were derived from the good and poor QT indicators identified in the Questioning technique review. These evaluation criteria have been divided into question-based and questioning strategy-based categories:

1. *Question-based.*

    a. Good QT criteria:

        i. Visual aids.

        ii. Precision.

        iii. Funnelling.

        iv. Open-ended.

    b. Poor QT criteria:

        i. Vague.

        ii. Jargon.

        iii. Leading.

        iv. Double negative.

        v. Compound.

2. *Questioning strategy-based*.

    a. *Questioning efficiency*. This criterion is calculated by the ratio of the number of questions asked and the number of SA elements discovered as a result. For the first prototype, this ratio was set at 2:1. However, this criterion will be revised based on SME feedback during the implementation phase.

    b. *Question tunnelling*. This criterion concerns QT effectiveness in terms of the propensity for students to 'tunnel' into the data and lose sight of the bigger picture. This criterion is calculated by the number of questions asked in the same question category (i.e. the 5Ws) before asking a question in another category. For the first prototype, the number of questions asked within the same category is set to 5. However, this criterion will be revised based on SME feedback during the implementation phase.

    c. *Missed follow-up question*. This criterion concerns failing to ask a question that would have naturally led to another question. For example, if the NPC answered that they saw a wire, a follow-up question should ask for more details about the wire.

In addition, the following physiological-based criteria for evaluating student QT were derived:

1. *Missed Visual SA element*. This criterion is concerned with the absence of a physiological response from Heart Rate Variability (HRV) tracking and/or attention tracking (i.e., mouse

cursor dwells over the visual image) when the presented visual scene includes a device SA element.

2. *Missed NPC SA element*. This criterion is concerned with the absence of a physiological response from HRV tracking when the presented NPC answer includes a device SA element.

Finally, the following performance-based criteria for evaluating student threat assessment were derived:

1. *Incorrect command classification*. This criterion is concerned with an incorrect classification of an SA element as indicative of a command IED type.

2. *Incorrect timed classification*. This criterion is concerned with an incorrect classification of an SA element as indicative of a timed IED type.

3. *Incorrect victim classification*. This criterion is concerned with an incorrect classification of an SA element as indicative of a victim IED type.

3.6 Instructional intervention specification

This section describes the instructional intervention of the ITS. Student QT evaluation criteria as described in Section **Error! Reference source not found.** are presented in Table 4, together with a summary of instructional intervention.

Table 4: Summary of instructional intervention based on QT evaluation criteria

Evaluation criterion	Instructional intervention
Question-based	
Visual aids	Good use of visual aids to support the answer.
Precision	Good use of precision words; this will help the witness give you a specific answer.
Funnelling	Good use of funnelling; going from broad to specific can help focus in on particular information.
Open-ended	Appropriate use of an open-ended question; this helps to establish rapport with the witness.
Vague	Inappropriate use of consecutive open-ended questions; try to focus in on something more specific.
Jargon	Avoid jargon that is only familiar to a certain audience; use more general, non-technical terms.
Leading	Be careful when using leading questions; you may bias the answer.

Evaluation criterion	Instructional intervention
Double negative	Avoid double negatives; ask questions directly.
Compound	You are asking too many questions at once; ask only one question at a time.
Questioning strategy-based	
Questioning efficiency	Examples and rationale as to how questioning efficiency can be improved.
Question tunnelling	Examples and rationale as to how question tunnelling can be avoided.
Physiological-based	
Missed visual SA element	Highlight missed visual SA element and rationale of the importance of the component.
Missed NPC SA element	Highlight missed NPC SA element and rationale of the importance of the component.
Threat assessment-based	
Incorrect command classification	Examples and rationale as to how command devices are classified (i.e., list of indicative SA elements).
Incorrect timed Classification	Examples and rationale as to how timed devices are classified (i.e., list of indicative SA elements).
Incorrect victim classification	Examples and rationale as to how victim devices are classified (i.e., list of indicative SA elements).

Example instructional intervention materials are presented in Annex B of this report. This material will be developed and extended during the development of the IEDD ITS. It will also be matched to the dominant learning styles of IEDD course students as identified in a baseline evaluation study.

4 Recommendations

The following section provides a proposed IEDD questioning instructional framework, together with recommendations for the implementation and evaluation of QT in the IEDD ITS.

4.1 Proposed framework for IEDD questioning

The QT review revealed a small number of applicable frameworks for QT in IEDD. The CI, police tactical questioning, and physician intake interviews are example domains that offered pieces of the puzzle, but no definite structure that would translate to an IEDD context. The IEDD operator often has to rely on intuitive processes to arrive at a final decision, as a result of being placed in an environment characterised by a high degree of uncertainty and less than perfect information about the factors which constitute an actual threat.

The information amalgamated across these domains provided generic guidelines for building rapport, question specificity, and active listening strategy, but did not account for the unique time pressure, potential for cognitive bias, and sensitive nature of the IEDD interview. The threat of a potential timed device requires the interview to be conducted quickly, whereas the CI, for example, is designed to be a lengthy process where the interviewee describes everything they can think of in great detail. Due to the constant time pressure of device identification, changing the sequence and perspective of witness accounts would be quite time consuming. The CI was not designed for a time constrained environment, as the emphasis is on letting the witness guide most of the conversation.

Perhaps in the context of teaching QT to novice IEDD operators, students do not need different or particularly domain-specific information. Instead, they could be trained to use tools that will enable them to understand the bigger picture first before becoming fixated on the specifics of the device. It is not a matter of needing to teach new information, but simply re-organizing and framing how the current information is taught, within a more domain-specific context. As such, Figure 9 illustrates Rapport, Alternate 5Ws, and Re-Evaluate (RARE), the proposed framework to merge the theory and practice of IEDD QT. The processes were derived from common themes found in the review of other domains that use interview-style questioning, and were then tailored to fit the context of the IED-specific domain.

