A Multifaceted Approach to Examining Emotion Regulation in Medical Settings

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Abstract

The ability to detect and regulate emotions is an important aspect of emotional intelligence (Mayer, Salovey & Caruso, 2000) that can benefit individuals in their personal well-being and improve social interactions. This thesis examined emotional regulation (ER) in medical students as they participated in an international technology rich learning environment designed to help them learn how best to communicate undesired news to patients (Lajoie et al., 2011). Gross' (1998) process model of ER served as the theoretical model that guided the analysis of regulatory strategies, in a case study (Yin, 2011) of four medical students. An exploratory mixed methods approach was utilised to determine how multichannels of emotion representations (vocal characteristics, motor expressions, attention tendencies) indicate instances of (un)conscious ER. The design of the coding scheme was driven from emotion regulation and coping literature, and methodological techniques were extended from the field of affective computing. Pre-post observations were analyzed to identify patterns of change in using regulatory strategies. Analyses revealed four major findings as evidences of ER: (a) dissociation between emotion channels did occur; (b) changes in emotion expression occurred; (c) unexpected emotions sometimes occurred; and, (d) multiple emotion channels were used to demonstrate emotion regulatory responses. Results also showed that voice modulation (specifically a decrease in voice amplitude) was an important strategy used to extrinsically regulate the patients when giving bad news as it demonstrated an empathetic response by the physician. These findings can provide insights for educators in designing programs to enhance and evaluate ER strategies of students in order to regulate personal emotions as well as the emotional needs of others in stressful situations. This work also makes important contributions to the design of technology-rich environments to embed dynamic ER detection mechanisms that

enable systems to gain a more holistic view of the participants, and to adapt instructions based on their affective needs.

Résumé

La capacité de détecter et de contrôler ses émotions est un aspect important de l'intelligence émotionnelle (Mayer, Salovey & Caruso, 2000) qui peut bénéficier le bien-être des individus et améliorer leurs interactions sociales. Cette thèse a examiné la régulation émotionnelle (RE) chez les étudiants en médecine lors de la participation à un environnement d'apprentissage international riche en technologie visant à les aider à apprendre la meilleure façon de communiquer de mauvaises nouvelles aux patients (Lajoie et al., 2011). Le modèle du processus de RE de Gross (1998) a servi en tant que modèle théorique afin d'analyser les stratégies réglementaires au moyen de l'étude de quatre cas (Yin, 2011). Une approche exploratoire utilisant des méthodes mixtes a été utilisée pour déterminer comment les représentations multidimensionnelles d'émotion se (les caractéristiques vocales, l'incarnation, les tendances d'attention) manifestent chez les cas (in)conscients de RE. Les observations avant et après ont été analysées pour identifier les tendances de changement dans l'utilisation de stratégies de RE. La conception d'un schéma de codage a été tirée de la littérature sur la RE et de l'adaptation, et les techniques méthodologiques ont été étendues du domaine de l'informatique affective. Les analyses ont révélé quatre résultats principaux: (a) la dissociation entre les canaux d'émotion est produite, (b) des changements dans l'émotion ont eu lieu; (c) des émotions inattendues ont eu parfois lieu; et (d) des canaux variées d'émotion ont été utilisés pour démontrer les réponses de RE. Les résultats ont également montré que la modulation de la voix (en particulier la diminution de l'amplitude vocale lors de la sympathie) était une stratégie importante utilisée pour réguler les patients de façon extrinsèque en donnant de mauvaises nouvelles. Ces résultats peuvent guider la conception de programmes visant à améliorer et évaluer les stratégies de RE chez les étudiants afin de réguler les émotions personnelles ainsi que

les besoins émotionnels des patients dans les situations stressantes. Ce travail fait également d'importantes contributions à la conception d'environnements riches en technologie visant à intégrer des mécanismes dynamiques de détection de RE qui permettent aux systèmes d'avoir une vue plus globale aux besoins des participants et d'adapter les instructions en fonction de leurs besoins affectifs .

Dedication

I lovingly dedicate this thesis to my husband, Hossein Mirzapour who supported me inspiringly and encouragingly through each step of the way, from the very first to the very end. Your delightful discussions, your opening of windows to new ideas, and your warm reassurance was my greatest source of enthusiasm. I believe in you as my expert in the field of emotion regulation and am truly proud of having you with me!

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

"Anybody can become angry - that is easy, but to be angry with the right person and to the right degree and at the right time and for the right purpose, and in the right way - that is not within everybody's power and is not easy" (Leonard, Miles & Ban der Kar, 1994, p. 203). This is a quote from Aristotle, which is consistent with what has been called emotion regulation (Gross, 1998). This thesis examines emotion regulation in medical students and describes methods for detecting emotion regulation strategies in the context of a technology-rich environment.

Emotions occur in a variety of settings and they can activate us to action or deactivate us into complacency. Anger may make us take action against an injustice. Fear may make us more alert. Sadness may make us withdraw from. Shame may make us conceal our self. Delight, interest and curiosity may mobilize us to move towards an action. Indeed emotions can deeply affect our personal and social lives, benefiting us in many ways but sometimes emotions may be detrimental. Some examples are, the anxiety of a goalie who lets in a goal in the world cup and performs poorly in the rest of the match; the high activation of a police officer who acts unjustly when facing an emotionally challenging situation (Berking, Meier, Wupperman, 2010); the fear of a firefighter who loses courage with children who are in danger (Scott & Myers, 2005); and patients who lose hope when faced with physiological illnesses (Baile et al., 2000).

Knowing when and how to regulate inappropriate emotional responses can enhance personal and social competencies. Studies have shown that emotion regulation is an important factor in enhancing personal well-being and effective interpersonal communication skills (Gross & Thompson, 2007). The ability to detect regulated emotions (of self and others) and to respond

accordingly is also an important component of emotional intelligence (Mayer, Salovey & Caruso, 2001) aimed towards the development of social competence, social cognition, adjustment and empathy (Eisenberg, Hofer & Vaughan, 2007). Thus, it is important to know when and how emotions are regulated and how individuals regulate emotions.

In the following sections, scientific definitions of emotion and emotion regulation are provided, along with their underlying theoretical frameworks and a review of existing methodological approaches in affective computing research.

Emotion and Its Measurement

Definition of Emotion

Even though the term emotion is used frequently, it is a complex and indeterminate, yet important scientific construct. Emotions play an important role in human life, from activating behavioral responses to smoothing decision making and enhancing memory (Gross & Thompson, 2007). Kleinginna and Kleinginna (1981) have reviewed a list of 100 definitions of the term "emotion" and have suggested a new definition that addresses different aspects of emotions. Based on their definition,

> "Emotion is a complex set of interactions among subjective and objective factors, mediated by neural/hormonal systems, which can: (a) give rise to affective experiences such as feelings of activation, pleasure/displeasure; (b) generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labeling processes; (c) activate widespread physiological adjustments to the arousing conditions; and (d) lead to behavior that is often, but not always, expressive, goal directed, and adaptive" p. 11.

Thus, emotion consists of different subcategories of feelings, cognitive appraisals, physiology and behaviours (Gross & Barrett, 2011; Scherer, 2005; Zelazo & Cunningham,

2007). Each of these subcategories is a channel in which emotions can be experienced and thus measured.

Current methods of capturing emotions

Different models emphasize emotions as outcomes of cognitive appraisals, facial and vocal expressions, postures and gestures, bodily symptoms and products of neural circuitry. In this section, several common emotion detection methods are described.

Self-report. Self-report measures record an individual's perceptions of the emotions they are experiencing and are the most widely used method of inferring emotions given the ease of administration and analysis. However, self-report methods have several challenges. One challenge is the validity of self-reports. Self-reports that capture current emotions are more valid than reports that measure distant emotions where recall may be unreliable due to the natural fluctuation of emotions where emotional valence and arousal change over time (Scherer, 2005). Researchers should be aware that real-time ratings of emotions are more accurate than retrospective reports. Validity of self-reports can be increased by providing open-ended questions instead of multiple choice items where participants may have difficulty matching their exact emotions to terms used in the report. Scherer (2005) has generated emotion categories and word stems pertinent to emotion labels that can ease the process of analyzing open-ended questionnaire data. There are a few specific challenges to using self-reports that have not yet been resolved. One is that using self-report methods may be unhelpful when a participant does not want to report his/her actual emotional experience and makes a false report. The other issue with self-reports is that they are not adequate for capturing unconscious emotions (conscious and unconscious emotions will be described in a later section) and data might be lost because participants were unaware of their emotions.

Content analysis of speech. Emotional expressions can be identified in transcriptions of oral speech. Osgood (1975) identified three dimensions of emotions that can be analyzed in text, namely, "evaluation," "potency," and "activity." Evaluation refers to pleasantness or unpleasantness of a stimulus, otherwise labelled as valence. Potency refers to the intensity (strength/weakness) of a word; and activity refers to whether a word is active or passive. These dimensions are qualitatively similar to valence and arousal, which are considered to be the fundamental dimensions of affective experience. Analysis of emotion-based words can be done manually or via machine coding. Text analysis (data mining) software can be used to explore trends in relationships between words, by visualizing possible patterns across data and providing word similarity queries, cluster analysis, tag clouds, etc. Figure 1 provides a visualization example of words as spheres. Most frequently found words are drawn as larger spheres, and those words that occur in combination with each other, are shown as clustered spheres.

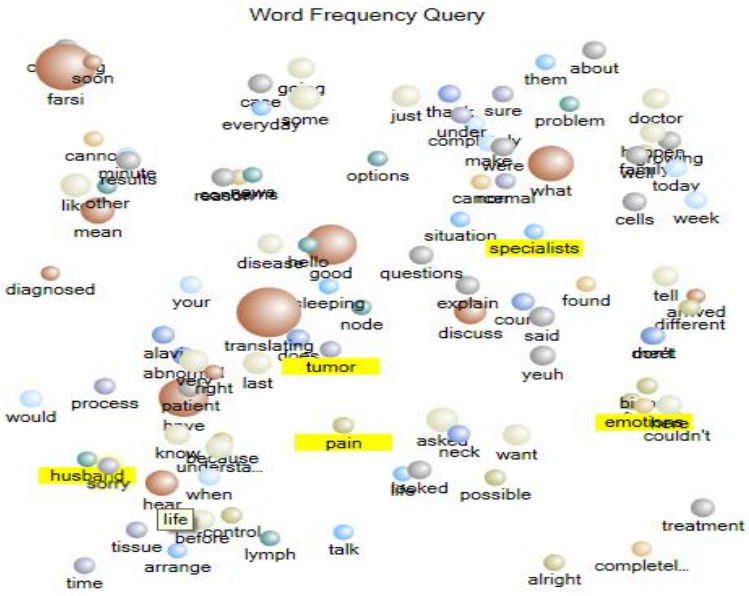


Figure 1. Text analysis software visualizing patterns across verbal data

Dialectical utterances are based on cultural norms and language, through which perceptions of words yield different results when analyzed in other contexts (Mesquita & Frijda, 1992). Per definition, "culture influences action not by providing the ultimate values toward which action is oriented, but by shaping a repertoire or "tool kit" of habits, skills, and styles from which people construct strategies of action" (Swindler, 1986, p. 273). In the context of this thesis, in an emotional dialogue where speakers communicate in different languages and across cultures, emotional words might be perceived differently due to culture-specific appraisal propensities. For instance, a given culture may perceive silence as acceptance and another culture might assume that silence is discontent.

Facial expressions. One method of inferring emotions is by observing facial expressions to deduce emotional states. Ekman & Friesen (1976) identified six discrete facial expressions, which possess cross-cultural innate characteristics. These universal *basic* emotions are happiness, surprise, disgust, sadness, anger and fear, which are inferred through a facial action coding system (FACS) that reveals emotion patterns through the arrangement of several facial action units. The FACS method is the most commonly used emotion recognition system for coding facial expressions manually (D'Mello et al., 2009) or through machine coding. However, studies have shown that the reliability of automatic affect detection systems does not match humans (Asthana, Saragih, Wagner & Goecke, 2009; Brick, Hunter & Cohn, 2009; Hoque, Kaliouby and Picard, 2009). Human coders are more advantageous than machine coding due to their familiarity with the person and the context of analysis (Aviezer et al.,2008; Hoque, Kaliouby and Picard, 2009). FACS has its limitations in that coders, machine or human, can only score deliberately displayed and extreme expressions of merely six prototypical emotions (Calvo and D'Mello, 2010).

Voice. Voice is an utterance that can reflect emotions (Russell & Bachorowski, 2003) through its explicit linguistic features of verbal utterances as well as its implicit paralinguistic features (vocal characteristics). Although there is room for further studies in this area, research has come up with interesting findings; for example, higher levels of pitch and amplitude are associated with higher degrees of arousal (Mauss & Robinson, 2009). Acoustic features of speech need to be studied in the context of authentic scenarios (e.g. delivering bad news to patients in medical settings) in an effort to yield rich sources of data (Zeng, Pantic, Roisman and Huang, 2009).

Posture or whole-body behavior. Posture has been identified as the best source of emotional detection since it presents "nonverbal leakage" (Ekman & Friesen, 1969) of emotion and is less vulnerable to modification in comparison to facial detection and voice paralinguistics. However, less research has been conducted in this area of emotion recognition research. Based on cultural norms (Butler, Lee & Gross, 2007), the human body provides a unique myriad of patterns that provide a gateway to the configuration of emotions (Calvo & D'Mello, 2010). For example, pride and embarrassment (Mauss & Robinson, 2009) depending on the cultural context are best represented through body language. For example, some cultures may be more exuberant in demonstrations of pride by raising hands and pumping their fists, whereas other cultures may be more discrete in expressions of pride where no body movement is visible. Studies have examined the effect of posture patterns in capturing one's emotions through the use of automated posture detection sensors; e.g. measuring seat pressure (Mota & Picard, 2003), or coding posture manually; e.g. positional orientation (person is leaning inwards or outwards), limb arrangements (arms are open or crossed), head situation (inclined or declined), etc. These studies have

attempted to automatically detect boredom, engagement, frustration, delight, and confusion from the gross body movements (D'Mello & Graesser, 2009).

Physiology. Fluctuations in electrical signals received from several physiological patterns from the heart (electrocardiography or blood circulatory system measuring heart rate and blood pressure), skin (electrical conductivity of sweat glands at the skin), muscles (electromyography), brain (blood flow in brain activating a particular region) and eyes (electrooculogramy) have been shown to be associated with emotions such as approach and avoidance, calmness and excitement, etc. (Mauss & Robinson, 2009; Calvo & D'Mello, 2010). James (1884) was one of the earliest psychologists to discuss interwoven connections of emotions with the nervous system, resulting in great contributions to the emotion research. For example increased heart rate has been found to be associated with anxiety (Scherer & Wallbott, 1994).

Although measuring emotions through the use of wearable and non-wearable sensors is becoming more common, issues such as intrusiveness, noisy signals due to movements and costly hardware raise some challenges about using such sensors (Arroyo et al, 2009). Another issue is the difficulty of analyzing received signals, which need to be aligned with contextual data for accurate inferences such as positivity or negativity of the signals' valence. For example, when analyzing physiological data such as increased heart rate, researchers must examine such data in context in order to determine whether the participant is happy or sad. The context in which emotions occur can help the researcher determine whether physiological signals are relevant or merely noise.

Brain imaging. Emotional experiences influence neural circuitry and the pathways of neurons. In this avenue, neuroscientists use Functional Magnetic Resonance Imaging (fMRI) to provide evidence of emotion-related processes on neurons (Ledoux, 1998; Calvo & D'Mello,

2010). Recent studies have shown promising capabilities in building affect recognition models derived from neural signals; but due to the novelty, complexity of experimental protocols and data gathering, and the high costs of this method, research is still limited in this area. One step forward could be developing an emotional model pertinent to neural imaging.

Multimodality. As formerly indicated, the experience of an emotion is manifested with a sophisticated response that incorporates multiple systems of peripheral physiology, facial expression, modulations of posture, affective speech, and instrumental action (Scherer & Ellgring, 2007). For example, excitement is expected to be expressed via particular facial, vocal, and bodily expressions, changes in physiology (increased heart rate) and neural system resulting in an instrumental action. Unfortunately, studies that incorporate data signals from different modalities to infer emotional states are infrequent. However, the advantages of inferring emotional states from a variety of emotion channels should be considered. One great advantage of multimodal data is that the accuracy rates of emotion detection are statistically higher than the best single-channel emotion detection alone (Castellano, Kessous, Caridakis; 2008; D'Mello and Graesser, 2010). As an example, Scherer and Ellgring (2007) looked at vocal characteristics, facial expressions, and body movements together to identify different emotions; and reached an accuracy rate of 79. However, synchronous combination of emotion channels is a time-consuming and labour-intensive method that requires specific emotion signal characteristics as well as researcher skills. Research (Zeng, Pantic, Roisman & Huang, 2009) has identified three methods of fusing signals to reach consensus in inferring an emotion, data fusion, feature fusion and decision fusion; each method depending on when the information from the sources of data are combined.

The methods previously described are employed in a variety of contexts to infer emotional episodes of individuals. One recent application of emotion recognition is the use of automatic affective computing devices embedded in technology-rich environments. Through this approach researchers aim to better address the emotional responses of human interactions within learning processes. In the following section I briefly introduce these contemporary advancements.

Emotion Recognition in Technology-Rich Environments

Technology-rich environments (TREs). Based on definition (Lajoie & Azevedo, 2006), TREs are theoretically-driven cognitive tools (Lajoie, 2000) that are embedded in technology-rich platforms and are designed for learning based on instructional goals. Several studies have shown learning enhancement through the use of TREs (Anderson, 2008; Azevedo et al., 2012, Graesser, VanLehn, Rosé, Jordan & Harter; 2001; Koedinger & Corbett, 2006; Lajoie & Derry, 2013; Lester et al., 2013; Shute, Ventura & Kim, 2013). Although initially computers were designed to enhance cognitive and metacognitive abilities, it has been shown (Lajoie et al., 2011) that they are an acceptable medium to address emotions as well.

TREs are used to teach a variety of subjects, and address learners from childhood to adulthood. TREs provide opportunities to gather multidimensional sources of data (video and audio recordings of user, screen capturing software, etc.) that help describe learning and affect in specific contexts. These data sources offer a cost-effective gateway to analyze and respond to emotions of users while interacting within a TRE. Automatically recognizing and responding to a user's affective states during interactions with a computer can enhance the quality of the interaction, making a computer interface more effective and enjoyable (Calvo & D'Mello, 2010). This area of research is termed affective computing.

Affective computing (AC). Affect-sensitive interfaces are being developed in a number of domains, including gaming, mental health as well as learning technologies. As mentioned, accurate recognition and consistent response to a user's emotional reactions within a TRE can increase the quality of the interaction. However, the reliability of current automatic affect detection systems does not match a human's ability to recognize emotions (Asthana et al. 2013; Brick, Hunter & Cohn, 2012). For example, affect detection systems infer that a user is angry because the system has detected an angry face. Affective computing researchers often assume that there is a one-to one correspondence between the experience and the expression of emotions, but research on emotion regulation may challenge this assumption (Gross, John & Richards, 2000). A famous example of emotional ambiguity is Leonardo da Vinci's portrait of Mona Lisa that is known for the enigmatic smile, as illustrated in Figure 2. Most human coders are not clear as to whether Mona is happy or sad. However affective computing mesh models calculate that Mona displays happiness.

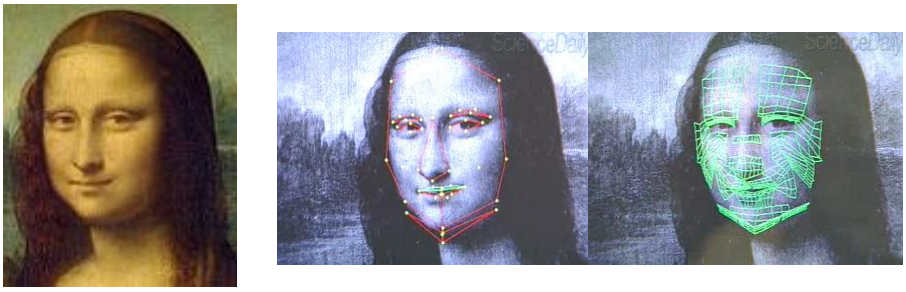


Figure 2. Mesh modeling of Mona Lisa's smile (retrieved from www.sciencedaily.com)

Coherence in affective signals. Although affective researchers attempt to fuse components of an emotional episode to infer a unique emotion, research has shown evidence of low coherence between the different emotion signals (Russell & Bachorowski, 2003; Ruch, 1995; Barrett, 2006). Identifying instances where emotional components are coherent versus loosely coupled is an important requirement for accurately detecting a unique emotional state.

This coherence gap, if bridged, can improve automatic affective computing (AC) systems by increasing the precision in emotion detection software.

So far I have defined the manner in which emotion can be defined in learning contexts and have broadened the definitions to TREs and research on affective computing. I have also presented the range of emotion detection measures used by the research community in fields of psychology, health, affective computing as well as the multichannels in which emotions are expressed. I now turn my review to the topic of emotional regulation.