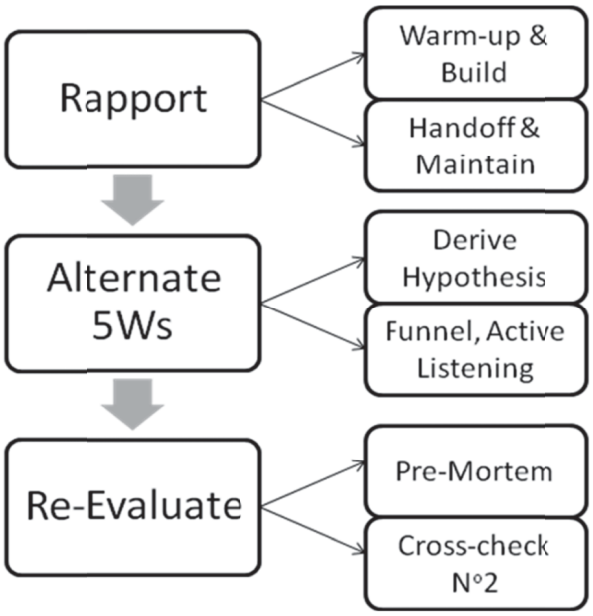

Figure 9: Framework for IEDD questioning technique

1. *Build rapport.* The difficulty of conducting a conversational style of interviewing within a time-pressured and safety-critical environment makes it especially challenging for the IEDD operator to build and maintain good rapport with the witness. Time pressure comes from the possible threat of a timed device, which may detonate before the team has a chance to dispose of it. Time pressure might also be exacerbated by the lag between the initial discovery of the device and the time it takes the IEDD team to arrive on scene and begin their investigation. Witnesses must be detained by on-site CF members until the IEDD team arrives, and this can be very time-consuming. Witnesses may become understandably agitated during this delay, thus making it increasingly difficult to regain their trust once the IEDD team arrives.

   One possible solution is to get detainers to 'warm-up' the witness by building initial rapport while they are waiting. Non-IEDD personnel may not be trained in QT, but they could easily conduct ice-breaker style conversation that helps ease the witness into disclosing more sensitive information. These warm-up questions, like any conversation, should always begin with introductions (focusing on names instead of titles). In addition, active listening needs to occur alongside of these questions as a means of building rapport. In order for the witness to feel like they are being heard, the interviewer needs to appear to be attentively listening by using verbal and non-verbal encouragers. This process should cover simple, non IED-relevant questions such as asking about personal interests, pets, and families just to get the dialogue flowing. It is also important for detainers to explain that another operator is en route to facilitate the hand-off of questioning to the IEDD team.

2. *Alternate 5W questions.* Once the IEDD team has arrived and is ready to take over witness questioning, they will need to maintain the initial rapport. The order in which each 5Ws question is asked can affect rapport and conversational flow. Overall, it is important to ensure that all 5Ws are covered to maintain awareness of the big picture, and not get fixated on one area alone. One solution is to plan in advance some type of overall structure. For example, after covering the primary concern of where the device is located, planning to ask about

whom the target is and how the device was emplaced may yield better results than an unplanned mix of open and closed questions that jump between the 5Ws.

a. *Hypothesis-driven.* Since many of the questions about each device type overlap (see Annex A), it is suggested to use hypothesis-driven instead of data-driven questioning. Hypothesis-driven questions frame the interview to purposely seek information for a certain type of device. For example, if timed devices are the biggest threat, questions can be targeted at collecting the information elements that either support or refute the hypothesis of a timed device, such as asking about the target's daily routines. Hypothesis-driven questioning can also help avoid unintended cognitive bias. By deducing clues from the perspective of each device instead of inductively assigning each clue into a respective device, the operator is forced to consider as much available information as possible.

b. *Funnelling.* During hypothesis-driven questioning, the interviewer still needs to elicit specific information about the device and the target. This can be achieved using a strategically crafted funnelling technique instead of a larger quantity of closed-ended questions. As a basic heuristic, funnelling could be thought of as imparting three layers of granularity for each topic explored. For example, for each of the 5Ws, the first question should be as open as possible, such as "can you tell me about your day?" The operator would then listen for important cues that would then cue them to probe further (e.g., does the response involve something about the person's daily routine?). The next layer would logically be a probe about a specific subtopic derived from the original question, such as asking the person to speak more about their routine. This then leads to the final level of detail where the operator wants to know any finite details about that topic. At this point, they know enough about the context and the specific information required to ask closed questions, such as "do you arrive at the same time every day?" Once the topic is saturated, the operator can either revisit more pertinent cues that they noted during the original open question, or they could ask a new open question about another of the 5Ws.

   While it may not be appropriate to teach a checklist of structured questions, the goal of the operator should be to touch on each of the 5Ws with the same open to closed approach. By premising each question domain with at least one open-ended question, the operator facilitates a better interview climate while still directing the conversation to the specific details that are needed. For instance, instead of having to ask shallow questions such as "how big is it? what colour is it? does it have wires?" for each piece of information, asking the witness "what can you tell me about the device?" opens the conversation to everything they can remember. That way, the operator can probe further on important information, without limiting the responder to only dispelling information that is asked about, as they may have pertinent knowledge that can help determine the correct device type.

3. *Re-Evaluate.* To help avoid and correct cognitive bias that may influence decision making, operators need to test the strength of their own hypothesis against the data, and verify their decision with another team member. For instance, has all available information been considered, or were questions focused on only a few areas? This method of re-evaluation is inspired from the concept of hindsight bias; instead of analyzing the failed events once they

have occurred, one anticipates potential problems in advance. A *pre-mortem* and *cross-check* are important tools for re-evaluation that can be described as follows:

a. *Pre-mortem*. A pre-mortem (Klein, 2003) is the hypothetical opposite of a post-mortem. A post-mortem in a medical setting allows health professionals and family to learn what caused a patient's death. A pre-mortem in a business setting comes at the beginning of a project rather than the end, so that the project can be improved rather than autopsied. Unlike a typical critiquing session, in which project team members are asked what *might* go wrong, the pre-mortem operates on the assumption that the 'patient' has died, and so asks what *did* go wrong. The team's task is to generate plausible reasons for the project's failure.

   To use a pre-mortem in the context of IEDD QT, an operator would pretend that the device conclusion that they selected was in fact wrong and as a result the disposal failed. For example, if they think that the device is a command-wire system, they could imagine that as the operator approached the device, the device detonated even though no one was in sight. The pre-mortem would consist of thinking of all the reasons why they did not make the right decision, such as forgetting to turn on the team's electronic countermeasures to jam the radio frequencies for wireless detonation. By revisiting one's own hypothesis from a different angle, it may be possible to uncover new relationships from information that was not clear the first time around.

   It is important to note that this recommendation may require more time than would be realistic during an actual IED disposal. However, the pre-mortem process may be valuable during initial QT training as a way of facilitating the student's thinking. By systematically unravelling all of the decisions before any action is taken, students may improve their ability to scrutinize data on their own.

b. *Cross-check*. As a secondary buffer to avoid bias, it is recommended to not only re-evaluate one's own hypothesis, but to also have someone else aid in the evaluation as a cross-check. Data on successful and unsuccessful revision of erroneous situation assessments show that it usually takes a person with a fresh point of view on the situation to break an individual's fixation (Woods, O'Brien, & Hanes, 1987). Therefore, it may be useful from the IEDD operator's perspective to get a second opinion of their initial assessment from another team member (such as the Number 2 assistant to the operator) before a final decision is made about the type of device.

4.2 Proposed QT performance evaluation

The biggest challenges associated with performance evaluation are deciding which factors should be considered and how to score them. Numerous recommendations were derived from this review, and some may not be feasible beyond the realm of training. From the early discussions on question elements, to overall interview structure, there are many factors that a course evaluator could take into consideration. Unfortunately, during the IEDD course final examination, the only assessment relevant to questioning technique is a single 'yes/yes but/no' check box to indicate whether the student's QT was 'good' (see Table 5). The notion of 'good' is thus mostly

subjectively inferred by the instructor with the exception of a brief definition (Table 6) far removed from the course content. Thus, this evaluation provides no insight into why the student succeeded or failed, making it very difficult to track weaknesses in the training content in order to improve it for future students.

Table 5: Witness questioning evaluation from IEDD course

Ref	Questioning Witnesses	Yes	Y/B	No
5.10	**Good questioning technique**			
5.11	**Task Appreciation / Threat Assessment**			

Table 6: Witness questioning evaluation criteria

Questioning Witnesses		
5.10	Good Questioning Technique	Were the 5 W's utilized? Were the witnesses kept separate (witness handling)? Were all relevant (reliable) witnesses questioned, and in what manner was information extracted? Were they allowed to tell their own story or were they led? Where plans/diagrams obtained?
5.11	Task Appreciation / Threat Assessment	Based on int received, did the operator identify the likely threat (e.g., Target, Device Type, Perpetrator, or MOs)? Allowing for appreciation on Aim, Factors, and Courses Open, did he come up with an initial plan? Did he review and/or modify his "Threat Assessment" as the task progressed (i.e., eliminating Timed, Command, and Victim appropriately)?

One solution is to increase the level of detail that is used during the evaluation. If the course stresses the importance of asking ‘how’ and ‘what’ questions as a measure of a student’s ability, then these factors should also be considered during the evaluation. Ideally, these variables should then be related to student performance, and better yet, these same variables should be implemented into the instructor model for the IEDD ITS. As such, an extended QT evaluation is proposed (see Annex B). This assessment includes some key factors that were discussed throughout this document and summarized in the proposed RARE framework. However, the evaluation does not cover any exact formula for how and when to ask questions because IEDD subject matter experts maintain that there is no ‘best’ way. Therefore, the alternative was to consider consistent question qualities that should and should not be used, even if the overall approach may differ.

5 Conclusions

The following section summarizes the outcome of the QT review and ITS development activities, and future tasks that will support the development of an ITS for the CF IEDD course.

5.1 Questioning technique review

The review of QT across multiple domains was used to create a general framework for developing instructional material and performance evaluation criteria for the IEDD ITS.

The review revealed common themes that appear across multiple domains: building rapport, asking open to closed questions, active listening, and avoiding biases, that all help to support a better interview. The missing piece was the link between the theory of interviewing skills and the actual application of those skills in practice. As such, in times of high workload, novices may revert to seeking device-specific content and become fixated on the information readily provided by the witness. This fixation inhibits their ability to probe for further and broader information, thus affecting decision making.

To remedy these limitations, it was recommended that QT instructional material be reorganized and adjusted to fit the IEDD domain. To do this, general interviewing skills were combined with the unique characteristics of high threat, time-pressured, and information sensitive decision-making. This framework can be summarized by building rapport, asking questions, then questioning the choice and supporting evidence. It was also recommended that the way QT is evaluated be improved, both to benefit the current course and to provide more specific requirements for the IEDD ITS implementation.

5.2 ITS specification

With the support of IEDD course instructors, a realistic scenario has been developed to represent current IEDD operational realities and complexities. It includes an OSC and three other witnesses along with IED verbal and visual SA elements. Under some degree of time pressure, students face a significant challenge in terms of the witness questioning and threat assessment required to determine the correct RSP for three types of possible IED threats (command, timed, and victim) in the scenario. Students can use the scenario software on an individual and self-paced basis. Students are assessed based on performance evaluation criteria derived from good and poor QT indicators.

5.3 Next steps

The information in this report will feed directly into the following tasks:

4. *Baseline evaluation*. To develop the IEDD course scenario and conduct a baseline study to support the development of the IEDD operator training course by using intelligent tutoring technologies.