Emotion Regulation – Concept and Framework

Definition of emotion regulation. According to Gross (1998), emotion regulation (ER) refers to ‘‘the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions’’ p. 275. Emotional regulation is a specific type of self-regulation (Tice & Bratslavsky 2000) which can dampen, intensify, or maintain an emotional reaction (Rime, 2007) through changes in “emotion dynamics” (Thompson, 1990); i.e. the rise time, duration and magnitude of responses.

Emotion regulation and emotional intelligence. Emotion regulation is a subcategory of the four major skillsets of emotional intelligence (EI) (Brackett, Mayer & Warner, 2004; Goleman, 2006). Per definition, EI is the “ability to recognize the meanings of emotions and their relationships and to use them as a basis in reasoning, problem solving and enhancing cognitive activities” (Mayer, Salovey, Caruso, & Sitarenios, 2001, p. 234). The other three components of emotional intelligence are emotion recognition in self and others, understanding emotion and utilization of emotions to facilitate thought (Ciarrochi, Chan, & Bajgar, 2001; Mayer, 2001). Emotion recognition refers to the way people automatically perceive emotional episodes in themselves and others; emotion knowledge refers to the capacity to analyze emotions

and appreciate changing trends over time and outcomes, and using emotion to facilitate thought is the ability to use emotional information to focus attention on the environment. Amongst the four branches, Gross and Thompson (2007) noted that skills for understanding emotion are at the heart of emotional intelligence influencing the other skill sets.

Control and regulation. It might be somewhat confusing as whether there is a difference between regulating one's emotion and controlling them. Control is a subcategory of regulation strategies (Zimmerman & Schunk, 2013) that can take two forms of being either effortful or reactive, where reactivity itself is comprised of impulsivity and high inhibition (Eisenberg, Hofer & Vaughan, 2007). Kopp (1982) has clarified that control is usually less flexible and adaptive than regulation. Well-regulated people can choose to practice ER strategies with various levels, without being strictly limited, over controlled or fairly unrestrained (under controlled) (Eisenberg, Hofer & Vaughan, 2007).

Emotion Regulation and coping. Another term that might sometimes be confused with ER is coping. Although ER has roots in the coping literature there are differences. Coping (Folkman & Lazarus, 1988) is often associated with dealing with negative emotions. But ER processes, may be used for either positive or negative emotions and can make things either better or worse. For example, diminishing negative emotions may help a medical physician operate efficiently in stressful conditions, but reversely this might neutralize negative emotion expressions for providing empathetical supports to a patient.

In addition to these basic definitions of ER there are different characteristics of ER that must be considered in terms of consciousness (implicit vs. explicit) and locus of regulation (intrinsic vs. extrinsic).These terms are described hereafter.

Conscious and unconscious ER. Some emotional phenomena might not be consciously experienced (Winkielman & Berridge, 2004) and similarly some ER strategies might be merely unconsciously driven (Bargh & Williams, 2004) for example quickly turning one's attention away from potentially upsetting material. Awareness is the state or ability to direct attention towards transient events, objects, or sensory patterns; and consciousness is the *consistent* tendency to direct attention towards/ away from such events (Scheier, 1976). There are several forms of unconscious ER strategies. For example, there is an automatic evaluation of stimuli where we encode nearly all incoming signals as positively or negatively valenced, which leads to either an approach or avoidant behaviour. Another unconscious strategy occurs due to the "mirror neuron" effect that pertains to unconscious mimicry and imitation, where one might unintentionally have a tendency to behave similar to another person. But the most common form of unconscious ER is unintentional goal pursuit (Bargh & Gollwitzer, 2001) where mental representations automatically inform when and how to pursue an ER goal; e.g. unconsciously hiding a smile on a sad occasion. A few studies (Gyurak, Gross & Etkin, 2011) have tried to categorize unconscious areas of ER. These categories are emotional conflict adaptation, habitual ER, ER as a result of affect labeling, ER goals and evaluations, and error related regulation.

Researchers have suggested that the transition from conscious and effortful (known also as explicit) to unconscious and automatic (or implicit) regulation is a process that occurs along a continuum rather than changing from one discrete state to another (Gross & Thompson, 2007; Gyurak, Gross & Etkin, 2011). Thus, it is hard to distinguish automatic emotion regulation processes from intentional and deliberate forms. To date, most emotion regulation research has focused on conscious and purposeful emotion regulation strategies (Gyurak, Gross & Etkin, 2011) through the use of self-report measures that do not provide rich contextual data.

Intrinsic and extrinsic ER. Fox and Calkins (2003) have developed the term intrinsic vs. extrinsic ER to describe the location of the locus of regulation. Intrinsic ER (IER) denotes when a person attempts to regulate his or her own emotions, whereas extrinsic ER (EER) focuses on interpersonal ER strategies applied to regulate others' emotions. The latter form entails approximating the emotional consequences for another person as well as managing one's own emotions (Gross & Thompson, 2007). For example, in medical settings patients are better able to cope with negative information about their health, when the method the physician delivers bad news is attuned with the patient's emotional styles (Miller, 1995). As an example, when the patient starts crying, the physician should provide the patient with empathetic responses. In this case the physician giving bad news would need to use extrinsic emotion regulation strategies to regulate the patient's emotions.

Some researchers focus on IER (Gross, 1998) and others on EER (Cole, Martin & Dennis, 2004), but both regulatory processes are important and should be considered together. The term "mutual regulation" is a third kind of regulation, which means a reciprocal regulation where one extrinsically regulates another and is also extrinsically regulated by that other (Cole, Martin and Dennis, 2004). An example is when a stressed physician attempts to empathize with a sad patient and is thanked by the patient for his caring which leads to the physician's self-satisfaction.

Emotion Regulation Strategies

There are numerous methods that can be used to regulate emotions. Gross (1998) has developed a model for categorizing ER strategies that are discussed in this section.

The modal model of ER. The modal model of ER (Gross, 1998) represents an integrated framework of five sequential processes involved in emotion generation. These points represent

five "families" of emotion regulation processes: situation selection, situation modification, attention deployment, cognitive change, and response modulation. Following is a brief description of each strategy along with an example for further understanding.

Situation selection. This strategy refers to choosing situations that relieve emotions, for example deciding to go walking after a bad day instead of yelling at the neighbour. Gross and Thompson (2007) state that situation selection requires an understanding of how one might act in a prototypical situation and what expectable emotional responses would occur as a consequence of a specific situation. However, research has shown that people under or overestimate emotional outcomes of unforeseen situations (Gilbert et al., 1998); for example negative emotions are estimated to be longer lasting than their real duration. Thus choosing appropriate situations to ideally regulate one's emotions requires careful calculation. Another consideration is that an individual must consider the short term and long term benefits of situation selection. For instance, a person diagnosed with a disease may choose not to receive treatments and may suffer more in the long-term.

Situation modification. This method refers to interventions that target direct modification of an emotion-provoking situation. For example, when a patient has been diagnosed with cancer, the doctor provides empathy and instructional support to help the patient in this distressing situation. This emotional support can be through empathetic emotional expressions through face, voice, posture, etc. or a combination. Studies have shown that the external regulator's mediation as well as physical presence are both important for modifying the situation (Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996).

Distinguishing between situation selection and modification is sometimes difficult since the word "situation" is sometimes ambiguous given that modification of a situation might turn it

into a new situation. As an example, when a physician asks the patient to join her accompanying family members, this is considered as situation selection and when the physician tells the patient that her accompanying family members should also understand the situation and express empathy, this is considered as situation modification. Gross and Thompson (2007) have proposed that situation modification refers to external rather than internal situations. Consequently, regulating emotions pertinent to implicit mental situations does not fall in the category of situation modification (this kind of regulation is explained further in cognitive change).

Attention Deployment. Attention deployment is a strategy used to divert attention away from an emotion-triggering stimulus. This method is especially beneficial when one cannot alter a situation by selecting or modifying it. Attention deployment can be used for both IER and EER. For example, when doctors want to communicate a cancer diagnosis to a patient, they may (un)consciously divert their attention away from the patient's face in order to decrease the emotional distress transferred from the patient. This method has two key subcategories of distraction and concentration (Gross & Thompson, 2007). Distraction refers to changing the focus of attention through (1) physically withdrawing by shifting gaze and (2) internal redirection of attention such as invoking thoughts and memories of (un)pleasant situations. Concentration refers to drawing attention to the emotion-provoking stimulus and deliberately attending to it, for example when a standardized patient focuses on a sad scenario to elevate sad emotions.

Cognitive change. Emotions and cognitions are two interwoven constructs that cannot be separable (Pessoa, 2008). Thus emotions cannot be detached from how we perceive them and their contexts. An emotion needs to be regulated cognitively as well in order to have longer

lasting effects. Through cognitive change one can attempt to change the meaning of a situation in order to alter its emotional significance. There are two major subcategories to cognitive change. One refers to methods of changing how one thinks about an emotional trigger; i.e. reinterpreting the situation; and the other suggests changing one's capability of handling the demands the trigger causes (Gross & Thompson, 2007). For example, when one has been diagnosed with a disease, he or she may think there are worse things in the world (using downward social comparison) or that he or she can handle it so that he can live a normal life (being brave).

Response modulation. Based on the modal model, the former methods of ER occur prior to generating an emotional response. However, if a response is produced there still is some chance of regulating it: through direct modulation of the experiential, physiological and behavioral consequences it may have on an individual (Gross & Thompson, 2007). This last form of ER is called response modulation where a response has actually been generated. Excessive food consumption, drug use and exercise are some common ways of direct modulation of elicited emotional responses; but one important method of modulating emotional response involves balancing emotional expressions, where one regulates the responses he or she is *expressing*. One common method is venting or suppressing emotions. For example, when a doctor reveals upsetting news to a patient, he or she needs to express sadness and suppress cheer to empathize with the patient. This method however, has some risks if used in maladaptive ways, resulting in long-term harm on the emotional, physiological and behavioral well-being of the person (Thompson, 1994). Thus enhancing competency to regulate emotions prior to generating a response seems to be more effective. It is noteworthy to mention that knowing which behaviors are adaptive or maladaptive may be based on cultural norms.

Now that the five ER strategies have been briefly introduced, in the following section I provide a classification by Gross (1998) that distinguishes response modulation from former methods of ER.

Antecedent- and response-focused strategies. At a broader level, the five families of ER are categorized into antecedent-focused and response-focused strategies. Antecedent-focused ER strategies are attempts we make (either consciously or unconsciously) to regulate our emotions prior to *activation* of an emotional response; e.g. when a test is viewed as something one can learn from rather than being viewed as a pass/fail exam. Response-focused strategies refer to attempts to regulate an experienced emotion that is under way; e.g. when one hides anxiety as the test is being distributed in class. These two levels of ER form the broader levels of the process model of ER and the five families of ER fall within these sections (see Figure 3).

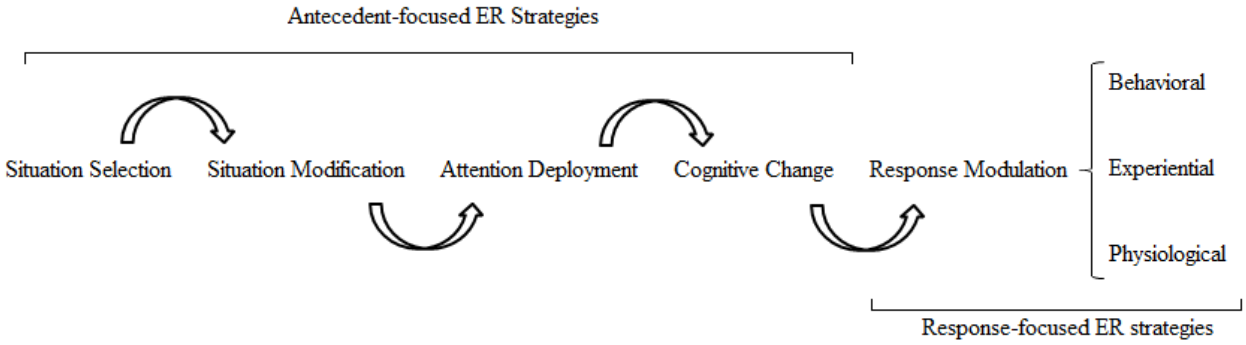


Figure 3. Summary of ER strategies in the emotion generation process (Gross, 1998)

Evidence has shown that antecedent ER strategies provide more effective emotional consequences than response-focused strategies (Gross, 1998) and Brackett, Mayer and Warner (2004) have referred to the term "intelligent regulation" for those who apply antecedent-focused strategies, specifically cognitive reappraisal, instead of response modulation methods.

So far I have talked about emotion and methods of capturing it, definitions and theoretical framework of ER, and five families of ER strategies. I hereafter explain what methods are used to capture ER. Finally, I summarize how this literature review informs my research questions and methodologies.

Methods of capturing Emotion Regulation

Measurements of emotion through facial and vocal expressions, physiological markers and embodiments can reveal complex regulatory processes as well as pure emotional reactions (Cole, Martin & Dennis, 2004). For example, a silent face in a person who usually expresses high emotions may mean that the person is regulating their emotions.

New approaches are required to study the complex process of ER. ER research has focused primarily on self-report measures which have several limitations as noted in a former section on methods of emotion detection. A handful of observational methods have been utilized to detect ER in early childhood and infancy (Fox & Campos, 1994; Rothbart, Ahadi & Evans, 2000; Stifter, Spinrad, & Braungart-Rieker, 1999). Although observational methods may not be perfectly accurate, they do not have the same limitations of self-report measures. As Cole, Martin and Dennis (2004) point out, observational methods allow researchers to make appropriate inferences of ER including but not limited to (a) measurement of changes in activated emotions and anticipated regulatory strategies; (b) multiple measures of emotion ratings, behavioral strategies and regulatory physiological data (i.e. vagal tone, a parasympathetic regulation scale of heart rate); (c) exploring temperament and behavioral inhibition, where inhibition may be due to ineffective regulation of fear [of novel situations]; (d) synchronized measurement of physiological and expressive behaviors in mother-child interactions where emotion exchanges of infant assume the development of mutual ER; (e)

regulating behaviors to unexpected outcomes of social interactions; e.g. the still-face paradigm (Tronick, Als, Adamson, Wise & Brazelton,1978); (f) comparison of emotion and regulatory phenomena in contrasting conditions.

Harman, Rothbart and Posner (1997) propose that observations of changes in emotion as a function of regulatory behavior provide the strongest evidence to infer regulation of emotions. Gross and Thompson (2007) have added that ER occurs when an emotional response does not occur in a predictable manner. For example, when a typical person is provided with upsetting news, naturally he or she should express negative emotions, but if he or she responses serenely, one can argue that ER has occurred. Another approach acknowledged by Gross and Thompson (2007) is inferring ER from changes in how response channels are interrelated as the emotion unfolds over time. For example, analyzing the video of a president candidate in public who is suddenly told that he is not elected may show quick changes from an upset to a regulated smiling face.

To date, there have been no published studies that explored observational methods of capturing intrinsic and extrinsic ER within a social and multicultural technology-based context.

Study Aims and Research Questions

This thesis extends the preliminary work of Lajoie et al. (2011) who examined the use of technology to support medical students in their communication of sensitive news to patients. This study aims to examine emotion regulation in medical students when they encounter emotionally triggered scenarios with patients in a multicultural technology-based environment. The process model of ER (Gross, 1998) is the underlying theory of this research used to identify intrinsic and extrinsic ER strategies applied by the medical students in delivering undesired diagnostic news to patients.

In the context of this thesis, emotions are embedded in culture, as well as in authentic learning situation that involves social interactions. The focus on emotion and culture within TREs is a relatively new field of research (see Blanchard, Mizoguchi & Lajoie, 2009) that emphasizes the importance of incorporating cultural perspectives in TREs to improve system-participant interactions. Analyzing culturally contextualized emotion data provides more accurate results when using manual coding than automatic emotion detection by data mining techniques. Apart from considering culture, AC research should consider the sociology of emotions. Some affective phenomena can be understood at the level of the individual, however, there is a need to understand emotions that are revealed in the social context (Parkinson, Fischer & Manstead, 2004); e.g. embarrassment, guilt, shame and pride. As regards to the third dimension, research has shown that authentic settings stimulating realistic emotions provide more accurate findings in comparison to studies examining acted emotional expressions (Afzal & Robinson, 2009).

To date, most emotion regulation research has focused on conscious and purposeful emotion regulation strategies (Gyurak, Gross & Etkin, 2011) through the use of self-report measures that do not provide rich contextual data. However, in the context of this study I aim to capture both conscious and unconscious ER through observational analysis of multiple channels of emotion representation.

Detection of regulated emotions can benefit individuals in their personal well-being and help them improve their social interactions. As mentioned previously, detecting regulated emotions of others and responding accordingly is an important component of emotional intelligence (Mayer, Salovey & Caruso, 2000) that can enhance social competence. One important application of ER is in the social context of medical settings (Larson & Yao, 2005;

Maes & karoly, 2005; Taylor, Bagby & Parker, 1999). Specifically in the context of this thesis, medical instructors can benefit from observational methods of capturing ER instances to evaluate the performance of medical students in interactions with standardized patients. The findings can provide insight for medical educators in designing programs to enhance ER strategies of medical students in order to regulate personal emotions as well as the emotional needs of patients in stressful situations.

Implementing findings from the use of observational multimodal inferences of ER in TREs, can also benefit AC research to better address the emotional needs of participants. These methods can be used to identify both types of emotion regulation (intrinsic and extrinsic) to gain a more holistic view of an individuals' capabilities and requisites. Such enhancements are especially important since AC scientists have often disregarded the effects of ER when studying emotional processes (Calvo & D'Mello, 2010). As a consequence, participants interacting with an affective computing interface might be evaluated and responded to by the system in a manner that does not accurately respond to the emotions they are expressing. For example, a serene face may not necessarily reflect a calm emotional experience and should be considered in the context of the situation.

Thus, understanding when emotional channels are harmonized or loosely attached and what this incoordination means is an important requirement for improving emotion detection systems as well as enhancing social interactions between individuals.

With this objective, I introduce the following research questions that guide the current research with the aim of studying this less analyzed landscape.

1. How is (un)conscious[1] *intrinsic* emotion regulation of medical students captured in an emotional dialogue such as bad news delivery?
2. How is (un)conscious *extrinsic* emotion regulation of medical students captured in an emotional dialogue such as bad news delivery?
3. Do ER strategies applied by the physicians and the extent of their application change from pre- to post-test as a function of the PBL intervention stages?

[1] For ease of writing, I have referred to conscious *and* unconscious as (un)conscious.

CHAPTER 2

METHODS

An exploratory mixed methods approach was utilized in a multiple case study (Yin, 2011) to determine how non-verbal and verbal channels of expressing emotions indicate instances of emotion regulation when delivering sensitive news to patients. As Yin (2009) states, a case study can be used as a revelatory case whereby the problems studied may be common across settings but the study site provides for an in-depth study that may not have been possible before. The cases of this study are unique since they use technology to support an international medical setting where bad news is to be delivered to the patient. Through this approach, we aim to extract multiple perspectives of what intrinsic and extrinsic emotion regulation consists of for these medical students who are tasked with giving bad news to their standardized patient (SP). Throughout this interview we document how several channels of emotional expression demonstrate emotion regulation.

Participants

Four medical students, two from a Canadian University and two from a Hong Kong University (3 males and 1 female, average age 25 years old), with approximately 2.5 years of medical education were recruited through university email and medical list-serves as volunteers. One experienced male physician-educator from Canada and one from Hong Kong participated in the intervention sessions. A standardized patient (female, 26 years old) and two translators (1 male, 28 years old and 1 female, 26 years old) were conscripted for the interview sessions. Ethics approval was obtained from both Universities and informed consent was obtained from all participants for using audio, video and text data.

Procedure and Materials

Participants were part of a larger study that was designed to teach effective communication skills to an international group of medical students using online TRE tools. Data collection spanned over five consecutive days and consisted of two individual practice sessions with a standardized patient (SP), two PBL sessions, and a final debriefing session (see Figure 4). All of the sessions were supported through web-conferencing software called Adobe Connect 9.