5. *Architecture and prototype for CF IEDD intelligent tutoring system.* To develop instructional data that can be transitioned to technical specifications and then implemented through a combination of new and existing technologies. The prototype will include learning objects and integrate technologies within a collaborative simulation environment.

6. *IEDD course ITS prototype integration*. To complete software modifications to the ITS prototype to improve its functionality, update its user interface based on SME recommendations, and support the evaluation studies.

7. *IEDD course ITS prototype evaluation.* To provide Human Factors support to the actual evaluation of the IEDD ITS, including the collection and analysis of the findings from the ITS evaluation study. These data will be compared and contrasted with data from the baseline evaluation study.

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Annex A NPC question and answer specification

The following table describes the questions (and answers) related to each NPC concerning their knowledge of the IED threat. The information presented in the table includes:

1. *Task*. This column classifies the NPC, question type, and the actual question posed to the NPC.
2. *Answer*. Provides the answer to the question.
3. *Device ID*. If applicable, categorises the answer in terms of Device #1 and/or #2.
4. *Compound word property*. Defines the type of question asked in terms of good and poor examples of QT.
5. *Question type*. Classifies the question in terms of the five Ws (where, what, when, why, was anything seen or heard) and provides the answer to the question.
6. *Classification phrase / Scenario device revealed*. Provides additional information about the device, bomber motivation, or target information that can be used by the student to help with their threat assessment.

Please note that the information contained within this table will be updated and extended throughout the remainder of the project. These updates will be reported in the documentation pertaining to each system build. As such, the information presented in this report is for illustrative purposes only, and will not reflect the content of the final version of the IEDD ITS.

Table 7: NPC Question and answer specification

No.	Task	Answer	Device ID	Component word property	Question type	Classification Phrase/ Scenario Device Revealed
	Questioning Technique					
1	On-Scene Commander					
1.1	WHERE				Where	
1.1.1	Where is the suspect IED?	There are 2 devices we know about. One was found outside a faculty member's office on the 7th floor by a student. Another was found near the door of the parking garage on the basement level of this building by the lab tech	Device 1&2	neutral	Where	location arrows
1.1.1.1	Could you draw me a map	Sure, here it is	Device 1&2	Visual aids	Where	map photo
1.1.2	Is there access?	Which device are you talking about?	Device 1&2	Vague	Where	
1.1.2.1	Is there a safe route to the device on the 7th floor?	Yes, for now we're using only the stairs to get access, we've shut down the elevator	Device 1 (backpack)	neutral	Where	
1.1.2.1.1	Has anyone approached the device?	No, not since the cordon was established. We have evacuated everyone out of the building.	Device 1 (backpack)	Funneling	Where	
1.1.2.2	Has anyone been in the vicinity of the device?	Yes several people, Faculty and staff arriving for work in the morning would have walked past the device.	Device 1 (backpack)	neutral	Where	Device approached without incident
1.1.2.2.1	where did they go exactly?	I dont' know.	Device 1 (backpack)	Precision	Where	
1.1.2.3	Is there line of sight to the device on the 7th?	None, there are no window in the corridor.	Device 1 (backpack)	neutral	Where	No line of sight 7th
1.1.2.4	Is there access to the device in the garage?	Yes, through one door in the basement, or by street down the ramp. You must take the elevator or stairs down to the basement and the door is behind you.	Device 2 (garage)	Precision	Where	choke point in garage
1.1.2.4.1	Has anyone approached the device?	Not since cordon was established	Device 2 (garage)	neutral	Where	
1.1.2.4.1.1	Tell me more	About what?	Device 2 (garage)	Vague	Where	
1.1.2.4.1.2	Before the cordon, where did they go exaclty?	They park their cars in a parking space, and walk to the entry door. At the door they need to swipe their IED cards to gain access to the building.	Device 2 (garage)	Precision	Where	choke point; target selection
1.1.2.4.1.3	Are the parking spaces allocated to individual staff members	No idea	Device 2 (garage)	neutral	Where	
1.1.2.4.1.4	Can I have access to security camera footage for the 7th floor for the last 12 hours?	Sure, here you go.	Device 2 (garage)	neutral	When	video clip; student setting up garage device
1.1.2.5	Is there line of sight to the device in the garage?	Pretty much anywhere from the parking garage	Device 2 (garage)	neutral	Where	Line of sight in garage
1.1.3	Are there any secondary hazards I should know about?	Yes, a gas main in the basement level of building, but it has now been turned off.	N/A	neutral	Where	
1.1.4	Have the emergency services been notified?	Yes, ambulance and fire trucks are on site.	N/A	neutral	Where	

No.	Task	Answer	Device ID	Component word property	Question type	Classification Phrase/ Scenario Device Revealed
1.1.5	Has anyone been in the vicinity of the devices using ECMs?	ECMs? I have no idea what you mean	Device 1&2	Jargon	Where	
1.1.5.1	Do you use anything to block radio frequencies?	oh, no we don't	Device 1&2	neutral	Where	No ECMs in garage
1.1.6	What is in vicinity of this building?	Other university buildings	N/A	neutral	Where	
1.1.6.1	Lots of other students nearby then?	Yes.		neutral	Where	Unintended targets nearby
1.2	WHAT				Where	
1.2.1	Could you please describe the device on the 7th floor?	I have not seen the device	Device 1 (backpack)	Open-ended	What	
1.2.2	Could you please describe the device in the garage?	I have not seen the device.	Device 2 (garage)	Open-ended	What	
1.3	WHEN					
1.3.1	At what time was the device place outside the office door on the 7th floor?	No idea.	Device 1 (backpack)	neutral	When	
1.3.2	At what time was the device found outside of the office?	We have a witness that noticed a person leaving a bag outside Prof Smith's office at around 5am.	Device 1 (backpack)	neutral	When	
1.3.2.1	Can I have access to security camera footage for the 7th floor for the last 12 hours?	Sure I'll get that for you.	Device 1 (backpack)	Visual aids	When	Bag Device not activated
1.3.3	At what time was the device placed next to the access door from the parking garage?	I don't know	Device 2 (garage)	neutral	When	
1.3.3.1	Can i have access to security camera footabe for the parking garage for the last 12 hours?	Sure, here you go.	Device 2 (garage)	Visual aids	When	Bomber placed device next to parking garage door access at 4am; current time 5pm
1.4	WHO				Who	
1.4.1	Were any warnings received?	There has been some school vandalism in the past.	N/A	neutral	Who	
1.4.1.1	Do you have any examples?				Who	Vandalism
1.4.1.2	Did the warnings contain recognized code words?	Not that we know of		neutral	Who	
1.4.1.3	Did the warnings give a time of intiations?	We did receive word that someone hacked into the schools email system, sending out a mass message saying "the early worm catches the bird..."	Device 2 (garage)	neutral	Who	possible time warning
1.4.2	What are the terrorists aims?	You never know with kids these days, they could be just empty threats, or seriously violent. We can never be too careful.	N/A	neutral	Who	
1.4.3	Who is the likely target?	Well, the bag was left outside of that prof's office...	Device 1 (backpack)	neutral	Who	

No.	Task	Answer	Device ID	Component word property	Question type	Classification Phrase/ Scenario Device Revealed
1.4.3.1	Does he go to his office at routine times? Like office hours, or does he stay there until the same time every day?	What do you mean?	Device 1 (backpack)	Compound	Who	
1.4.3.1.1	Okay, does he hold office hours?	Probably, don't they all?	Device 1 (backpack)	neutral	Who	Publicly known routine
1.4.3.1.2	Does the prof routinely use certain routes and access points?	I have no idea, you should probably ask the people who know him.	Device 1 (backpack)	neutral	Who	
1.4.3.2	Any history of previous attacks?	Previous lecture disruptions on campus	N/A	neutral	Who	
1.4.3.2.1	Any recurring suspects?	ALF activity on campus	N/A	neutral	Who	Vandalism
2	Witness - lab Tech					
2.1	WHERE				Where	
2.1.1	Where are the suspect IEDs?	What's an IED?	N/A	Jargon	Where	
2.1.1.1	Sorry, I mean can you tell me about what you saw?	I saw a small box attached to the keypad of the external door to the parking garage.	Device 2 (garage)	Open-ended	Where	location arrows
2.1.1.1.1	Can you go more into detail about the door?	Its the one that goes from the parkin glot in the basement to the elevator. This is how you get into the department if you park your car there.	Device 2 (garage)	Funneling	Where	
2.1.1.1.2	Can you draw me a sketch?	No but here's a picture from my phone, I was planning on putting it on facebook.	Device 2 (garage)	Visual aids	Where	Garage device
2.1.1.1.3	Is that the only way in or out of the garage?	Yes.	Device 2 (garage)	neutral	Where	choke point in garage
2.1.2	Have you been in the vicinity of the parking garage?	Yes, I came to work by car this morning and parked there.	Device 2 (garage)	neutral	Where	
2.1.2.1	Tell me more.	Well, i have a honda civiv with lowered suspension, racing shocks and an exhaust that sounds great.	Device 2 (garage)	Vague	Where	
2.1.2.1.1	Where did you go exactly in the garage?	Well, i have a honda civiv with lowered suspension, racing shocks and an exhaust that sounds great.	Device 2 (garage)	Precision	Where	device approached without incident
2.1.2.1.2	Did you touch anything?	Just the key pad and the door like usual.	Device 2 (garage)	neutral	Where	
2.1.2.1.3	Are the parking spaces allocated to individual members?	No, it's a free-for all.	Device 2 (garage)	neutral	Where	unintened targets present
2.1.3	Have you been in the vicinity of Prof Smith's office on the 7th floor?	No, I normally meet with him in the lab, I very rarely meet him in his office.	Device 1 (backpack)	neutral	Where	
2.1.4	What is in the vicinity of this building?	Next door is the school of medicine.	Device 2 (garage)	neutral		
2.1.4.1	Can faculty from that building access the same parking garage?	Yes, it's for all faculty	Device 2 (garage)	neutral		unintended targets nearby

No.	Task	Answer	Device ID	Component word property	Question type	Classification Phrase/ Scenario Device Revealed
2.2	WHAT				What	
2.2.1	Could you please describe the device by Prof Smith's office on the 7th floor for me?	Sorry, I have no idea what you are talking about.	Device 1 (backpack)	Open-ended	What	
2.2.2	Could you please describe the device you saw in the parking garage?	I saw a small black box attached to the wall next to the card swipe we use to get access to the building. There was a wire attached to the box going up the wall.	Device 2 (garage)	Open-ended	What	
2.2.2.1	What colour was the wire?	Black.	Device 2 (garage)	neutral	What	
2.2.2.2	How long was the wire?	About a foot maybe? But it didn't seem to go anywhere.	Device 2 (garage)	neutral	What	
2.2.2.2.1	Where did the wire go exactly??	Up the wall for a bit, then stopped.	Device 2 (garage)	Precision	What	antenna in garage
2.2.2.3	What shape and size was the box the wires were connected to?	About the size and shape of a house brick.	Device 2 (garage)	neutral	What	explosive in garage
2.2.2.3.1	Were there any lights, switches or markings on the box?	Not that I can remember	Device 2 (garage)	neutral	What	
2.2.2.3.2	Was there anything else attached to the wall? Like a battery for example?	Yes, I suppose there could have been a battery	Device 2 (garage)	Leading	What	
2.2.2.3.2.1	Could you draw me a sketch of the device?	Sure, here you go	Device 2 (garage)	Visual aids	What	Battery in garage
2.3	WHEN				When	
2.3.1	At what time did you see the person outside Prof Smith's office?	I didn't go to the prof's office this morning.	Device 1 (backpack)	neutral	When	
2.3.2	At what time did you see the device next to the access door in the parking garage?	About 6 o'clock this morning	Device 2 (garage)	neutral	When	
2.3.2.1	What were you doing at the school so early?	I have to take care of the animals in the lab.		neutral	When	
2.4	WHO				Who	
2.4.1	What type of research does Prof Smith do?	Animal experiments	N/A	Open-ended	Who	
2.4.1.1	Does he hold regular office hours?	Yes, usually first thing in the morning for a couple of hours each day.	Device 1 (backpack)	neutral	Who	Publically known routine
2.4.2	Does Prof Smith have any enemies?	Lately his lectures have been disrupted by roudy students, probably animal rights activists.	N/A	neutral	Who	
2.4.3	What is in the lab in the basement of this building?	The lab holds animal cages	Device 2 (garage)	neutral	Who	
2.4.4	Does Smith generally arrive on campus at the same time? What about leaving the campus?	uhhh it depends.	Device 1&2	Compound	Who	