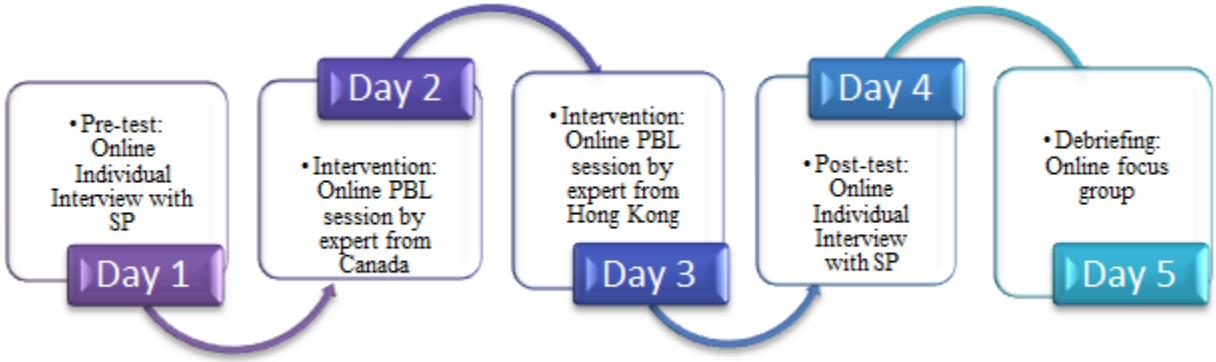


Figure 4. Data collection activities

The learning sessions were designed to provide practice with emotionally sensitive communication issues and to provide multiple perspectives on how best to communicate bad news to patients (discussed further in the PBL sessions). Additional factors that influenced emotions in this context were: (a) the cultural diversity of participants; (b) the indirect communication with patients through a translator; and (c) dialogue through a technology-based platform rather than face to face in the same room. Based on participants' post-reflection notes, the learning context did present an emotional load on participants.

Pre- and Post-Test. The pre and the post-test consisted of two online individual interviews with the SP that were performed before and after two online PBL sessions. The activity of the pre- and post-test consisted of giving a standardized patient the bad

news of having Hodgkins lymphoma, a cancer of the lymph nodes that forms part of the immune system (Parham, 2005). Standardized Patients (SPs) are people trained to portray an actual patient as accurately as possible. In this study, the standardized patient (SP) was an actress trained by a physician-educator participating in this research. The SP was a native Farsi speaker that communicated via a translator. The indirect communication would increase the difficulty of the task as well as simulate a multicultural experience for everyone. The SP was instructed to show emotional reactions including questioning behavior, crying and concern about death. The case provides an equally unique cultural context for both Canada and Hong Kong. The scenario recreated a triadic interview in which the patient was a native Farsi speaker who could not understand English, and was accompanied by a hospital assigned official translator. The pre-and post-test were identical, but the translator in the pre-test was a male and in the post-test, a female. As stated by Von Flotow and Von Flotow (1997), construction of meaning in any textual practice is gender-specific.

Each student was given the same instructions for the SP: "Mrs. Mehri is a 30 year-old unilingual Farsi-speaking woman who underwent a biopsy last week of a lymph node on the right side of her neck. She was told by her doctor to come in to clinic today to be given the results of the biopsy. Mr. Amir has accompanied her as a Farsi translator. Her doctor is unavailable at this time. Your task is to give Mrs. Mehri the results of her biopsy. The biopsy report reveals Hodgkin's Lymphoma (i.e. mixed cellularity sub-type with classic Reed-Sternberg cells)". Participants went through a general procedure of initiating the session, explaining the unfavorable news and closing the session (Silverman, Kurtz & Draper, 2005). In other words, each participant started with an introduction, identifying reasons of the consultation, gathering

information from the patient (initiation); providing information on the news and empathizing (explanation) and, forward planning and ending the session (closure).

After the second interview (post-test), participants were instructed to reflect on their videos. The instructions were as follows:

- What kind of emotions did you experience as you watched the video cases?
- Please review each video and timestamp (indicate the time, eg.1 min 33 sec) where you experienced some emotion, either positive emotion where you were happy about how you managed the interaction or negative emotion where you were anxious, stressed or worried.
- For each instance that you timestamp please tell us what you were thinking at the time and why you felt the way you did.
- What did you notice about the emotional responses of the patient? Can you please time stamp and describe these events as well.

Intervention (PBL sessions). The PBL intervention sessions facilitated students through collaborative group work in their understanding of communicating bad news to a patient. They reviewed two video cases on communicating bad news - receiving HIV positive results - one from a Canadian context (first PBL session) and one from a Hong Kong Context (second PBL session), each being facilitated by a physician from the respective country. A PBL expert synchronously supported the two instructors during the PBL sessions through a private chat window integrated in Adobe Connect 9, which participants could not view or access. Both medical instructors used a SPIKES model (Buckman, 2005; Fishel & Hochman, 2009) to illustrate best practices for communicating bad news. The sessions were aimed to: (1) identify difficulties in communicating bad news to a patient with strategies for addressing these issues;

(2) provide an approach to giving bad news; (3) use a model to analyze a video of a bad news communication session; and (4) discuss and reflect on how the use of the model may have to be changed in response to context, culture and language barriers. In this regard SPIKES was used as a model for disclosing unfavorable health related news with a clear emphasis on teaching techniques, helping physicians respond appropriately to the emotional reaction of patients (Baile et al., 2000). This model is named from the abbreviation of six categories of: Setting, Perception, Invitation, Knowledge, Empathy, and Strategies and Summary (view Table 1).

Table 1

The SPIKES Protocol (Buckman, 2005; Fishel & Hochman, 2009)

Category	Explanation
Setting	Planning and arrangements in order to deliver bad news
Perception	Evaluation of patient perception about the medical situation
Invitation	Assessment of patient's desire for information
Knowledge	Providing appropriate medical information
Empathy	Acknowledgement of patient's emotional reactions
Strategies & Summary	Strategizing and summarizing proceeding follow-up activities

Day five was a debriefing session with the entire community (the four participants, the two facilitators and the SP) that served as a focus group about the experience. For the purpose of this thesis we focus only on the online practice activities with the SP.

Adobe Connect 9. Adobe Connect 9 was selected as the TRE given the ease in which it supported collaborative engagement through audio, video, and text including notes and chats (see Figure 5 for its features). To control for bandwidth speed and technical difficulties, data were

collected in two laboratories, one located in a Canadian University and the other one in a Hong Kong University. The same procedures were followed in both universities. Four computers with video camera and headsets were located in different spaces were required for the study. Each participant was located in a different room and interacted with the other students only through Adobe Connect 9. Students received training on how to use the software prior to the commencement of the study.

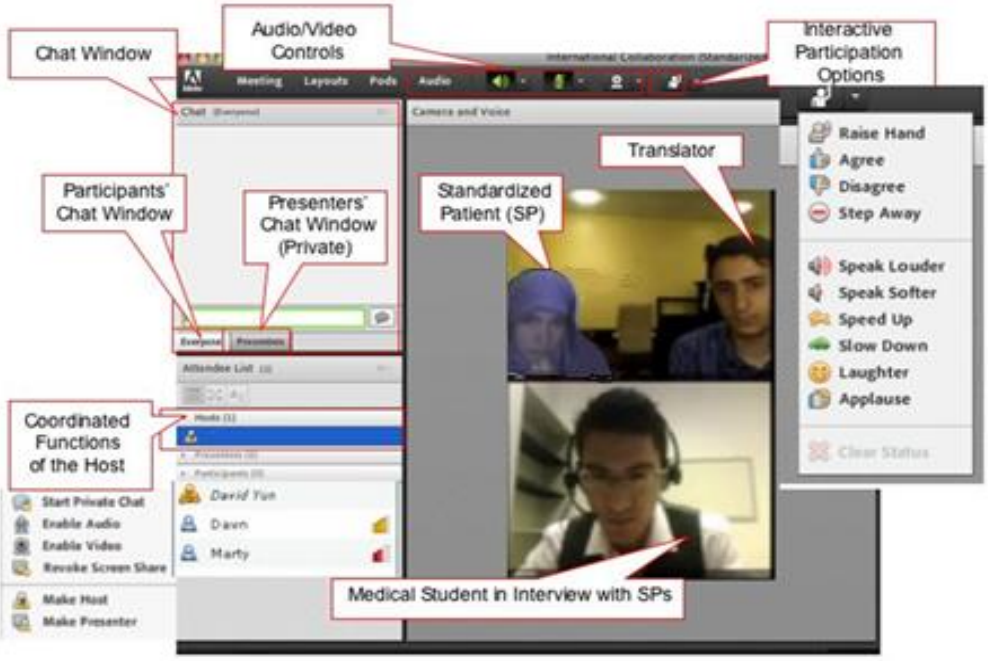


Figure 5. Description of features of Adobe Connect 9

The Adobe Connect 9 interface could only be modified by the instructors and researchers who could chose to add elements such as note/chat windows, play videos, and share files according to the needs of the meeting. Participation using Adobe Connect 9 was facilitated by using icons to raise hands to speak, to show agreement or disagreement during the meeting, or request that someone speak louder or slower. The software is platform-independent and does not need to be downloaded to access the online meetings; participants received a link sent by

email. The software's recording capabilities allowed for independent records of all content sources (audio, video, chats, and notes). In further sections, I provide links to some of the interview sessions that can help readers gain a better understanding of the TRE.

Data Sources and Analysis

Data were collected through time-stamped video-screen captures of the Adobe Connect sessions between an assigned medical student, patient and translator, in two stages (pre-test and post-test); resulting in eight interviews of the four novice participants. The activity required that the medical student meet the standardized patient and tell her the test results, confirming that the patient had Hodgkin's Lymphoma. After the post-test, participants' reflections of their pre and post videos with the SP were gathered to capture their subjective self-reports of their emotional experiences (Mauss & Robinson, 2009) while managing their interactions with the patient.

The pre- and post-test video recordings were divided into three stages of the interview named as "gathering, explanation and closing" (Silverman, Kurtz & Draper, 2005). Each interview was analyzed quantitatively. For the purpose of this research all three stages were analyzed: (a) the gathering stage was analyzed to identify the baseline for emotion coding (since bad news had not been delivered yet); (b) the explanation stage where the diagnosis was given was regarded as the emotional peak for both student and patient since this is the main part of communication, and; the closing stage when the medical student tried to provide support to the patient and close the session effectively through regulation of the standardized patient.

The use of video analysis (Derry, 2010) provides the tools for time stamping codes at a fine-grain size of ER verbal and behavioural patterns expressed by participants. Approximately two hours of video records were collected and transcribed verbatim (word by word) and

behaviorally (including non-verbal expressions). The following is an example of such transcription:

> [7:50-8:10] "We uhm, we have the uhm, the test results, the biopsy, and they are they are confirmed, its unfortunately a kind of cancer". [the physician is looking at the camera nodding then he looks up to his right and away, nods his head when explaining the cancer]
>
> [8:10-8:28] "She says, how is this possible? I didn't think, I mean, I'm very young. How how is this possible?" [patient is looking down, she has her hand to her mouth, appears to be crying, she closes her hand into a fist and places it to her mouth, her head is now resting on her hand with her fingers clenched, she is looking down away from the camera]

The transcripts were analyzed using an exploratory mixed methods approach to examine the interview sessions over the two days. To address the first and second research questions, an inductive approach was used to identify significant themes and patterns that provide evidence of ER detection. The third research question used a deductive analysis to examine the extent to which the process model of ER (Gross, 1998) evolved in the pre and post interview sessions. The data were coded using a coding scheme developed from ER and coping literature and then quantified to look for patterns in the progression of the group over the two days.

For this purpose, the transcripts were initially segmented into "units of meaning" (Pratt, 1992). Units of meaning are segments that contain part of a sentence, a sentence or more than a sentence representing an idea or a single meaning, without any limitation on the length (Butterworth, 1975). In the analysis of the video screenshots, both verbal utterances (either in the form of a word, sentence, or paragraph) and behavioral expressions were divided based on

meaning units. In this event, meaning units would signify any kind of *change* in emotion representation based on verbal, vocal and/or motor expressions.

Meaning units were inductively coded (Chi, 1997) based on multiple emotional verbal and non-verbal channels (Mauss & Robinson, 2009). Multimodality measurement of emotions was preferred than other methods since inference of an emotional state from only one emotional channel might be subject to misinterpretation (Calvo & D'Mello, 2010; Lang, 1995). The determination of an emotional state was done through manual coding. Manual video coding required a significant amount of time (approximately 15 minutes for 1 minute video) but was the only reliable option since automatic system detection has only been developed for static images rather than for dynamic ones where movements change over time (Calvo & D'Mello, 2010). Coding was applied to the medical students and the SP, although the students were the main subjects of analysis. The SP provided the context in which to understand the reactions of the medical student and the ongoing conversation.

The multimodal measures of emotion. For the purpose of this study, attention tendencies, vocal characteristics, and motor expressions were chosen as indicators of emotions (Scherer, 2005; Mauss & Robinson, 2009; Calvo & D'Mello, 2010) as well as verbal utterances containing emotional cues since they could be manually coded. Motor expressions referred to facial clues and body motions which included codes based on: (a) facial expressions (Mauss & Robinson, 2009) such as smiling, frowning, raising eyebrows, gazing eyes, becoming upset and crying; (b) general motor behaviors such as nodding, shaking head, leaning head on hand, covering face, expressing with hands or head movements, changing position, and playing with lips; (c) looking at physician/patient, looking back and forth and looking away; and finally (d) activation and withdrawal indicating the dimensional perspective of an emotional state (Mauss &

Robinson, 2009). Activation in this context refers to sitting upright or leaning in with eyes focused at a specific point. View Figure 6 as a demonstration of three different levels of activation.

 (a) Not activated.

 (b) Moderately activated.

 (c) High activation.

Figure 6. Levels of activation

Attention (action) tendencies refer to states of readiness to act in a particular way when confronted with an emotional stimulus, e.g. "approach" is associated with "desire" (Frijda, 1987). From the perspective of attention tendencies, the participant's/patient's direction of face *and* verbal utterances were coded simultaneously. These included attention towards physician/patient, attention away from physician/patient, attention self-centered and information search. As an example when the SP said: "How can I have that disease?" the participant answered: "Well, that's a good question" which can simply be coded as "attention towards patient", but with expanding our viewpoint to the participant's nonverbal cues, i.e. facial

direction, which in this case was “looking down while speaking”, we can more accurately code this segment as “information search”.

Vocal characteristics refer to implicit paralinguistic features of speech, which provided an enriching passage to infer the emotional and thereby the ER state of the participants. Subcategories of vocal characteristics (voice frequency analysis and voice amplitude) were established based on theory (Scherer, 2005; Bachorowski, 1999) and observational notes; including silence, normal voice, voice volume increased/decreased, voice pace increased/decreased, voice trembling, assertive voice (activated) and speaking hesitantly (unconfidently). Coding was initially based on speech analyzing software, named icSpeech Analyzer (http://rose-medical.com/speech-analyzer.html) and via analysis of waveform graphs (view Figure 7). Waveform analysis gave information regarding vocal pitch. Based on literature (Bachorowski & Owren, 1995; Kappas, Hess & Scherer, 1991) vocal pitch was used to assess the level of emotional activation experienced by the participants; i.e. higher levels of activation were linked to higher-pitched vocal samples. Voice amplitude was also used to assess loudness of the speech. The initial set of data (one interview) was compared with manual coding of two individual coders and due to high consistency of the codes but the time consuming procedure of speech analysis using waveform graphs and also limited access to the software, further cases were only coded based on manual detection. It should be noted that “normal voice” was categorized based on the initial stage of each interview (gathering data) as the baseline to infer codes since unfavourable news was not yet communicated.

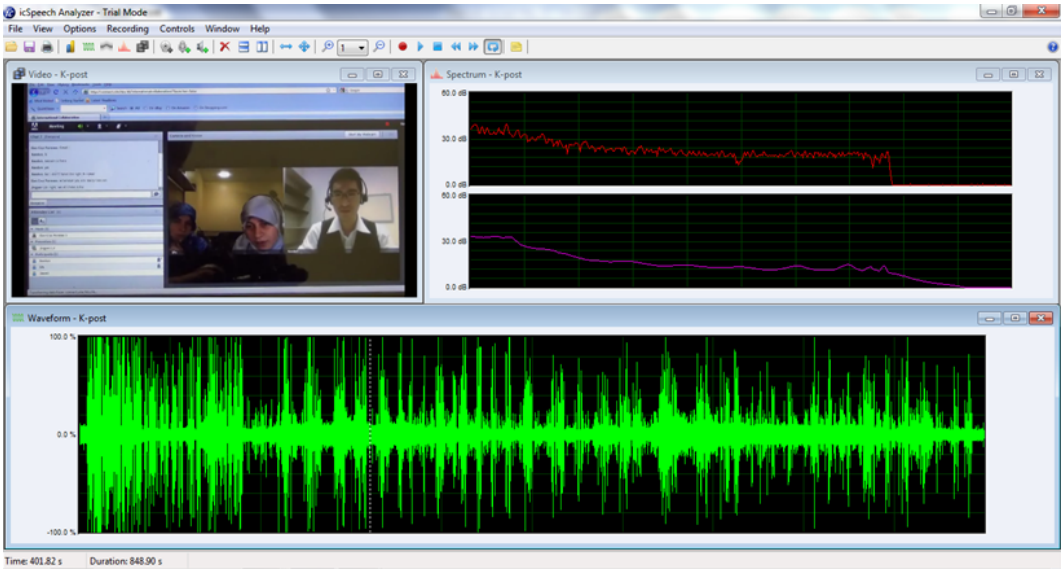


Figure 7. Analyzing speech using digital analysis of sound waveforms.

An example of speech analysis would be when the participant said: "…unfortunately you have a disease…" which had a low pitch and amplitude and was coded as "speaking hesitantly" since it was convergent with other non-vocal cues such as "eyes looking up and down" and "becoming activated". For a complete list and description of codes, as well as concrete examples, see Appendix 1 for the medical student and the standardized patient.

Figure 8 illustrates how codes were documented. Using an Excel spreadsheet any occurrence of an emotional state was recorded in a binary fashion (1 referring to occurrence and no code representing no occurrence).

In order to increase the validity of the analyses, the above channels of emotional behaviour were all coded with two individual coders and Pearson's correlation coefficient was calculated to obtain an interrater agreement percentage of 74.6 .

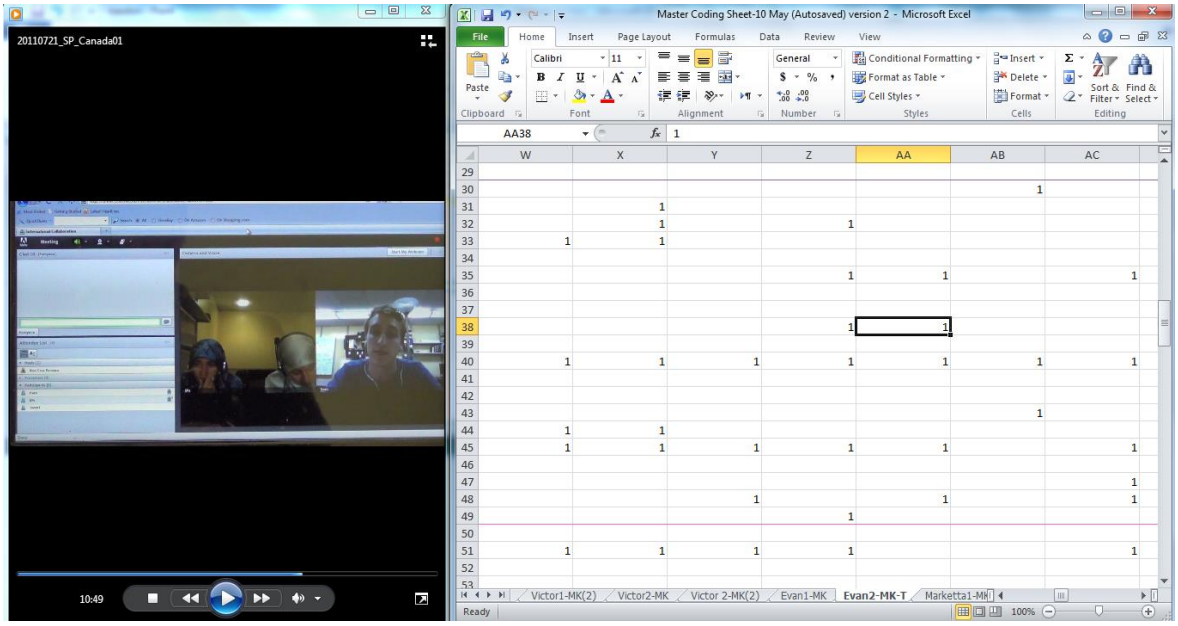


Figure 8. Recording codes in an excel sheet according to occurrence.

In a second stage and in order to infer instances of intrinsic/extrinsic ER strategies, a theory-driven coding scheme of ER was developed based on the Process Model of ER (Gross, 1998). Data were deductively coded using indicators provided in the form of action units (AUs) and key words/phrases under each category of ER: situation selection, situation modification, attention deployment, cognitive change and response tendencies. These indicators served as an outline to analyze the data. In a further detailed analysis the subcategories were once again broken into smaller units. Items from the Cognitive Emotion Regulation Questionnaire (CERQ) were modified from the relevant subscales (Garnefski & Kraaij, 2007) to match the context of this study via adaption of the root of the questions to focus on emotion regulation in receiving/delivering bad news. Additional items were derived from coping literature (Skinner, Edge, Altman & Sherwood, 2003, p. 223-225) in order to provide a more comprehensive layout of emotion regulation strategies within Gross' ER model. Table 2 and 3 provide the ER codes in

a concise format, but for a detailed description of codes along with examples refer to Appendix 2 and 3 respectively for IER and EER codes.