No.	Task	Answer	Device ID	Component word property	Question type	Classification Phrase/ Scenario Device Revealed
2.4.4.1	What time does he tend to arrive in the morning?	Around 7am i'd say.	Device 2 (garage)	neutral	Who	Publically known routine
2.4.4.2	How does he get to work normally?	Drives to work.	Device 2 (garage)	neutral	Who	
2.4.4.3	What time does he leave at night?	No idea, i usually leave before him.	Device 2 (garage)	neutral	Who	
2.5	What can you tell me about the ALF?	That's the animal liberation federation, they destroy animal research labs.	N/A	Open-ended	Who	
2.5.1	What about history of previous attacks?	They were believed to have set some monkeys free a few years ago, but lately there has just been vandalism and lecture disruptions.	N/A	neutral	Who	
2.5.1.1	What types of acts have been committed?	Someone tried to break into the lab once, lots of spraypainting, increasing in violence though.	N/A	neutral	Who	
2.5.2	Have they ever given any warnings about future attacks?	Not that I would know of.	N/A	neutral	Who	
3	Witness - Student					
3.1	WHERE				Where	
3.1.1	Where are the suspect IEDs	What's with the crazy acronyms dude?		Jargon	Where	
3.1.1.1	Can you tell me where you saw the suspicious device?	Just by Prof's Smith office.	Device 1 (backpack)	neutral	Where	Target motivation
3.1.1.1.1	Where exactly did you see it?	On the floor by the office door on the 7th floor.	Device 1 (backpack)	Precision	Where	
3.1.1.2	Have you been in the vicinity of the parking garage?	No, I came in through the front entrance, students are not allowed to park there.	Device 2 (garage)	neutral	Where	
3.1.1.3	Have you been in the vicinity of Prof's Smith office?	yes	Device 1 (backpack)	neutral	Where	
3.1.1.3.1	What did you do exactly?	Was on my way to hand in my assignment early in the morning to put it under the door, since the prof gets in so early.	Device 1 (backpack)	neutral	Where	
3.2	WHAT				What	
3.2.1	Could you describe the device by the office door for me?	In the backpack there were a bunch of wires and a clock.	Device 1 (backpack)	Open-ended	What	
3.2.1.1	What colour were the wires?	Red	Device 1 (backpack)	Funneling	What	
3.2.1.2	Describe the alarm clock?	The mechanical type with the bell.	Device 1 (backpack)	Open-ended	What	Alarm clock in bag
3.2.1.2.1	So you saw wires coming out of the alarm clock?	I'm not sure, but I don't think they wer	Device 1 (backpack)	Leading	What	

No.	Task	Answer	Device ID	Component word property	Question type	Classification Phrase/ Scenario Device Revealed
3.2.1.2.2	Were the wires and clock attached?	No, well kind of, they were attached to something...	Device 1 (backpack)	neutral	What	
3.2.1.2.2.1	Can you draw me a sketch?	Yes, here you go.	Device 1 (backpack)	Visual aids	What	Device not activated
3.2.1.3	Where was the battery?	Not sure I saw one	Device 1 (backpack)	Leading	What	
3.2.1.3.1	Was there anything else in the bag? Like a battery for example?	I just saw the wires and alarm clock and decided not to look any further.	Device 1 (backpack)	neutral	What	
3.2.1.3.2	Could you draw me a sketch of it?	Better, I took a picture of it with my iphone, here you go.		Visual aids	What	Device not activated
3.2.2	What did you see?	I saw some dude crouching down next to a backpack outside of Prof Smith's office.	Device 1 (backpack)	neutral	What	
3.2.2.1	At what time did the device next to the access door from the parking garage?	Some guy, looked like a students. Wearing a black hoodie and jeans. As soon as he saw me, he ran off and left his back pack.	Device 1 (backpack)	neutral	What	
3.2.2.2	Tell me more about the backpack	Red, the kind of one you use for hiking.	Device 1 (backpack)	Vague	What	
3.2.2.2.1	Did you look inside the bag? What did you see?	Yes, I opened it up and saw some wires and a alarm clock.	Device 1 (backpack)	Funneling	What	Timer identified
3.2.2.2.2	Did you touch anything in the bag?	It looked dodgy to I left it alone and tld the security guy at reception.	Device 1 (backpack)	neutral	What	device disturbed without incident
3.2.3	Describe the garage device for me please.	I did not see any device	Device 2 (garage)	Open-ended	What	
3.3	WHEN				When	
3.3.1	At what time did you see the person outside Prof Smith's office?	About 5 am	Device 1 (backpack)	neutral		
3.3.2	At what time did the device next to the access door from the parking garage?	I told you I didn't park there this morning.	Device 2 (garage)	neutral	When	
3.4	WHO				Who	
3.4.1	What kind of relationship do you have with Prof Smith?	Good he teaches my intro biology course, but i don't know him that well.	N/A	Funneling	Who	
3.4.2	What type of research?	He does brain studies with monkeys or something.	N/A	neutral	Who	
3.4.2.1	Are you a part of prof Smith's lab?	Nope, there's no WAY I'd ever take part in that kind of cruelty	N/A	neutral	Who	
3.4.2.1.1	How do you feel about Prof smith's research?	Well....it's kind of controversial, but important for learning I guess	N/A	Funneling		
3.4.2.1.2	So you are against animal research?	Well I didn't say that	N/A	Leading	Who	