Table 2

Intrinsic Emotion Regulation (IER) of physician and patient

Category	Subcategory
Situation Selection	Denial
	Acceptance
	Behaviour disengagement
	Self-isolation
Situation Modification	Turning to religion
	Planning
	Seeking instructional support
	Seeking empathetical support
Attention deployment	Distraction
	Concentration
Cognitive change	Optimistic refocusing
	Positive reappraisal
	Catastrophizing
	Rumination
	Self-blame
	Blaming others
	Putting into perspective
Response tendencies	Venting of emotions
	Restraining
	Suppressing
	Suppressing competing activities

Table 3

Extrinsic Emotion Regulation of physician

Category	Subcategory
Situation selection	Enabling acceptance
	Keeping appropriate distance
	Arranging privacy
Situation modification	Referring causality away from patient
	Putting into perspective
	Turning to religion

	Planning
	Providing instructional support
	Providing empathetical support
Attention deployment	Distraction
	Concentration
Cognitive change	Optimistic refocusing
	Positive reappraisal
Response modulation	Easing venting of emotions
	Easing suppression of emotions
	Enabling suppression of competing activities

Using this coding scheme and the multiple emotional (verbal and non-verbal) channels, a gateway to a more contextualized analysis was achieved in order to infer instances of emotion regulation; either intrinsic (physician and patient) or extrinsic (physician). In other words, after the two coders coded each video session from verbal and non-verbal perspectives, they coded emotion regulation instances (individually and together) from two angles: (a) medical student's intrinsic emotion regulation (IER), (b) medical student's extrinsic emotion regulation (EER) for patient. The coders' extrapolations regarding non-self-report inferences about ER (intrinsic/extrinsic) were compared with each corresponding case's self-reflection notes for increased validation. This coding scheme was developed with the aim to develop a non-self-report and inductive measurement scale of (evidences of) intrinsic/extrinsic ER strategies (discussed later in the Results section).

Following is an elaboration of coding using the multimodality approach: The physician smiled while introducing himself whereas the patient looked tense. The physician's face changed quickly from smiling to rather serious (focusing eyes, looking tense and activated) but his tone of voice remained normal resulting in a discrepancy between two emotion expression channels (normal voice and tense face), which was thus coded by two coders as an attempt to consciously or unconsciously regulate intrinsic emotions by suppressing tension: "IER – response tendencies

– suppression". Post-reflection notes of the physician also approved the code: "This was my first time meeting this patient, and she looked very anxious. Therefore, I become more nervous and wanted to make careful choices of words in the consultation" (view Figure 9).

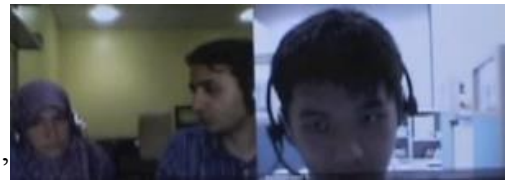
 at 29.58'  at 30.13'

Figure 9. Physician smiling initially, but noticing patient's tenseness, becoming serious

A noteworthy point is that the five ER strategies are not necessarily chronologically ordered and units of analysis can be multi-coded simultaneously.

Constructing the CORDAVAM diagrams

The CORDAVAM diagrams (Chronologically-Ordered Representation of Discourse, Attention tendencies, Voice And Motor expressions) are constructed by creating a unified transcript that integrates action units (AUs) of non-verbal and voice coded data along with the coded ER strategies. These diagrams are generalized based on recent studies (Hmelo-Silver, Lei & Jordan, 2009, Luckin et al., 2001; Luckin, 2001) with the aim to chronologically analyze specific instances of interest. With a *holistic* visualization of data while enabling fine grain coding, these diagrams provide valuable representations of a variety of codes in order to understand how the interactions in the medical interview unfolded. Technically, these diagrams are scatter plots created in a spreadsheet excel file. These diagrams can include as many or as few coding categories and tools as needed to study a particular question (Chernobilsky, Hmelo-Silver & DelMarcelle, 2003).

Studying the CORDAVAM diagrams often suggests points that are in need of further investigation. In essence, a CORDAVAM diagram provides an abstract transcript. In conducting

these analyses, researchers cycle back and forth between the diagrams and actual data to achieve a comprehensive understanding (Hmelo-Silver et al, 2008). The diagram can enable us to see how interaction patterns and ER strategies change over time as participants move from initiating to closing the session.

Followed by the qualitative analysis, frequency counts of the ER strategies applied by the participants and the SP were obtained and graphically represented in order to view which strategies were most prominently used by the participants, in each case and from pre to post.

CHAPTER 3

RESULTS

A qualitative case study analysis of the four medical students is presented in this chapter that blends verbal and nonverbal emotion data to describe emotion regulation occurring in the context of giving bad news to patients. A CORDAVAM diagram is presented to give an overview of coded nonverbal behaviour, in terms of action tendencies, vocal speech characteristics and motor expressions for each of the four participants. The analyses address the following research question: how can (un)conscious *intrinsic* and *extrinsic* emotion regulation of physicians be captured in an emotional dialogue (i.e. bad news delivery)?

As a next step, within (pre- to post-test) and between (across) case comparisons are analyzed to answer the third research question: do ER strategies applied by the medical students change from pre- to post-test as a function of the PBL intervention stages.

For this reason the four participants (cases) are introduced individually (in both pre- and post-tests), starting with a brief history of each participant followed by a qualitative analysis of interesting ER instances. For ethical purposes, pseudonyms (alphabetical letters) are used to refer to the four participants (A, B, C & D), each being divided into pre and post-tests. A quantitative frequency count of nonverbal behavior of each participant is also provided for within and between case comparisons. At the end of this section a complete table of all intrinsic and extrinsic ER strategies (applied by physician) is provided to summarize the findings. Also, Appendix 4 provides the transcripts of the main part of the interview; i.e. introducing the disease to the patient.

Participant 1 pre-test (A-pre)

Participant A was a second year male medical student from Hong Kong. In the beginning stages of his interview, A-pre asked the patient about why she sought consultation and realizing that she would not guess any major issues concerning her health, A-pre informed her of her disease. He then familiarized the patient with the disease and recognizing signs of depression in her, tried to calm her down. A-pre let the patient know of the many treatments available and tried to provide her with hope. The session ended after several sympathetic attempts by A-pre but the patient was still distressed.

Figure 10 presents a CORDAVAM diagram of this session demonstrating the 76 units of analysis that pertained to verbal utterances as well as nonverbal vocal, motor expressions and action tendencies. This diagram gives a general layout of the codes in chronological order of occurrence and helps identify emotional channels representing emotion regulation.

At the initial stages of their discussion, A-pre asked the patient about her expectations of the biopsy results, while having a gentle smile on his face with slightly raised eyebrows, and while speaking with the patient with low volume and slow pace. The patient replied that she was not expecting anything specific. At this point A-pre looked down and to the side while (un)consciously not looking directly into the screen and said: “Actually the result is not as good” (view Figure 11). This instance has thus been coded as IER – Attention deployment – distraction, and IER-cognitive change-rumination.

Figure 11. A-pre does not (un)consciously look at the screen while main delivery of the news.

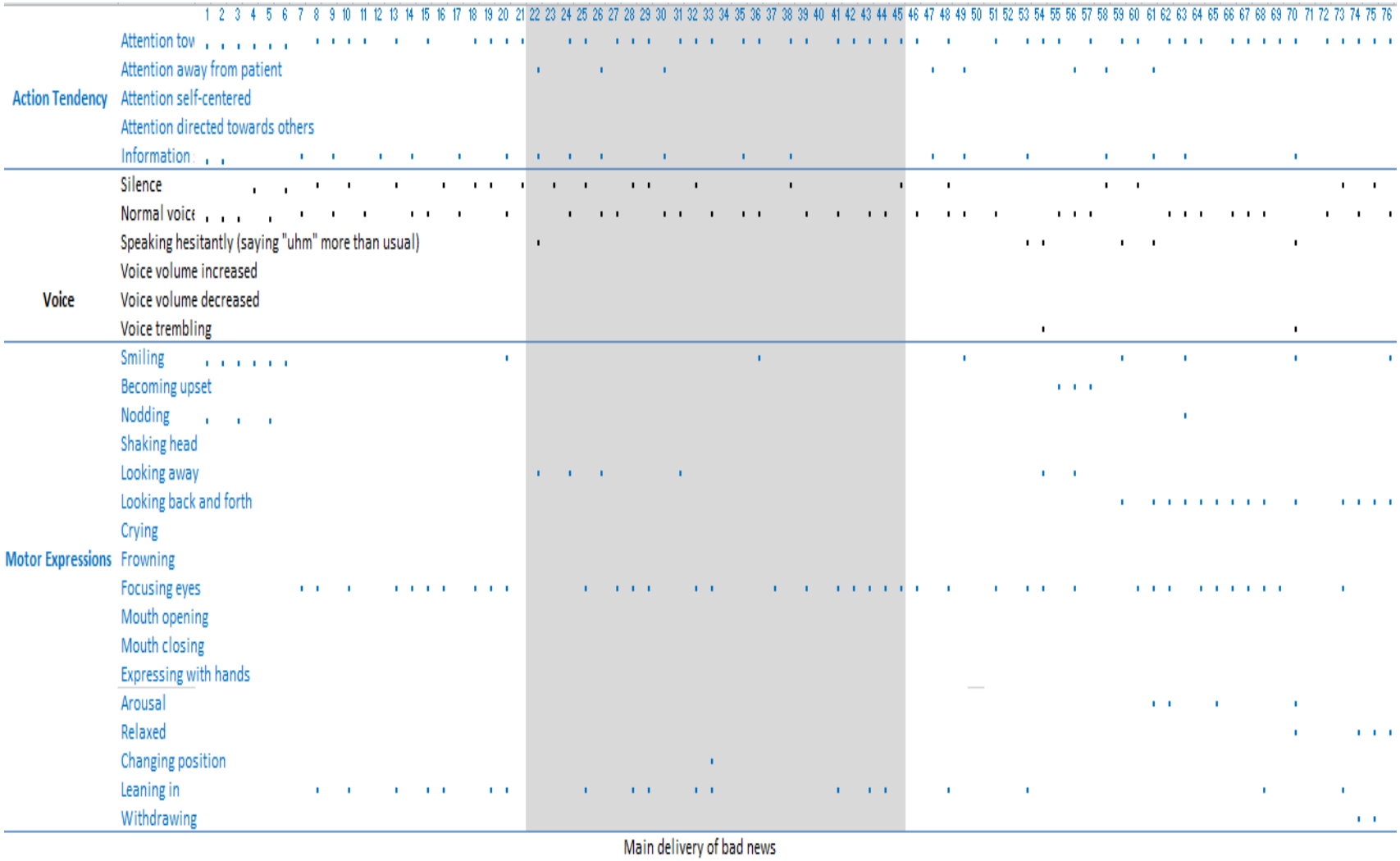


Figure 10. CORDAVAM representation of action tendencies, vocal and motor expressions

The patient then replied[2] that she did not understand what was just mentioned. A-pre then told her that she was suffering from a disease called Hodgkin's lymphoma. Again the patient became activated, leaned in and turned her face directly to the translator wanting to know what the physician was saying. Here, the physician replied with hesitation, while looking back and forth and leaning into the screen: "sure, uh uhm, have you h… heard about it before, or anything about lymphoma?" Realizing from the patient's trembling voice when she said "no" and her head shifting down and looking away, A-pre tried to calm her but he replied with hesitation and eliptical phrases: "oh, it's ok. maybe uh I should explain it to… you step by step". Hesitation in speech is referred to as "back channelling", which depending on the context can be evaluated as negative or positive. This instance was thus coded as EER – Situation selection – keeping appropriate distance, EER – Situation modification – empathetical support and IER – Response tendencies – suppression.

While clarifying the disease in non-medical terminology and allowing the patient to take a few moments in order to digest the news, the patient who was still in shock replied "what is this disease?" However A-pre showed expressions of surprise (as he leaned back and raised his eyebrows, saying oh) and replied with his low-volumed voice: "oh, um maybe I should put it this way. The disease is um some problems with the white blood cells in the blood". Here, the patient realized A-pre's surprise and tried to word her concern differently. Regarding these clues and comparing our conclusions with A-pre's reflection notes, this instance was coded as EER – Providing instructional support (while avoiding medical words) and IER – Response tendencies – Venting of emotions: "After an explanation in simple and layman terms the patient still asked

[2] For ease of understanding, video excerpts have been added; please click the highlighted link for viewing.

what is the disease?" I was surprised and try to evaluate whether this is appropriate time to give more details" (see Figure 12).

Figure 12. A-pre shows expressions of surprise while trying to control the discussion.

Later, as the patient came to believe in the reality of her stressful situation, while looking downwards and crying, she interrupted the physician: "what's going on? What do you mean by all this?" Here the physician became distressed and stopped talking and began to listen carefully, leaning inwards and focusing his eyes directly at the patient. This instance has been coded as Patient IER – Response tendencies – venting of emotions and physician IER – Response tendencies – restraining. Going further into the consultation, A-pre spoke hesitantly while looking back and forth: "um, um because um maybe at this moment…um I can let you know". The patient then assertively spoke while looking away from the screen: "I am very young. How can this happen to me?" Here, the physician leaned inwards again and as he was activated (eyebrows raised) and expressing sadness, replied with a low pace and volume: "Yes this is very difficult to accept, but at least I can say because you are young, there will be more treatment option for your disease". This instance has thus been coded as patient IER – Response tendencies – venting of emotions and EER – Situation modification – providing empathical and instructional support. Again these codings are in consistency with A-pre's reflections: "The patient burst into tears. I firstly try to figure out whether this is my fault and try to be supportive" (view Figure 13).

Figure 13. Physician is activated, leans inwards and focuses eyes as patient starts crying

Looking at Figure 14, when the original investigator interviewed A-pre, he initially responded with a rather low voice and rubbed his eyes. As he mentioned in his reflective notes: "During this case, I had some negative feeling because I think I did not control the pace of the consultation well, [I] also did not respond well when the patient burst into tears because [she] wasn't expecting it".

Figure 14. A-pre expressing relief after interviewing session ends.

Following is a graph (see Figure 15) of the frequency counts of intrinsic and extrinsic ER instances of A-pre (IER and EER). Some of the interesting ER instances of A-pre are highlighted at the end of the results section in Table 7. It is interesting to see that attention deployment was the least used strategy by A-pre for both intrinsic and extrinsic regulation. Response modulation was the highest IER strategy applied by A-pre to regulate his own emotions which could be explained by his emotionally expressive nature of A-pre. Situation modification was the most frequent EER strategy that he used to try to help the patient.

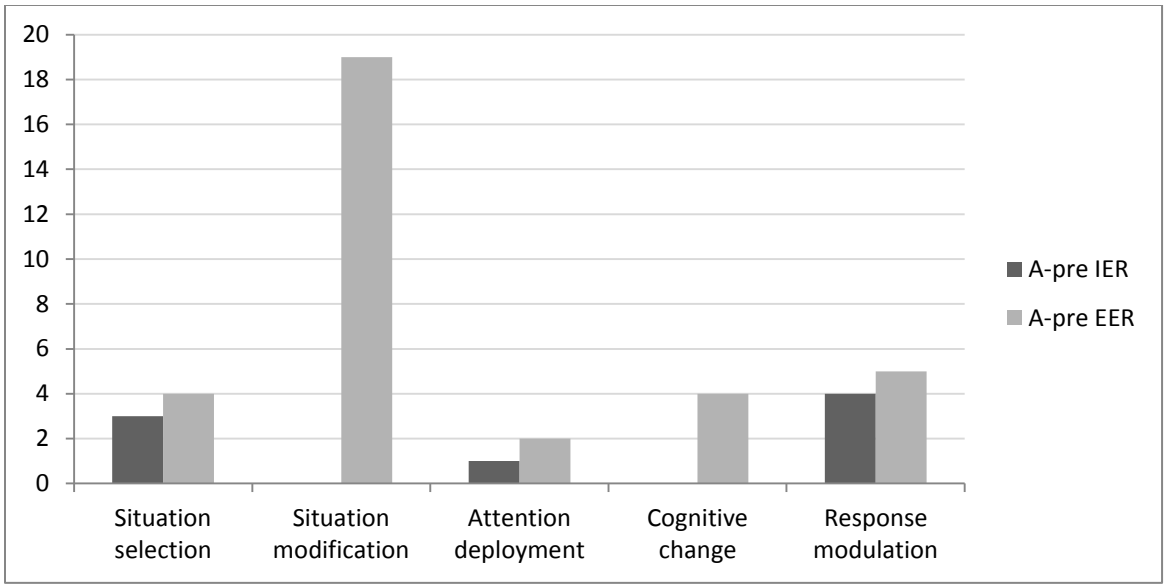


Figure 15. IER and EER of medical student A-pre

Participant 1 post-test (A-post)

A-post started by introducing himself, and asking the patient of her current situation. He asked her whether she had any family members accompanying her but noticed that she was alone. He thus aimed for delivering the news, but initially asked the patient whether she had any expectations for the results of her biopsy. Realizing her unawareness, A-post revealed the diagnosis, but was confronted with patient denial and depression. In the continuing dialogues, A-post put his efforts to calm the patient and lets her know that there is a good prognosis. The session ended as A-post arranged follow up meetings and re-assured the patient of the positive outcomes.

A-post's consultation session comprised of 69 units of analysis (view Appendix 5) that were coded to determine intrinsic/extrinsic ER. Some of the interesting ER instances of A-pre are highlighted at the end of the results section in Table 6. However, a few examples of coding ER instances are provided hereafter.

At the beginning of the session, while introducing himself to the patient, A-post spoke with hesitation: “um I am going to um tell you um the um biopsy results um we took, um you've um that you've took last time”. He looked at his notes several times while trying not to lose patient’s eye contact. It seemed that he was experiencing anxiety while his non-verbal behaviours (nodding and pressing his lips together) were trying to convey thoughts to patient that he would take care of the session. This instance was therefore coded as IER – response tendencies – suppression and cognitive change – positive reappraisal. This coding was consistent with P-post’s reflections: “The patient looked tensed yet attentive. Therefore I become more nervous about the careful choices of words so that I won’t provoke her emotion. But at the same time I was glad that she was attentive because I know she could concentrate on what I say”. Below is an example of an *unsuccessful* attempt of A-post to regulate the patient’s emotions:

> A-post: “Ok, maybe we can talk about the biopsy a little bit later. Do you have any family members coming with you today?”
>
> Patient: “Why did you say we can talk about it later? Why did you say that?”
>
> A-post: Oh**,** because I want to know your current situation first, before we talk about the results. [silence] So don’t worry too much.”

In this situation, the physician became rather unsuccessful in distracting the patient since the patient became highly activated rather than being prompted to deploy her attention away from the situation. Here, A-post got surprised (“oh”) at the patient’s reaction to his question of whether she had any family members (where she asked him why he would give the results later) He leaned back and looked around slightly, then smiled, nodded and pressed his lips together to convey relaxing thoughts to the patient: “because I want to know your current situation first, before we talk about the results”. He also suppressed his own anxiety since as discussed his

verbal (oh!) and non-verbal behaviours (smiling and nodding) did not match. Below are his reflective thoughts from A-post's own words: "The patient asked why did I want to talk about the result later, make me worry that I made a wrong choice of work, but I know I had to calm down and try to make the patient and myself more relaxed" (see Figure 16).

Figure 16. Activation in patient (right image) after physician's attempt to regulate the patient.

As can be seen in the video, the patient asked the physician "What's going to happen to me? What are the side effects of that disease? Can you explain more?" Here these sentences are coded both as seeking instructional support and seeking empathetical support for patient IER. The former is based on verbal utterances, but the latter is based on the patient's voice (decreased volume) and her non-verbal behaviour (head down, sagged in chair and turning away from the screen), which led to another attempt by the physician to externally regulate the patient. Thus A-post replied "Sure, um, ok so um …", but his non-verbal behaviour (eyes quickly glancing away from the screen and his speaking hesitantly) indicated that he was not actually *sure* and rather uncertain in answering her question. This instance has been coded as "IER response tendencies – suppression of emotions" and IER cognitive change- rumination (see Figure 17).

Figure 17. Physician responding hesitantly while trying to hide his uncertainty.

Coming to the end of their discussion, when the patient said whether she could leave the session and go home, the translator smiled while translating and the physician also smiled when he saw the translator's smile. However, he quickly covered his mouth in order to hide his smile (IER – response tendencies - suppression). This photo (see Figure 18) was captured by slowing the speed of the video to 50% the normal pace.

Figure 18. A-post hides his smile with his hands

In his overall reflections, A-post mentioned: "Throughout this case, there was lots of room for improvement ... however, the overall feeling was good because I can feel that the patient is consoled to a certain extent" (see Figure 19).

Figure 19. The ending screen shot of A-post showed his satisfaction of the session.

Figure 20 illustrates a quantitative perspective of the emotion regulation strategies applied by A-post.

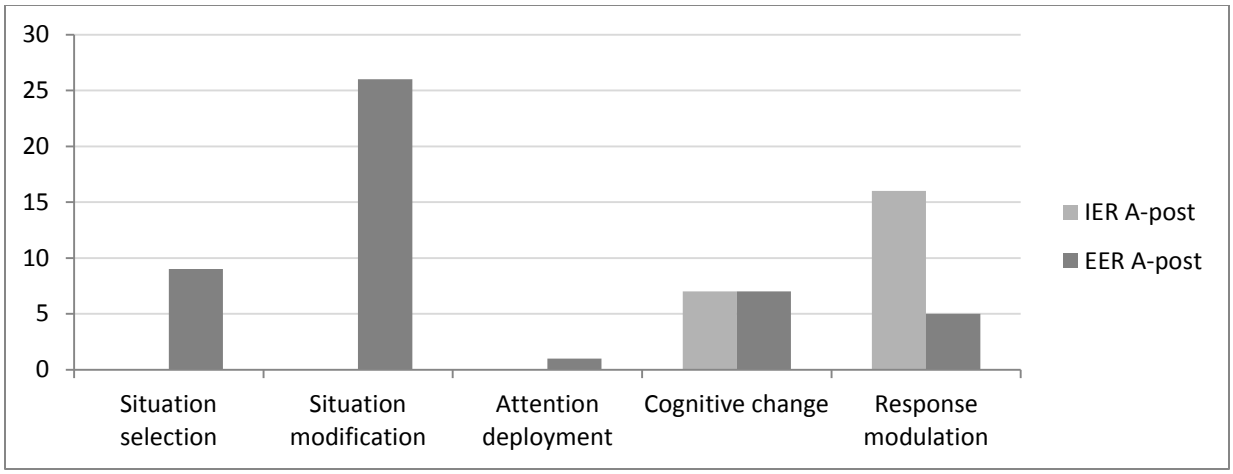


Figure 20. IER and EER strategies applied by A-post and the SP.

As can be seen, the most prominent emotion regulation strategy applied by A-post in efforts to regulate the patient (EER) is situation modification, whilst the least is via attention deployment. He continues to use response modulation for his own IER.

Pre-post comparison of participant A.

In one instance, the patient asked A-post whether she would soon die, while after a long while she raised her head and looked at the translator (clearly attending to the discussion). A-post, in response said: "No, don't worry! You are not going to die. This disease is treatable", but interestingly his face had a grin, which can be interpreted as a conscious calming reaction or as an unconscious (cultural-based) response to the question. In the latter case, although verbally one can code A-post's attempt to regulate patient concerns and emotions (i.e. providing instructional support – Situation Modification), his verbal and non-verbal behaviours *together* may actually dysregulate patient distress, especially given the context of the multicultural setting. The two individual coders coded this instance as physician IER – Response tendencies - Venting of emotions.

Hereafter, I provide a few quantitative representations that can help demonstrate changes from A's pre to post-tests emotion expression and regulation.

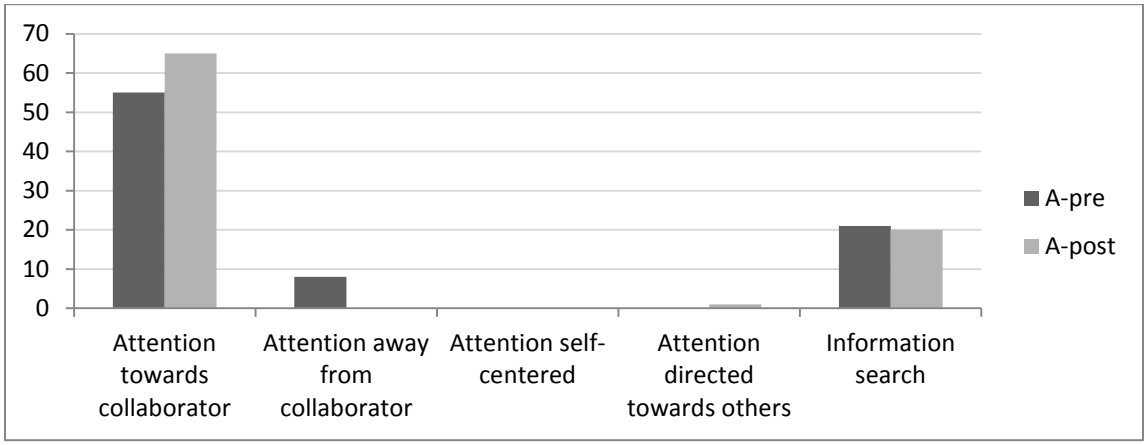


Figure 21. Attention tendencies of participant A, a comparative point of view from pre to post

Another issue that shows change from pre to post is hesitation in verbal utterances which is less observed in the post-test (view Figure 22).

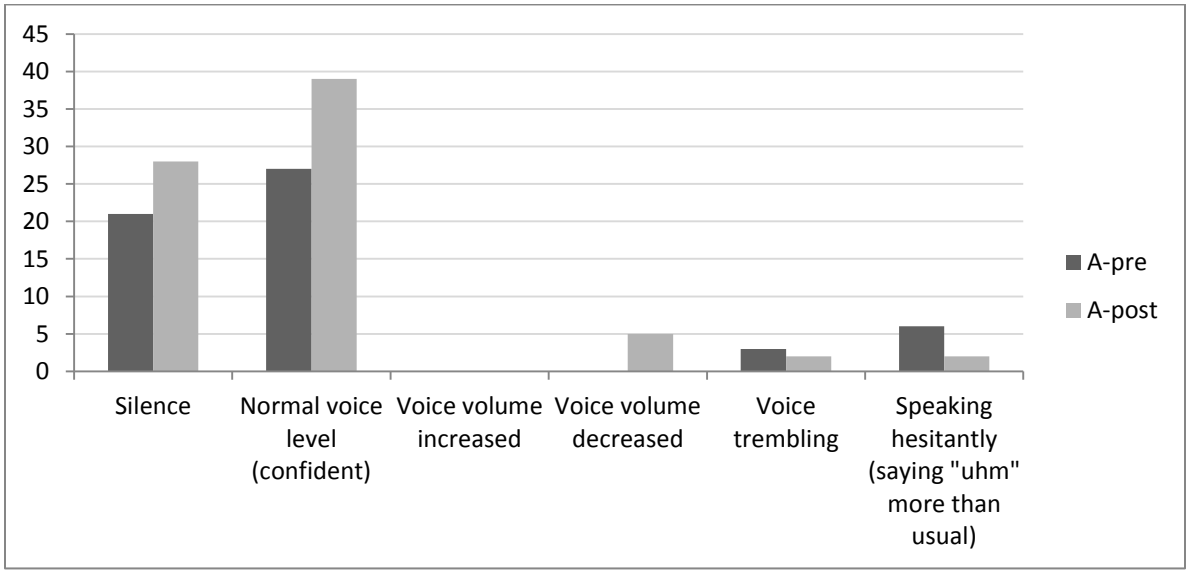


Figure 22. Voice quality of participant A, a comparative perspective from pre to post.

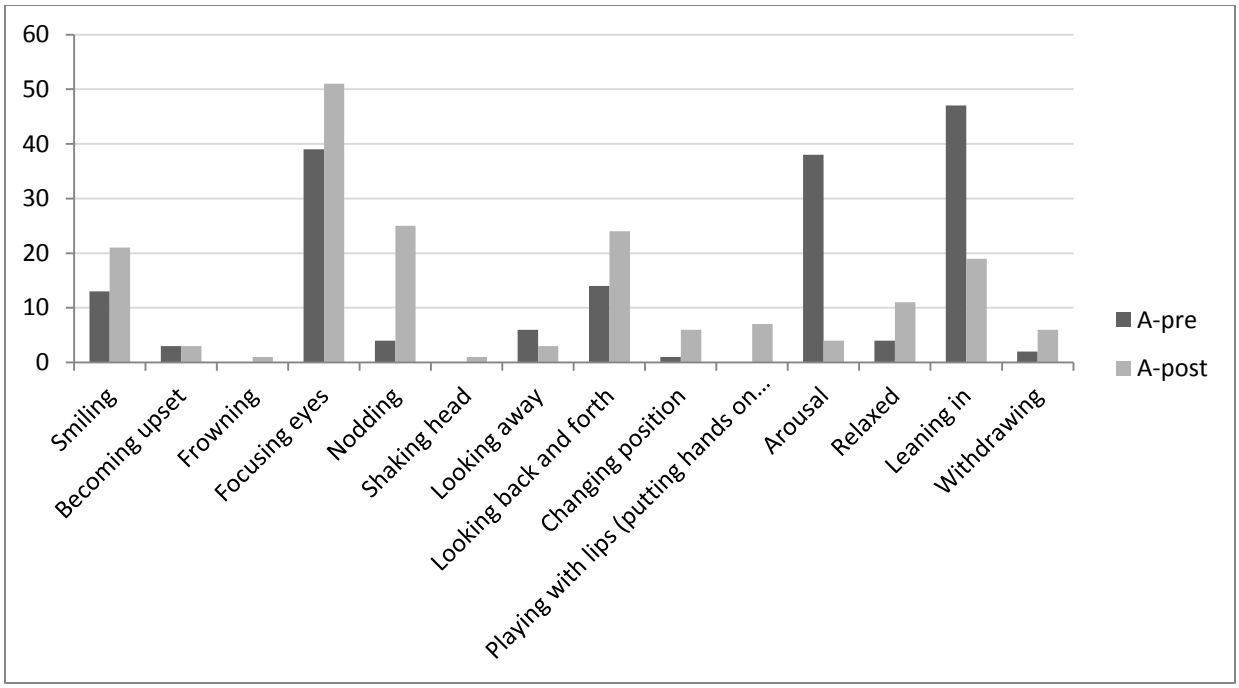


Figure 23. Motor expressions of participant A, a comparative perspective from pre to post.

From the general behaviour of medical student A appears more confident in post then in pre in that he demonstrates less activation (view Figure 24). Following is a comparison table of intrinsic and extrinsic ER application from pre to post. This table shows that A was more efficient at extrinsically regulating the patient in post. It also indicates that A-post had more instances of intrinsically regulating himself.

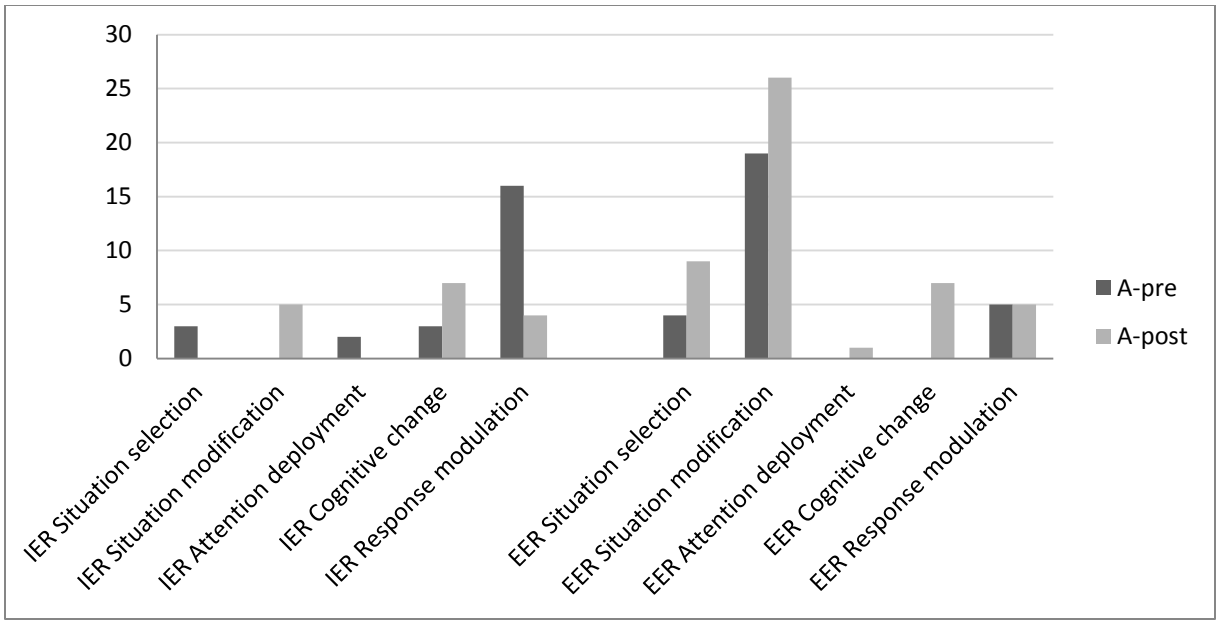


Figure 24. IER and EER frequency counts of participant A

Participant 2 pre-test (B-pre)

The second participant was a third year male medical student from Hong Kong. In the beginning stages of bad news delivery, B-pre reminded the patient of the follow-up procedures after her first consultation and that the results of the biopsy had been obtained. He told the patient that he was responsible for giving the news to her since her original doctor was away. Realizing that she was alone, he confirmed that the results were obtained but not as "optimistic as he thought it would be", and then introduced the patient to her underlying disease. In the next stages of their conversation, B-pre tried to explain the disease briefly while trying to calm the patient and giving her hope of the many available treatments. The dialogue consisted of 84 segments that served as the units of analysis (view Appendix 6) and was coded by two coders for intrinsic and extrinsic ER of the physician. Unfortunately since audio and video data were not synchronized for this participant, video extracts for further clarification cannot be provided.

Several indications of emotional regulation occurred in this participant. When B-pre heard that the patient was alone he looked down at his notes and continued talking with a doubtful voice (frequent ‘um’s - short silences). Looking back at notes and speaking hesitantly was an indication of IER-cognitive change-rumination and IER – Situation modification – planning [on how to proceed], also approved by B-pre’s reflection notes: “[I] didn't know how to tell her the bad news when she said she was unaccompanied by anyone”. The continuum of his speech was however coded as IER – response tendencies - suppression since his verbal statements did not match his vocal cues while he tried to suppress his nervousness: “[after] 2 weeks’ time [your husband will be back], ok [silence], well um Miss Alavi, we took a biopsy from your neck …” Here, the patient showed interest to know about the results but when B-pre realized this, he changed positions and moved back and forth in his seat, then he said (21.54-22.05): “yeah of course, um and um, the results came back, um but it is, um I’m afraid Mrs Alavi that it’s not as um o… optimistic as we thought it would be” which showed B-pre’s hesitation, although he tried to hide it by changing positions on his chair and using reassuring words (i.e. yes of course). This instance was thus coded as IER- response tendencies - suppression due to the discrepancy between non-verbal (hesitation) and verbal (confident reassuring words) cues. Referring to his post-reflections, B-pre admitted that he “didn't expect the patient to be demanding for the lab results” which confirmed this conclusion (see Figure 25).

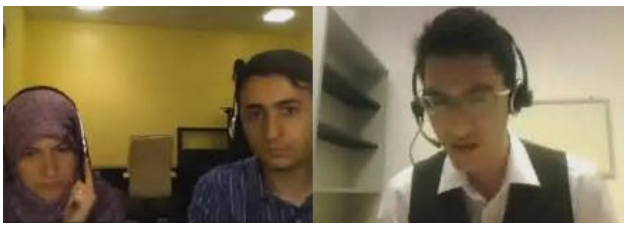


Figure 25. B-pre is hesitating how to proceed while patient is still calm prior to bad news delivery.

As the patient began to realize what is going on she mentioned that she could not understand the situation. B-pre faced the translator and asked what exactly did she not understand completely. B-pre seemed to be looking for more information to answer this ambiguity: he moved in his chair, frowned and focused his eyes to detect any cues expressed by the patient in order to respond to her properly (see Figure 26). At the same time B-pre had a calm and quiet voice and he decreased the pace of speech while taking to the patient. These behaviors were coded as IER - response tendencies – suppression (given that two emotion channels were divergent: curious face and movements in chair did not matching a calm and low-paced voice).

Figure 26. B-pre's curiosity and misunderstanding of patient's concerns.

B-pre's curiosity was confirmed by his post-reflections: "When the patient said she couldn't understand completely, even after I have given her the simplest explanation of the disease, I didn't know how to further simplify the explanation or what she didn't understand about". Here, the patient replied in an assertive voice, looking back at the doctor and asked whether he was telling her that she had "cancer". Leaning in and focusing his eyes at her, B-pre tried to switch the patient's attention by asking her about her understanding of cancer and lymphoma. This instance was thus coded as EER – attention deployment – distraction.

In order to modify the situation, the physician asked about the patient's family but the patient wiped her tears and speaking sadly said her family were away from her. Here, B-pre quickly looked down and then looked back up, and in an attempt to calm the patient he sympathized with her and expressed his understanding. The initial (un)conscious reaction of the

physician (turning away and looking down), is interpreted as an intrinsic emotion regulation strategy by the physician, IER – Attention deployment – distraction, to turn (even shortly) away from the situation. This instance is also further confirmed through the reflective thoughts of B-pre: “After enquiring the whereabouts of the patient's family (father? mother? sons? daughters?), I realised the patient's emotional state worsens, only learning that she is separated from her love ones alone in Canada. I shouldn't have been specific by asking for specific members of the family as it could draw back poor memories…"

After organizing a follow-up session and checking for any remaining questions that might be left, B-pre asked the patient to look at his face not down and he then tried to convey to her that she would be fine and she would get cured. He also assured her of his accessibility until the next meeting and the patient in response agreed that that this would be a good option. Coming to the end of the conversation, B-pre slightly leaned back, closed his eyes shortly and sighed. This instance was thus coded as IER – Response tendencies – venting of emotions. In his concluding reflective notes, B-pre admitted: “After thoughts immediately after the webcam ended, seeing that the patient is calm and composed when I end the consultation, I thought the session wasn't so bad, however poor the beginning was. There were definitely lots of room for improvement. I knew I was nervous and out-of-place for I have repeatedly said 'Umm' while trying to figure out what should be my next step” (view Figure 27).

Figure 27. B-pre showing relief at the end of the stressful communication

Figure 28 shows the frequency of emotion regulation strategies applied consciously or unconsciously by the physician (intrinsic/extrinsic)).

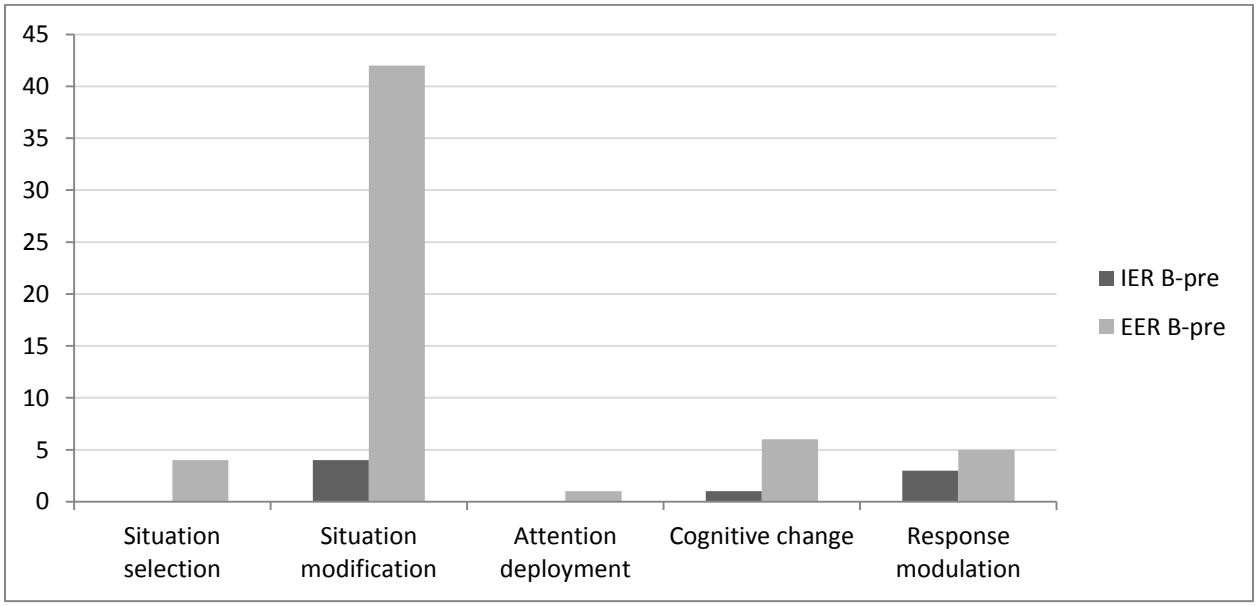


Figure 28. IER and EER strategies applied by B-pre.

As can also be seen, situation modification is the most prominent strategy applied by B-pre in order to extrinsically regulate the patient and intrinsically regulate himself. B-pre used attention deployment least in EER, and used cognitive change and response modulation at a moderate level.