No.	Task	Answer	Device ID	Component word property	Question type	Classification Phrase/ Scenario Device Revealed
4	Prof Smith					
4.1	WHERE (where is the IED)				Where	
4.1.1	Where are the suspect IEDs	You tell me, I have no idea what is going on here!	N/A	Jargon	Where	
4.1.2	Have you not been in the vicinity of the parking garage or your office today then?	No, this moring, I usually park my car in the garage, but today my car wouldn't start, so I took the bus and entered the department through the front door instead.	Device 1&2	Double negative	Where	Break from routine
4.2	WHAT (what type of IED)				What	
4.2.1	Could you describe the device by the office door for me?	You must be mistaken, I did not go to my office this morning.	Device 1 (backpack)	neutral	What	
4.2.2	Describe the garage device for me please.	No idea.	Device 2 (garage)	neutral	What	
4.3	WHEN (When was IED emplaced?)				When	
4.3.1	At what time did you see the person outside Prof Smith's office?	Did not go to my office this morning	Device 1 (backpack)	neutral	When	
4.3.2	At what time did the device next to the access door from the parking garage?	No idea	Device 2 (garage)	neutral	When	
4.4	WHO (is the target)				Who	
4.4.1	Have there been any related incidents in the past?	Yes, a few lecture disruptions and there was some lab vandalism a few months back, here i have the newspaper article on my phone.	N/A	neutral	Who	Vandalism
4.4.1.1	What subject do you teach?	Mostly neuroscience, some chemistry, animal behaviour	N/A	neutral	Who	
4.4.1.2	What type of research does your lab do?	We conduct animal research, brain patterns, social behaviour, that sort of thing	N/A		Who	
4.4.1.2.1	That's pretty unethical don' t you think.	Absolutely not.		Leading	Who	
4.4.1.2.2	How do students tend to perceive your research?	They are naive, they dont' understand how important it is and just try and stop my work.			Who	
4.4.1.2.3	Are there any other labs like yours on campus?	No this is the only one that allows this type of research	Device 1&2		Who	Target Motivation

Annex B Instructional intervention

The following section describes examples of instructional intervention content for the following question types:

- Jargon;
- Leading questions; and
- Compound questions.

B.1 Jargon

Text:

Speaking in shorthand (e.g., acronyms), slang, or any other type of domain specific language creates a barrier between the interviewer and interviewee. The goal is to establish a good rapport, so using language that may not be understood does not help put the witness at ease.

As an example, even the acronym IED is a form of jargon to most non-military witnesses.

Example of jargon when travelling on the London Underground:

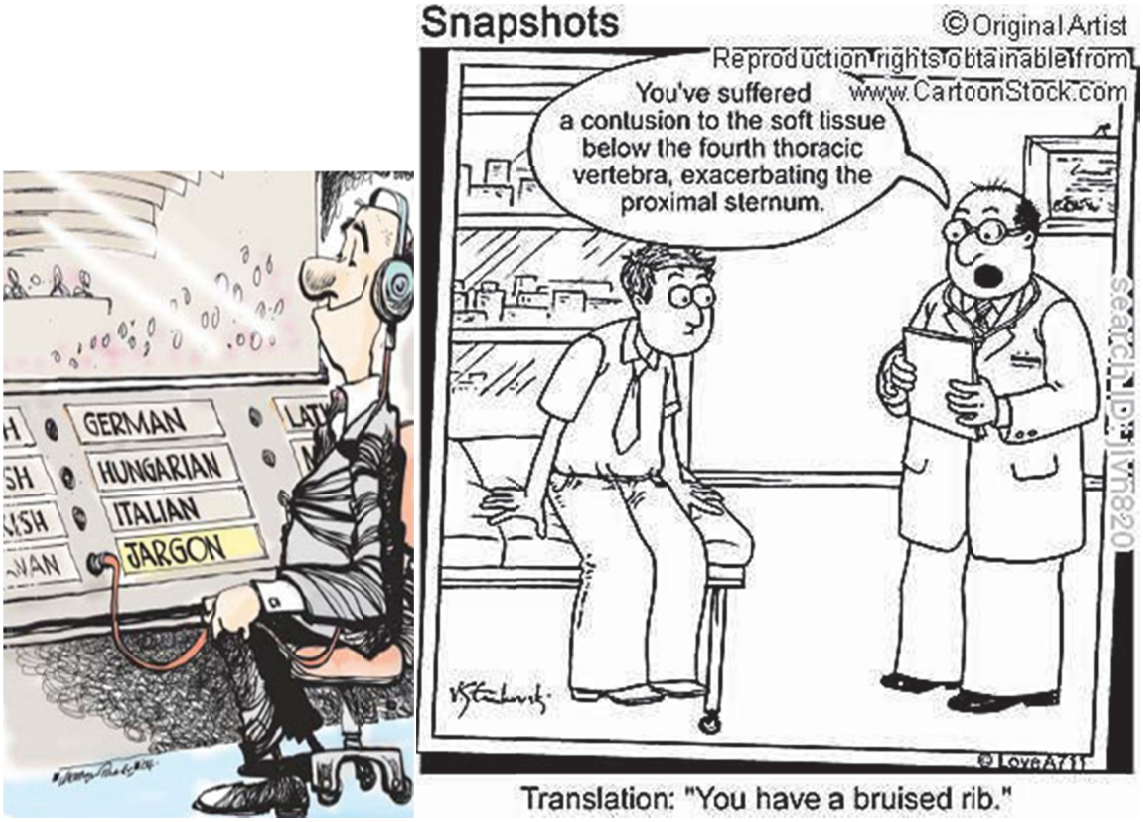
> I was on my way up to Baker Street to meet up with a crowd of friends and had got on an Aldgate service from Uxbridge. As the train approached Rayners Lane it stopped. In itself not unusual - it's a busy area with Piccadilly and Metropolitan lines converging and diverging and, of course, the Piccadilly Line has trains which are reversed there. However, the delay seemed unusually long.
>
> The standard practice is to wait for two minutes and then make a PA to let your passengers know what's going on. At first, this may just be an announcement to let them know that you're making some enquiries and should there be a significant delay, you'll keep them informed.
>
> So, after about two or three minutes, the driver made an announcement; although these weren't the exact words it was very much as follows:
>
> 'Good afternoon Ladies and Gents. We're standing at a red stick. I don't know what the problem is, but I'm going to speak to the cabin to find out. I'll come back to you as soon as possible when I've spoken to the cabin.'
>
> A couple of minutes later he made a further announcement: 'I've spoken to the cabin and there's a track down in front of us. The supervisor's on his way down to scotch and clip the route. This will take a few minutes, so we'll be here for a bit longer yet.' More bemused expressions on the faces of the passengers.
>
> However, in the event, the situation resolved more quickly, but this was accompanied too by two further rather meaningless announcements: 'It looks like the route's cleared itself. I'm going to speak to the cabin again just to make sure everything's OK and that I can move up'. A further brief delay occurred, followed by 'I've spoken to the cabin again. It looks like the route's come back up and he can clear the sticks so we're now going to move up - sorry for the delay'. With that the train moved off and we continued with our journey.