Participant 2 post-test (B-post)

B-post started with a confident voice (in comparison to B-pre's initial vocal characteristics) and assured smile. He asked the patient whether she felt comfortable with the physical and technological setting, collected medical information from her, and then initiated explaining the situation: "I'm afraid it's not the best of news that we can give you". Noticing that the patient was beginning to undergo emotional stress, B-post tried to deliver manageable chunks of information to her. He looked back and forth at his notes throughout the conversation and

focused mainly on sympathizing with the patient and trying to address her emotional/instructional concerns. He ended while trying to convince the patient of the many available treatments and asked to schedule a follow up meeting soon. The utterances consisted of 67 analysis units (view Appendix 7) and were coded for intrinsic and extrinsic ER of B-post, based on verbal/nonverbal behaviours in terms of vocal features, motor expressions and action tendencies.

In the beginning stages of their discussion, B-post asked the patient whether she knew what the lump in her right side of neck could be, and she responded that if she knew she wouldn't have come to see him. B-post replied, that "it's very true" and then laughed, being surprised by her answer. This instance was thus coded as physician IER - venting of emotions due to laughing in reaction to the patient's answer. In his reflections B-post mentioned the patient's perspective as a cultural issue and demonstrated that he should be more aware of her cultural identity in further communications: "When the patient replied 'if I knew, I wouldn't have come to you', I realised how different a Caucasian patient would answer compared to her. This begged for serious consideration of her cultural identity for the rest of the session".

In a further instance B-post said: "the results came back actually, and um unfortunately they came back rather surprising" followed by the patient becoming activated and leaning in: "what do you mean?" Here it seemed that the physician had selected words to reduce the negative weigh of the information: "I'm afraid it's not the best of news that we can give you". But the patient again became activated: "What do you mean by 'not the best of news'?" Here again, the physician tried to control the situation and regulate the patient's feelings by speaking with a decreased pace and volume but reassuringly, ending with a single nod to confirm his message: "the tests came back positive for, and we are quite sure about it after rechecking, that

Miss A… has the condition known as the Hodgkin's lymphoma". This instance was thus coded as EER – Situation selection – enabling acceptance. The patient turned her head away from the doctor, and while moving her hands to explain replied: "What? A kind of cancer?" B-post replied with a low voice but confidently to help the patient accept the news. This instance was coded as EER – Situation Selection – enabling acceptance and EER – situation modification – providing empathetical support. Later raised in B-post's reflective thoughts, he said: "When the patient exclaimed: 'What a kind of cancer?', I could see the emotional change from being curious about what the lab results said to being in shock and perhaps anxious…".

While the patient was leaning on her head on her hands, silently thinking and wiping tears off her face (IER – Situation Selection – self-isolation), B-post looked at the translator and asked her to provide the patient with tissues (EER- Situation modification – providing empathical support). B-post mentioned later: "I noticed the patient was in tears and her eye contact was broken. I looked away from her face and asked the translator to give her some tissues which I thought would be useful since it is an Asian culture to be embarrassed by teary eyes and thus, would 'hide tears' despite how much they wanted to cry. I too felt the need to give the patient time while she recomposed herself, thus waited for her to speak again". This statement again confirms the coding.

In an overall perspective, B-post reflected upon his second session: "after thoughts immediately after the consultation, I felt that it went well, as I was calm and did not feel out of place, nor did the consultation halt because I didn't know what to do next. Looking at the emotional changes that the patient had, I was glad to have smoothed the process of receival, and that I have at least addressed some of her concerns".

B-post modulated his response more than any other method of emotion regulation,

specifically in order to hide his expressions. Similar to A-pre, he used situation modification chiefly to control the emotional dialogue with the patient (see Figure 29).

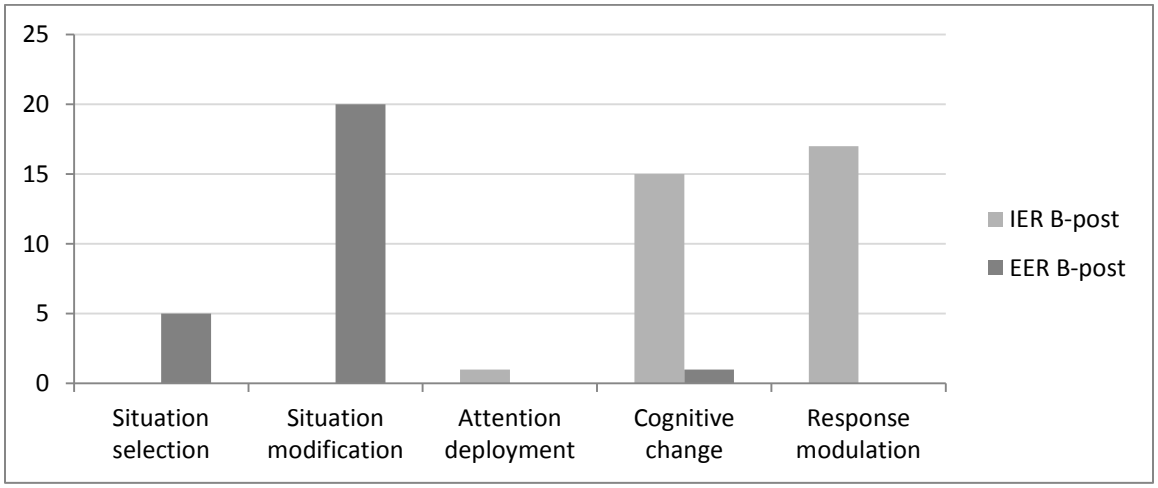


Figure 29. Intrinsic and extrinsic frequency counts of Emotion regulation – B-post

Pre-post comparison of participant B

In order to have a comparative point of view of participant B from pre to post, a quantitative frequency count of attention tendencies, voice and motor expressions was obtained. The produced graphs demonstrate the difference from pre to post. According to the frequency counts of Figure 30, it can be seen that the physician is more attentive to the patient in pre than post, while in post, he is looking for more information (at notes).

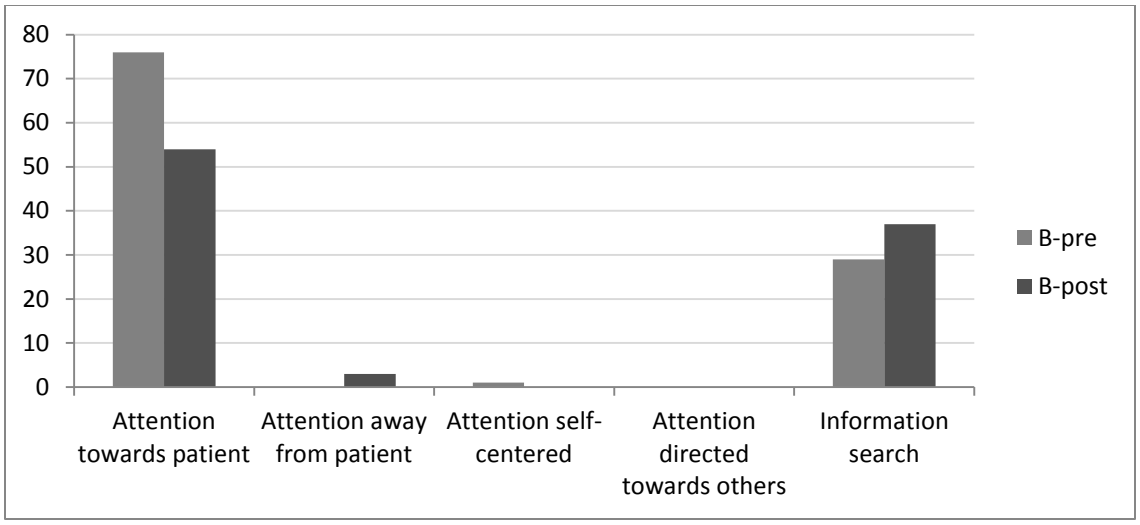


Figure 30. Attention tendencies of participant B, a comparative point of view.

Figure 31 describes voice modulation for this participant. Apparently B expresses less hesitation and lower voice pace in the post interview. As seen in the table, B-post has a greater frequency of lowering the volume of his voice in the post interview while he was sympathizing with the patient. There are also more instances of normal voice in post-test in comparison to the pre-test which infer that he had become more confident in managing the session.

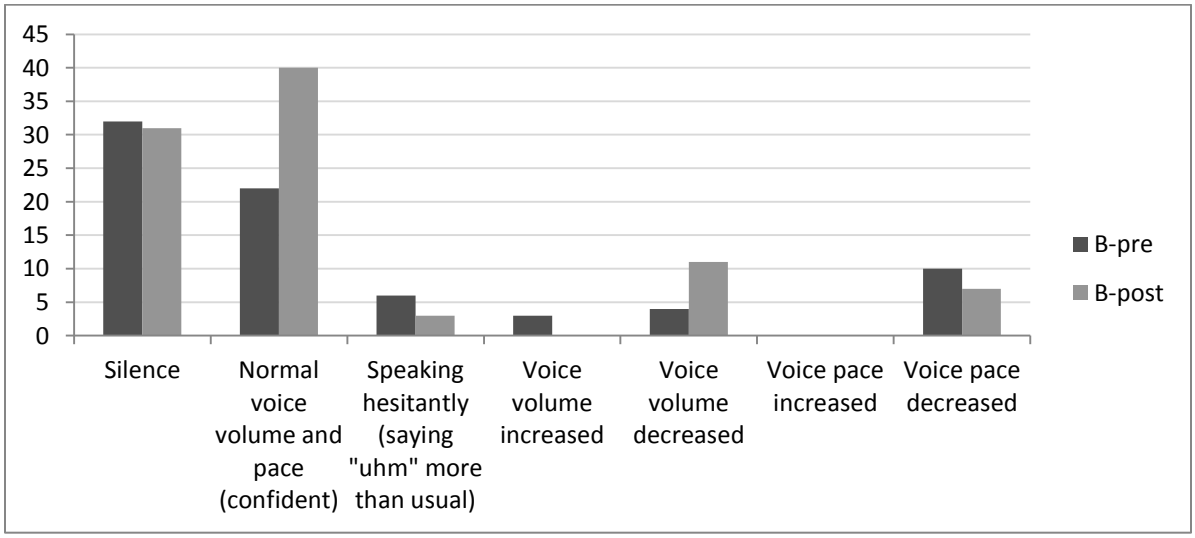


Figure 31. Voice quality of participant B, a comparative point of view from pre to post.

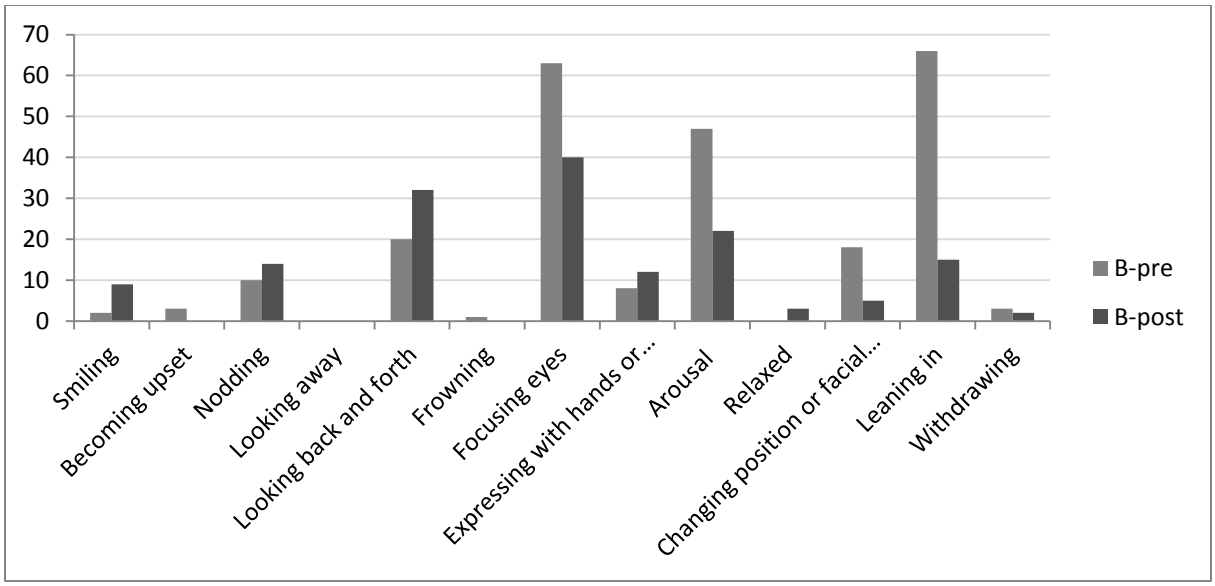


Figure 32. Motor expressions of participant B, a comparative perspective from pre to post.

Figure 32 is a rich representation of behaviour changes from pre to post. As can be seen, the level of activation in post is much less than in pre. This is also visible for the frequency of "leaning inwards to the screen" and having eyes more focused on the patient or translator. As described before, changing position which is also an indicator of emotion regulation (intrinsic) has occurred less in post than pre.

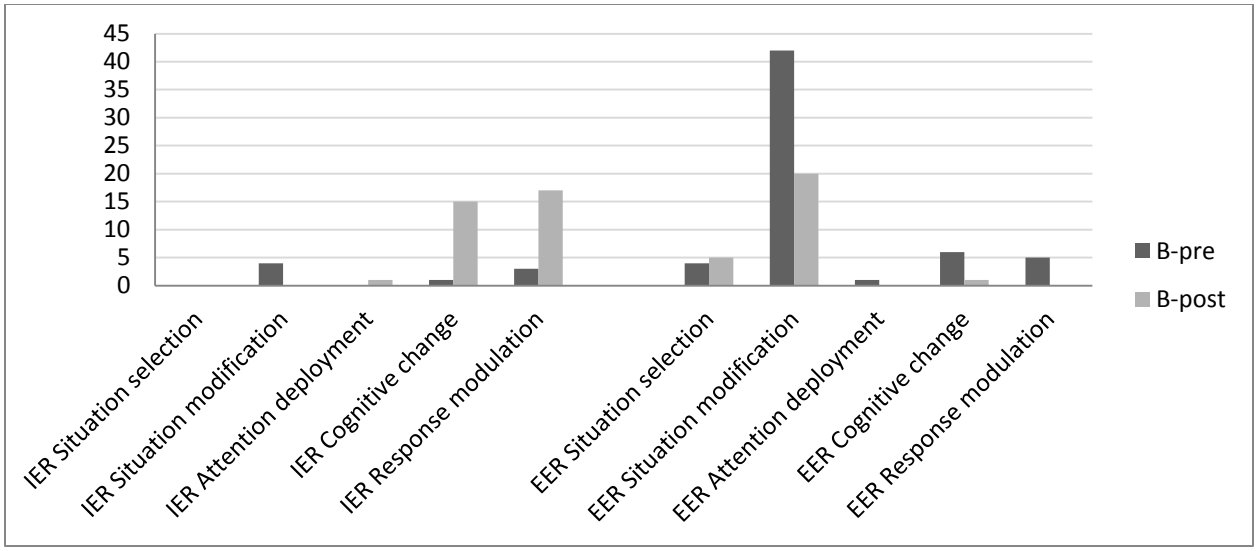


Figure 33. Frequency counts of IER and EER in participant B

Having gone through participant B, I now describe the third participant (participant C).

Participant 3 pre-test (C-pre):

The third participant was a third year male medical student from Canada. C-pre's approach towards delivery of the bad news differs from (A and B-pre). After a short introduction of why he was replaced by the patient's usual physician, C-pre dives into delivering the test results, revealing the stressful news soon after the start of the conversation (after 1:09 minutes), which made the patient shocked and start crying. This direct approach by C-pre might be due to cultural differences where C does not consider the fact that using direct statements, such as "you have widespread cancer" or "this cancer is incurable" may be seen as insensitive, rude, or uncaring (Barclay et al., 2007). Although C-pre broke bad news in the very initial stages of discussion he tried to calm the patient by giving her hope of available treatments. After several (successful and unsuccessful) attempts, C-pre finished the interview by letting the patient know that he would organize a follow-up meeting and make arrangements for what she needed to know in the coming session (refer to Appendix 8).

Taking a deeper look into the behaviours of C-pre, some interesting intrinsic and extrinsic ER instances were revealed: After the physician suddenly broke the news to the patient, he was confronted by the patient's questioning of the disease. C-pre replied with a normal tone of voice, although with hesitant expressions such as frequent um's that he was not much aware of the disease but the patient's usual physician would answer her questions once he was back. This instance was thus coded as IER – Cognitive change - Referring to others (see Figure 34).

Figure 34. Patient distressed as physician suddenly breaks the bad news.

In a later instance, the patient said she could not understand what was going on, asking the physician what he meant by her having cancer; C-pre replied briefly and continued expressing his thoughts while looking up at the ceiling (view Figure 35). This instance has therefore been coded as IER – Cognitive change – Rumination. This code is also confirmed with the post-reflections of C-pre: "[I] Broke 'eye contact' and looked up and to the right as I tried to recall information about Hodgkins Lymphoma".

Figure 35. Instance of IER – Cognitive change – Rumination.

Later as C-pre tried to regulate the patient, he suddenly moved in his seat, and asked the patient if she knows of anyone who has had cancer before. The patient asked whether he wanted to specify within her relatives and family or generally, but C-pre restated anyone in general. The patient looked like she did not understand the intent of his question, and replied that she was confused and this response made C-pre activated and lean inwards to the screen (see Figure 36). This instance has been coded as response tendencies – suppression since he only expressed non-verbal surprise, but blocked it through tranquil words.

Figure 36. C-pre leans inwards and shows activation as he tries to address patient concerns.

As the patient rejected C-pre's attempts to regulate her emotions, C-pre sank back and looked at the screen in a few silent moments. This instance was thus coded as IER – Response tendencies – restraining.

Figure 37. Physician fails to regulate the patient's emotion.

As the session ended, the investigator noted the session was difficult, and C-pre agreed and laughed (Figure 38).

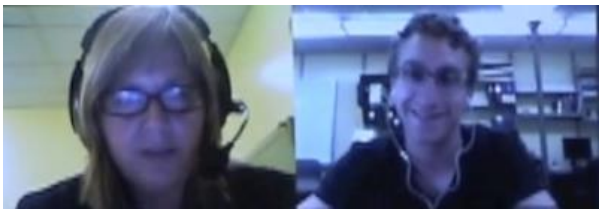


Figure 38. End of C-pre and participant laughing with relief.

Figure 39 represents the frequency counts of ER strategies applied by C-pre.

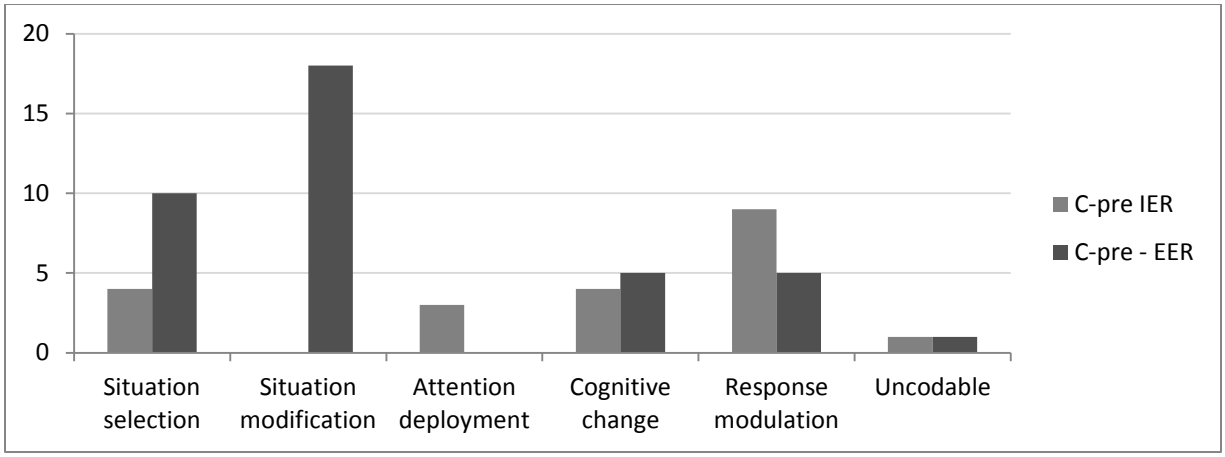


Figure 39. ER strategies applied by C-pre both intrinsically (IER) and extrinsically (EER)

As can be seen, the most prominent emotion regulation strategy applied by C-pre in attempt to regulate the patient was situation modification, whilst attention deployment is not applied at all.

Participant 3 post-test (C-post)

After the PBL sessions C-post started with more control over the session, asked the patient of her symptoms and current situation. He then told the patient that she was diagnosed with Hodgkin's Lymphoma. C-post explained the disease to her but realized from the patient's leaning away, sinking head and tears that she was under emotional stress. C-post tried to regulate patient's emotions and promised that he would soon schedule a follow up meeting. He then asked the patient if she had any specific concerns before leaving. C-post tried to speak with more precision and carefully choose his words, although he sometimes looked down at notes (view Figure 40).