What do you think the problem was?

REFERENCE THE URL

Pictures / Media:

http://www.youtube.com/watch?v=i3RqDp7i308&NR=1



B.2 Leading questions

Text:

Biased questions tend to produces biased answers. This can occur when questions are phrased as statements, such as “did you see any wires?” instead of asking “what did you see?”

Leading questions can influence how a witness thinks. A leading question is one that alters the way a person perceives a fact or event.

The first was demonstrated in an experiment where people were asked a series of questions after watching a car accident on film. One group were asked how fast the cars were going when they *smashed* into each other. The second group was asked how fast the cars were going when they *hit* each other. And the final group were asked how fast the cars were going when they *made contact*.

The researchers found that the first group estimated the cars to be travelling at 40mph. The second group estimated the speed to be 34 mph. And the last group 31 mph. So just changing the way the question was asked, influenced how fast each group perceived the cars to be travelling.

What was even more surprising was when asked if they had seen *the* broken headlight, people were 3 times more likely to respond yes, than when asked if they had seen *a* broken headlight.

However, there was in fact no broken headlight! This simple leading question altered their memory, and caused them to recall something that didn't even happen. This is how powerful leading questions can be in influencing someone.

Pictures / Media:

http://www.youtube.com/watch?v=6ZKKvVgQoeU&playnext=1&list=PL4D88F8653D32D167&index=6

B.3 Compound questions

Text:

Too many questions asked at once will put the witness on the defensive. It may also shift the control from the responder to the interviewer, which can limit the amount of information dispelled. For example, asking “where were you going after work and who were you meeting there?” may result in only one question being answered.

Buttering-up is a type of a double-barrelled question. It happens when one of the questions is a question that the responder will want to answer "yes" to, and another that the questioner hopes will be answered with the same "yes". For example, "Would you be a nice guy and lend me five bucks?"

Some questions may not be double-barrelled but confusingly similar enough to a double-barrelled question to resulting in similar issues. For example, the question "Should the organization reduce paperwork required of employees by hiring more administrators?" can be interpreted as composed of two questions: "Should the organization reduce paperwork required of employees" and "Should the organization hire more administrators."

Double-barrelled questions have been asked by professionals, resulting in notable skewed media reports and research pieces. For example, Harris Poll used double-barrelled questions in the 1980s, investigating the US public opinion on Libya – United States relations, attitudes to Mikhail Gorbachev.

Pictures / Media:

http://www.youtube.com/watch?v=HLzxu-G2_nY

List of symbols/abbreviations/acronyms/initialisms

5W	Who What When Where Why
CF	Canadian Forces
CI	Cognitive Interview
DND	Department of National Defence
DRDC	Defence Research Development Canada
IED	Improvised Explosive Device
IEDD	Improvised Explosive Device Disposal
ITS	Intelligent Tutoring Systems
NPC	Non-player character
QT	Questioning Technique
RSP	Render Safe Procedures
TQ	Tactical Questioning
VO	Victim Operated
XML	Extensible Markup Language

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This document presents the results of a literature review on Questioning Technique (QT) and the development of a scenario, instructional material, and evaluation criteria that support the development of an Intelligent Tutoring System (ITS). The use of QT across multiple domains was surveyed and synthesized to illustrate how this knowledge can be incorporated into IEDD course instructional material and the assessment of student QT performance. The QT literature review demonstrated consistent themes across domains. Overlapping strategies that directly support the current teachings of the IEDD course were included as 'good practices'. Differences between current literature and the course were included as recommendations for either the course, the ITS, or both. The Improvised Explosive Device Disposal (IEDD) scenario was developed to illustrate a two-IED, domestic-oriented threat that reflects CF operational realities and supports current witness questioning and threat assessment training. The scenario used verbal and visual Situation Awareness (SA) elements to enable students to determine the correct Render Safe Procedure (RSP) for three types (i.e., timed, command, and victim) of possible IED threats. Further recommendations derived from the literature review included a proposed questioning framework tailored to an IED-specific domain and a proposed performance evaluation that rates students based on QT performance criteria.

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intelligent tutoring system, intelligent tutoring technology, adaptive learning, scenario generation, questioning techniques, distance learning, IED disposal training, interview skills, situation assessment, threat detection.

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