Figure 40. Choosing appropriate words and next steps based on written notes.

During this scenario, C-post was more confident, and based on his reflection notes: "I can definitely say that throughout the course of this interview, I felt much, much, more at ease and in control of the discussion". The whole session was comprised of 48 units of analysis (view Appendix 9), and through taking account of a blended mixture of verbal, vocal, and motor expressions; units were coded as ER instances applied by the participant (see Figure 41). However, no novel instances of ER detection were captured in this scenario.

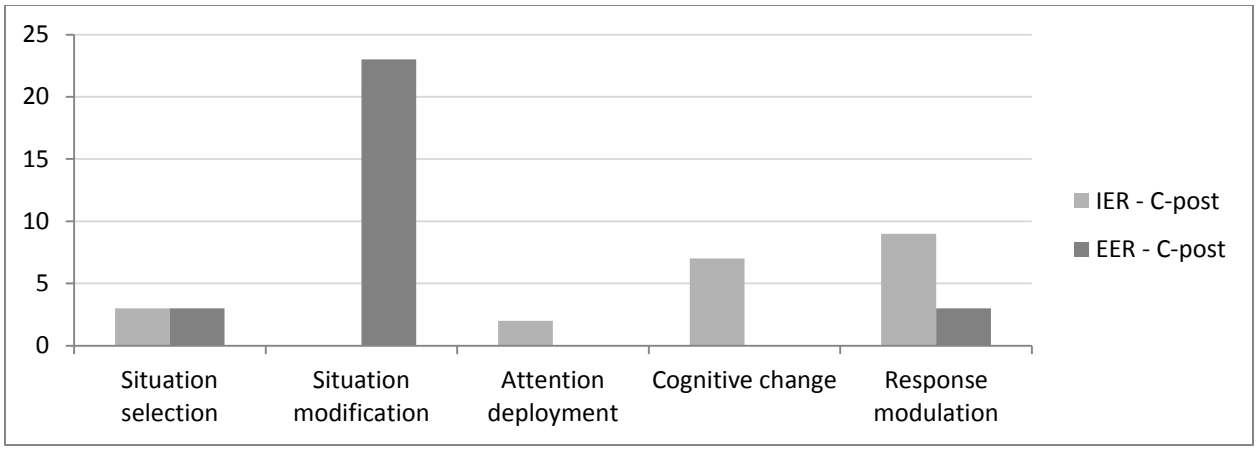


Figure 41. IER and EER of medical student C-post

Again the most predominant extrinsic ER strategy applied by C-post was situation modification (providing instructional and empathetical support). C-post used response modulation (suppression/venting) most and then cognitive change in order to self-regulate his emotions.

Pre-post comparison of participant C

Overall it seemed that E improved from pre to post in his communication strategies and expressed more concern and empathy while communicating with his patient. The following quantitative representations help demonstrate changes from participant C's pre to post in emotion expression and regulation.

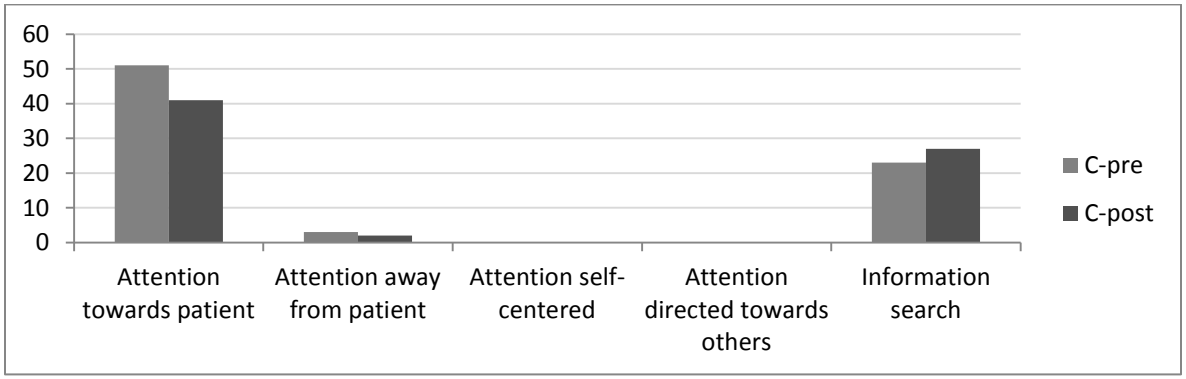


Figure 42. Attention tendencies of participant C, a comparative point of view from pre to post.

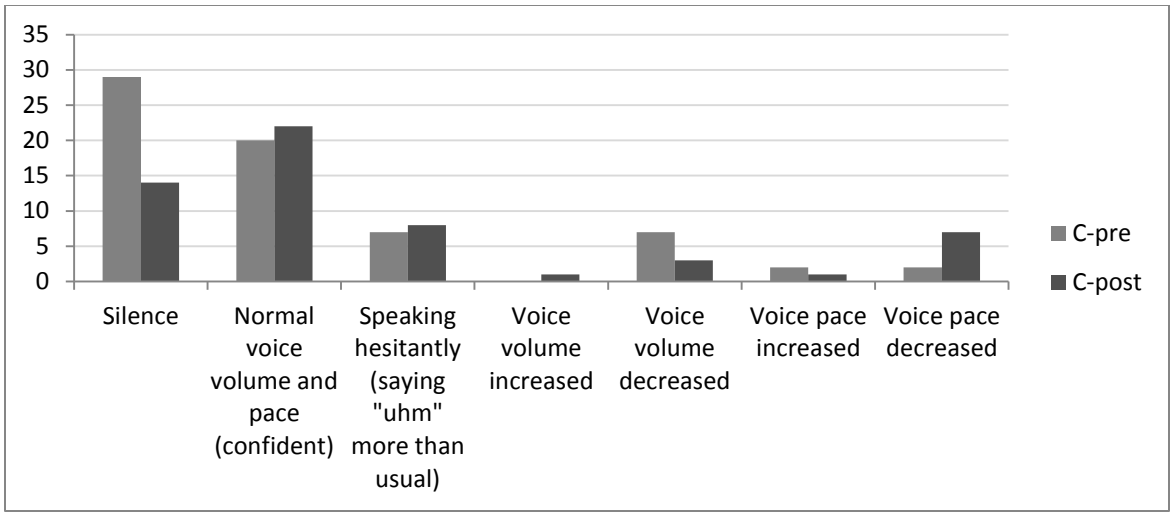


Figure 43. Voice quality of participant C, a comparative perspective from pre to post

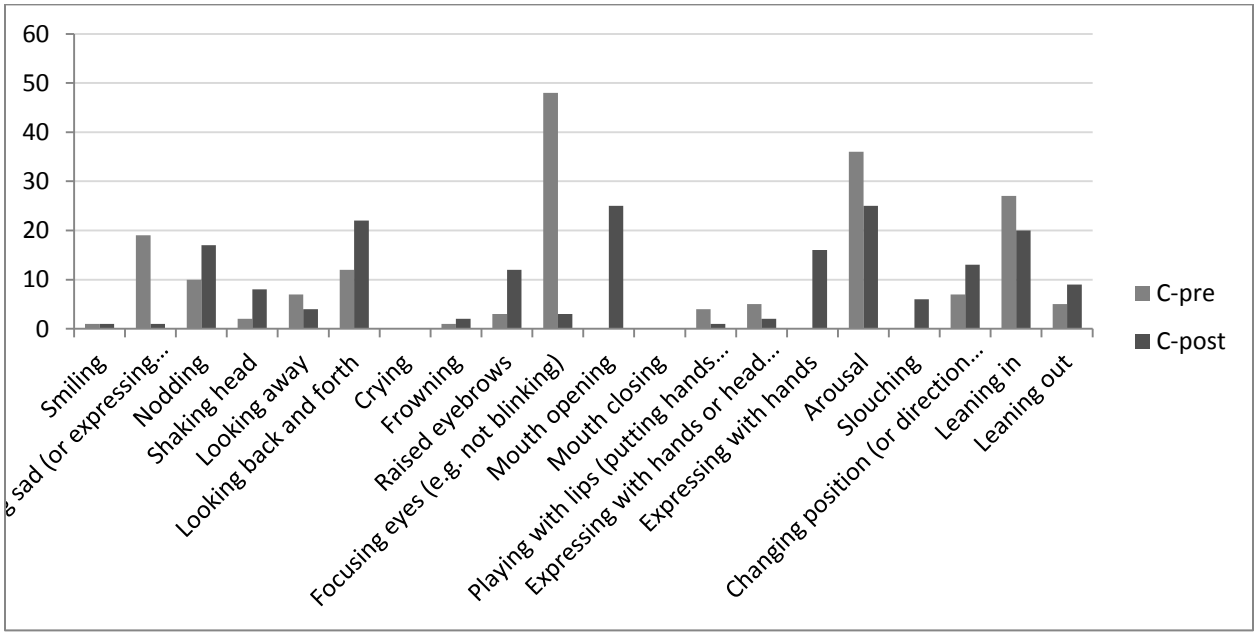


Figure 44. Motor expressions of participant C, a comparative perspective from pre to post

From the general behavior of medical student C, the number of times C is activated in pre is significantly higher than the number of times he is activated in post (view Figure 45). These changes can demonstrate that he is more confident in the post-test.

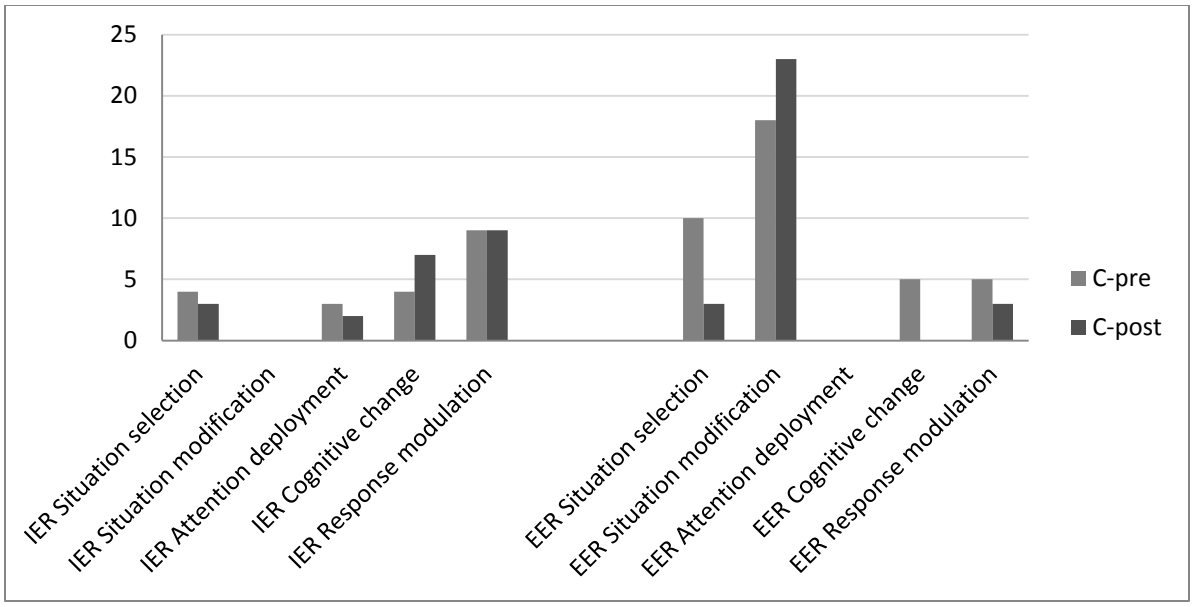


Figure 45. Pre-post comparison of ER in participant C

In the section below the last participant is presented (D-pre to D-post).

Participant 4 pre-test (D-pre)

The last two interviews (pre and post) were run by a female medical student from Canada with the same SP. Due to technical problems (audio and video not synchronous, participants speaking on top of each other and videos freezing periodically) results pertaining to posture analysis were difficult to examine. This issue was even brought up by D-pre in her post reflection: "Overall, I believe that I was not able to feel many emotions due to the technical difficulties which kept interrupting the interview. Moreover, I was not able to see the patient's emotions due to poor video and was not able to assess the patient's concerns properly due to a translator. Thus, I think that my interviews were cold and monotone". Thus results of this section (see Appendix 10) are an estimation of correspondence between audio and video data, however approved by dual coding and an interrater reliability of 68.3.

D-pre introduced herself and asked the patient about her current situation. D-pre then told the patient that she had received the biopsy results and explained it briefly. She assured the patient that the results were confirmed and she informed her of the available treatments and spoke of the quality of the hospital team. D-pre provided very few instances of emotion expression, rather she used normal voice volume, pace and tone; and/or normal posture. D-pre tended towards session closure soon but after realizing that the patient was under emotional pressure, she expressed several sympathetic phrases at the end.

In one instance, the patient put her head down and leaned her chin on her hand while attending away from the physician. She then asked D-pre how it could be possible that she was diagnosed with cancer. In response, D-pre told her with a firm voice that she needed to look through the patient's medical history and would arrange a meeting with her previous doctor. Although verbally she did answer the question of the patient, but non-verbally (vocal: normal voice volume & pace; posture: confident) her behaviour did not correspond to patient's emotional needs (see Figure 46), which as noted previously, could be because of D-pre's difficulty in connecting empathically with the patient due to technical barriers.

Figure 46. Patient in shock while physician speaking confidently and with normal voice

In one instance, the patient covered her face, sank in the chair and spoke with a low paced, low-volume voice: "I can't believe that I have this disease, that I have got cancer. I can't believe it". D-pre replied: "I know it's a very difficult situation. I can understand that. We, very fortunately, we have an excellent team to deal with this and we have very good doctors. This is a

good hospital to treat this type of disease". Looking only at verbal utterances of D-pre, may allow us to conclude that patient needs were satisfied, but paying attention to D-pre's paralinguistics (normal voice volume and pace) and neutral facial expressions, this instance was coded as an unsuccessful EER attempt to provide emotional support (View Figure 48). In other words, D-pre verbal utterances, posture and attention corresponded with the patient's *cognitive* needs, but since her voice was strong and uttered in a normal tone it made the overall conversation less consistent with the patient's *emotional* needs.

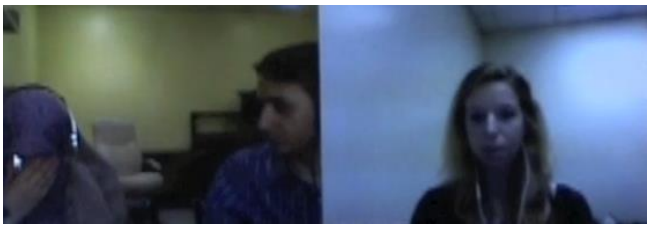


Figure 47. Physician's verbal utterances do not match with her vocal expressions in order to regulate patient.

Although generally D-pre did not show as many compassionate reactions, at the end of the session there were a few instances of empathizing. For example, after reminding the sad patient of the many treatments available, the patient paused, silently nodded and only said "ok". D-pre realized patient's depression and sympathized with her: "Can you ask the Patient if she has any questions? I would like to answer any questions patient has … [raising eyebrows, leaning slightly to left, voice pace increased]", which has been coded as EER – modifying situation – providing instructional and empathetical support. However, the patient replied that she needed time and wanted to think about the whole issue alone, coded as patient IER – situation selection – self-isolation, which disregards D-pre's attempt to calm her. Thus D-pre declined her head and

changed her normal tone of voice to a sympathetic low-volume voice and said: "…I am sorry and I know this is a very difficult situation for you".

A quantitative review of her emotion regulation strategies is provided in Figure 48.

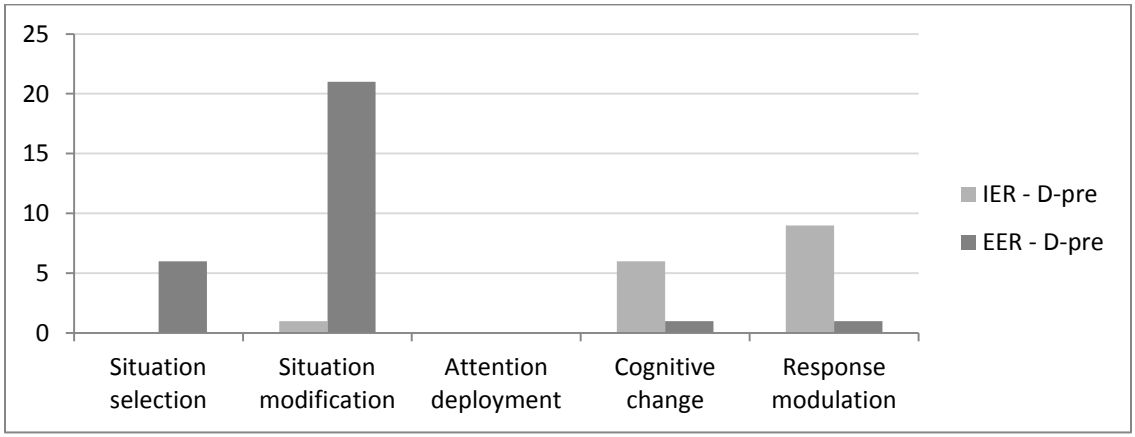


Figure 48. ER strategies applied by D-pre both intrinsically (IER) and extrinsically (EER)

The most prominent emotion regulation strategy applied by D-pre is situation modification. She used response modulation frequently and suppression was her most dominant IER strategy.

Participant 4 post-test (D-post)

Similar to the other medical students D-post managed the second session with more confidence. She welcomed the patient with a warm smile and asked the patient what her reason was for her original referral to doctor. After gathering information and noticing that the patient had no idea of the diagnosis, D-post informed the patient that the biopsy results were obtained and without mentioning any stressful concepts (i.e., cancer, Hodgkin's Lymphoma, disease) she gradually told the patient that there were abnormalities in her body. D-post paused after she administered small chunks of news and allowed sufficient time for translation (view table x for the complete verbal transcription of the bad news delivery and Appendix 11). D-post assured the

patient that there were many treatments available and the disease was not lethal (in response to the patient asking whether she would die). D-post spoke firmly but slowly and was concerned that the patient could understand her medical situation. As D-post was explaining the disease, the patient gradually sank into herself and expressed depression. But unlike the pre-test, D-post showed sorrow and sympathized with the patient. The session reached its end as D-post organized a meeting soon, emphasizing a family member to accompany the patient.

A CORDAVAM diagram is presented (refer to Appendix 12) to provide a general layout of the behavioural aspects and ER codes of this consultation. The consultation was comprised of 82 units of analysis that were coded for action tendencies, vocal, motor expressions and intrinsic/extrinsic ER instances. Following is a brief explanation of coding interesting ER instances in this participant.

After gathering information from the patient in terms of any new symptoms, or whether she was told why her previous doctor had taken a biopsy of her neck, D-post looked at her notes, leaned inwards and introduced the negativity of the results: “Unfortunately, I don't have very good news”. D-post clearly and fluently explained that there were abnormalities in the blood cells, but she became hesitant and activated, and looked back and forth as she mentioned that these were tumor-type abnormalities. This instance was thus coded as IER – cognitive change – rumination.

As D-post explained the good prognoses of the disease, the patient asked what would happen to her after the diagnosis. Here, D-post became activated, leaned in and frowned but spoke with the same level of volume and pace to identify what the patient exactly meant by her question. D-post’s normal voice and activated posture indicate an instance of IER – response tendencies – restraining.

Later in the final moments of the interview the patient asked D-post whether she had anyone who was cured completely. D-post raised her eyebrows, leaned in, attended directly at the patient and hesitantly said: “Get well completely? This, euhm, it its uhm...I mean that uhm...”. Here again the physician seems to be regulating her emotions via response tendencies – restraining, since she later on vents her emotions of surprise and ambiguity as she continues: “I don't know how to define get well completely” This second instance has been coded as IER – response tendencies – venting of emotions. The patient further explained whether there was a participant that had been cured completely and in response D-post became shortly silent, sighed and replied with a low pace and while initially hesitant: “To be honest, the complete cure, it, it occurs, but it's not that common”. This instance was thus coded as IER – cognitive change – rumination, IER – response modulation – suppression and EER – situation modification – providing instructional support.

Following is a quantitative analysis of the frequency counts of intrinsic/extrinsic emotion regulation strategies applied by D-post.

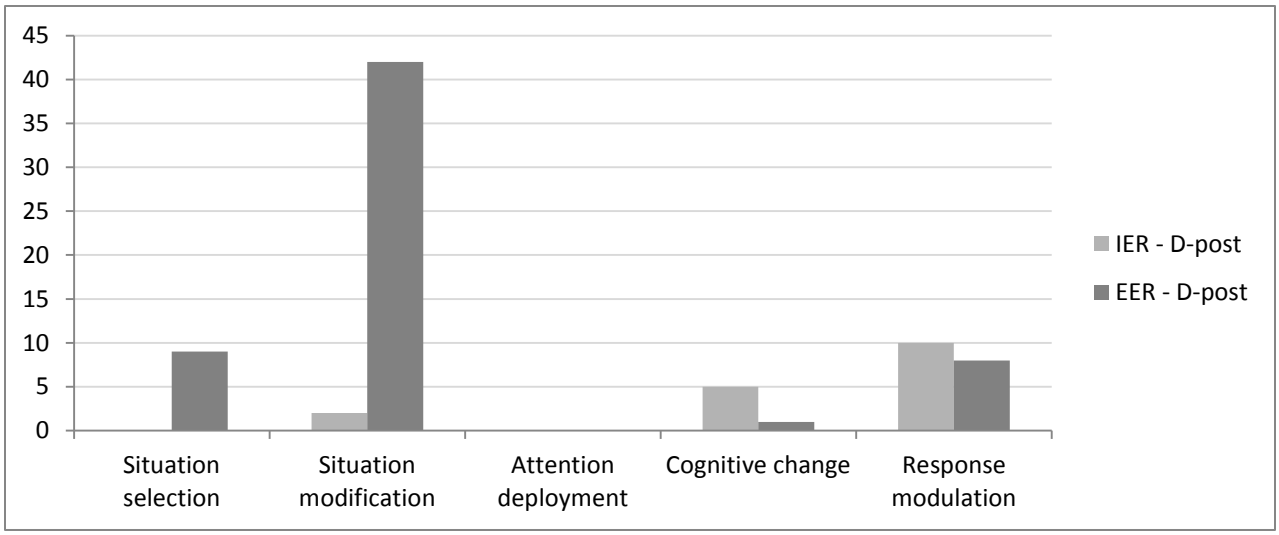


Figure 49. IER and EER of medical student D-post.

Pre-post Comparison of Participant D

Overall D-post revealed more nonverbal expressions e.g. nodding, shaking head, raising eyebrows, leaning inwards (view Figure 50), in comparison to D-pre that shows her effort to express feelings toward her patient.

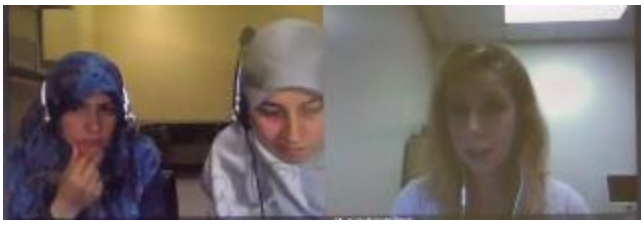


Figure 50. D-post raises eyebrows, leans in and speaks with a low-volume voice as she begins to explain the results.

Following, I will provide quantitative analyses that help demonstrate changes from participant D's pre to post in emotion expression and regulation.

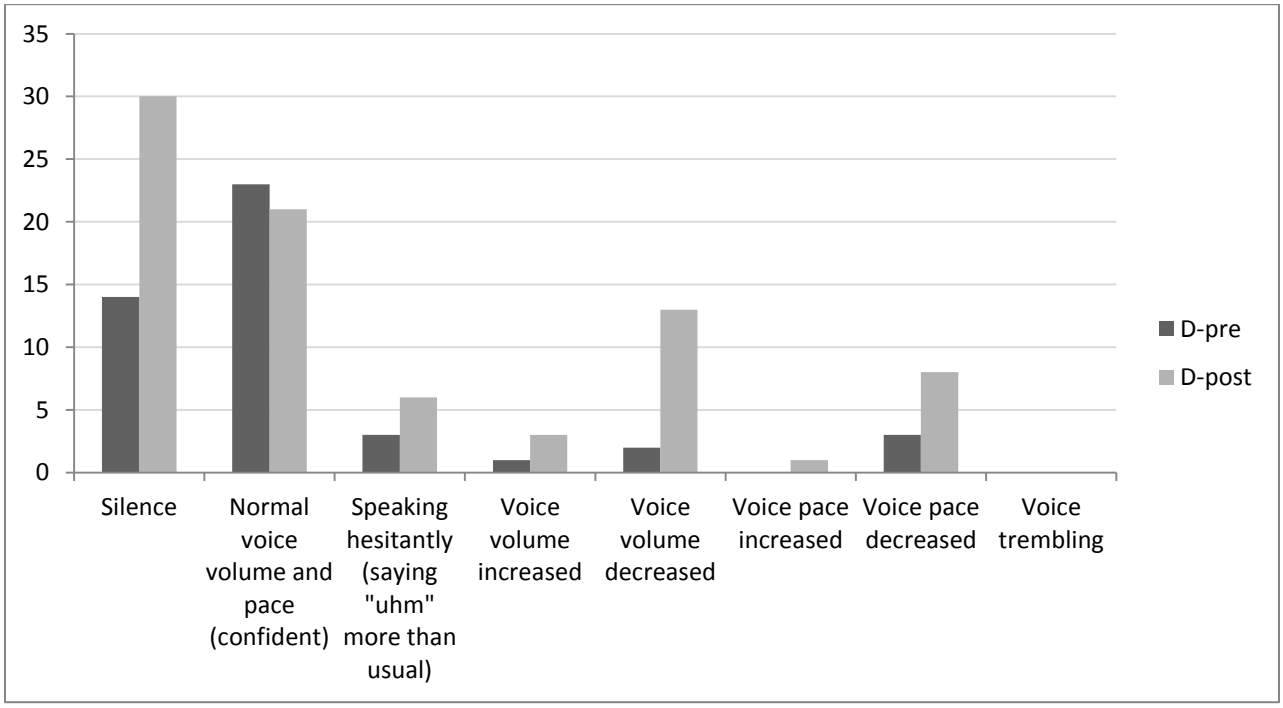


Figure 52. Voice quality of participant D, a comparative perspective from pre to post.

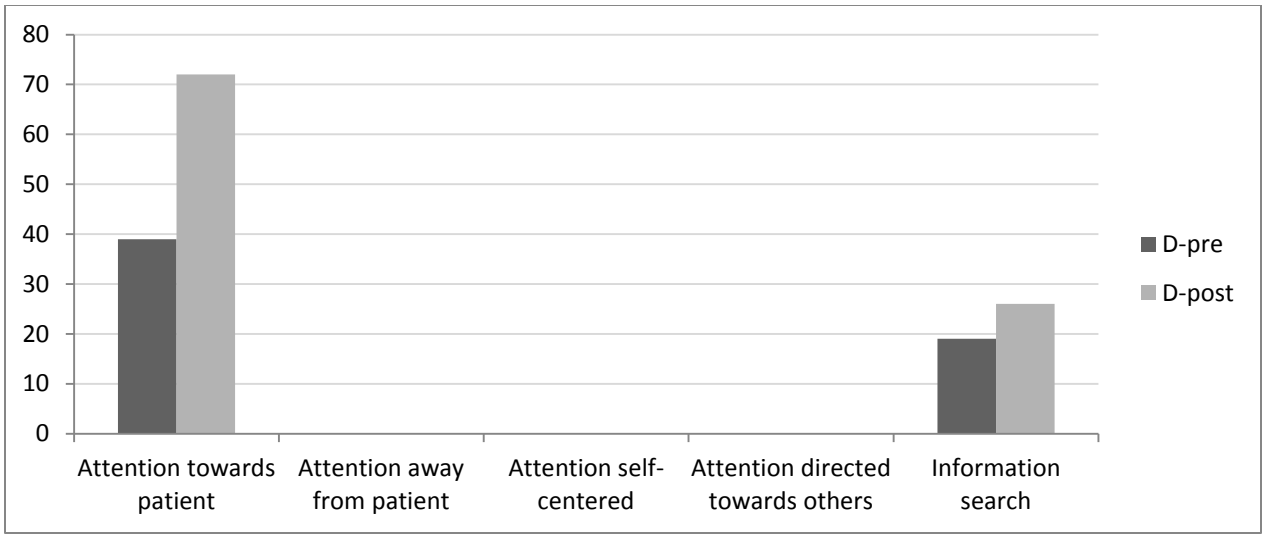


Figure 51. Attention tendencies of participant D, a comparative point of view from pre to post.

It is interesting to see that D-post is expressing more instances of hesitation in speech, decreased voice volume (due to sympathizing/rumination), and decreased voice pace. This is again in concordance with D-post's goal to externalize emotions. She is also more silent and allows patient to express her feelings more.

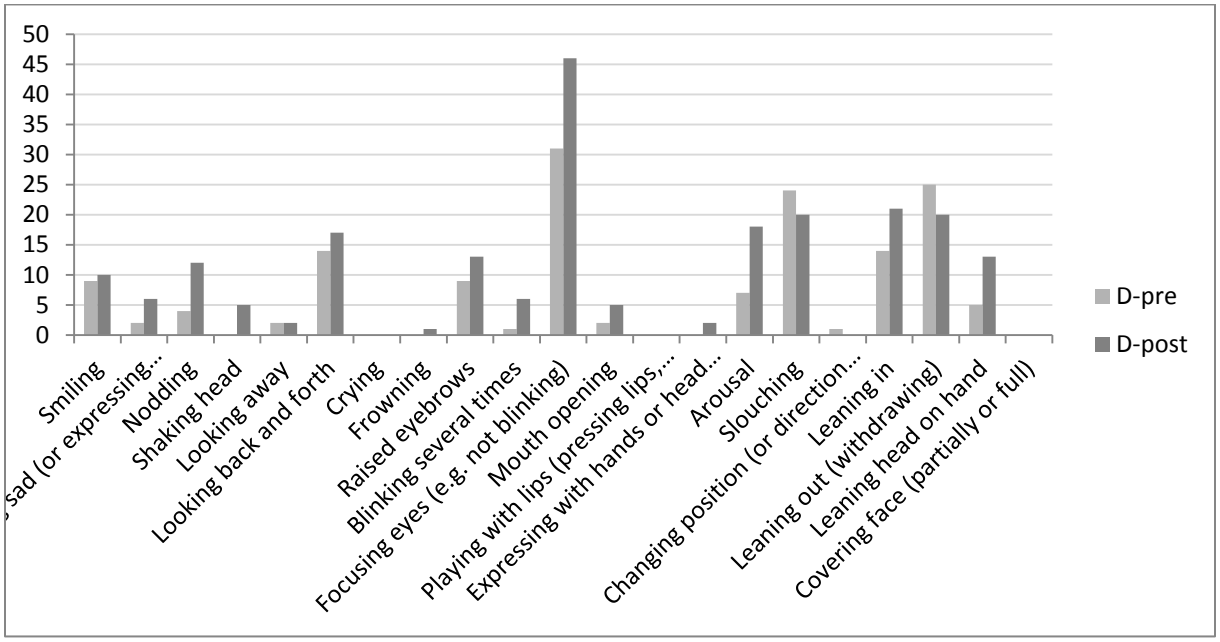


Figure 53. Motor expressions of participant D, a comparative perspective from pre to post

As can be seen in the graph, nodding and expressing sadness are more frequent in post than in pre-test, which show that D-post attempted to express more of her feelings to sympathize with the patient. Activation, leaning in and focusing eyes have also occurred more in post than pre, which show that the physician was trying to show her attention to the patient.

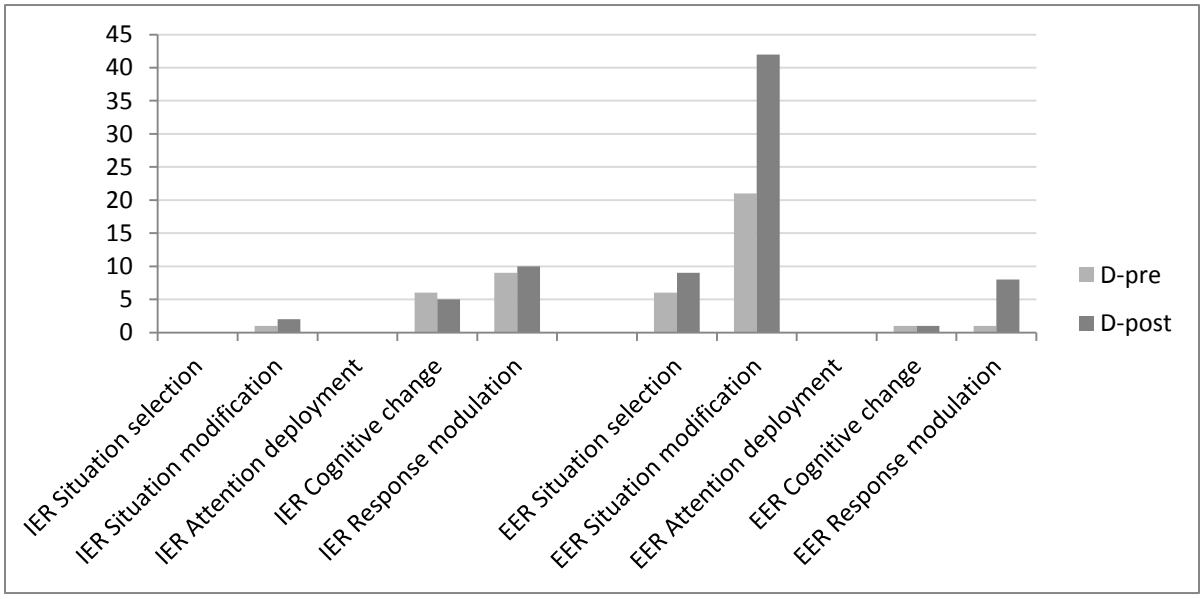


Figure 54. Comparison of IER and EER strategies of participant D

Hereafter I provide a cross case comparison of different channels of emotion expression, followed by a cross-case analysis of the ER strategies used across the participants.

As can be seen, all participants focused mainly on the patient, followed by a strategy where they shift attention toward information search. Information search is more frequent in post than in pre of all participants.

Table 4

Time used to deliver bad news from initiation to explanation and closing the session in pre and post-intervention stages

Medical Student	Initiating the session		Explaining bad news		Closing the session	
	Pre	Post	Pre	Post	Pre	Post
A	02.07	03.32	07.30	4.54	01.01	02.01
B	02.24	04.43	11.51	4.44	03.56	03.27
C	01.09	01.06	09.23	06.39	03.01	01.32
D	01.07	04.16	04.18	05.45	03.58	08.16

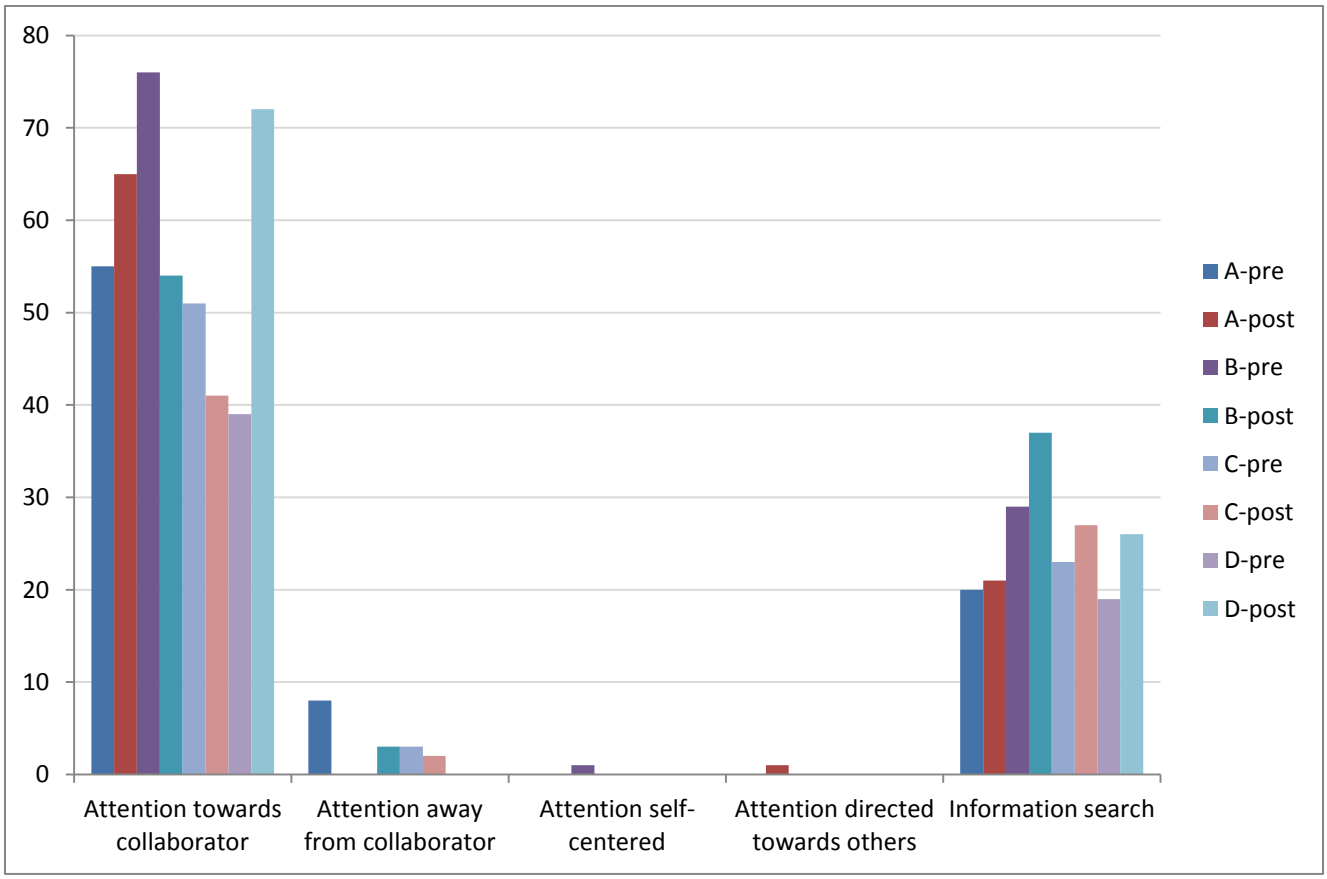


Figure 55. Cross-case comparison of attention tendencies.

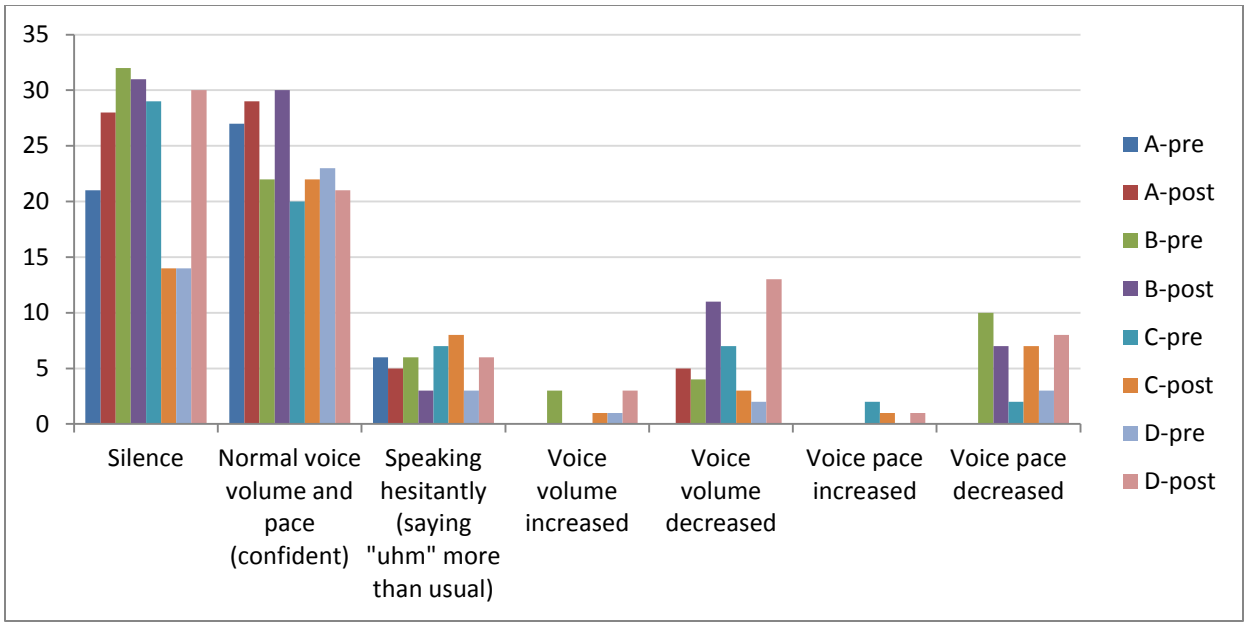


Figure 56. Cross case comparison of vocal characteristics

Based on Figure 56, fewer instances are coded for voice volume and voice pace *increase*, while voice volume and voice pace *decrease* have more often been observed. Hesitation in speech is more in A-pre and B-pre than A-post and respectively B-post; but C-post and D-post have more hesitation than C-pre and D-pre.

Figure 57 shows a cross-case comparison of motor expressions. It is interesting to see that nodding and looking back and forth have increased from pre to post in all participants. Activation and leaning inwards have decreased from pre to post in three participants, except for participant M, which expressed more in post.

Cognitive change has decreased from pre to post in all four participants, however response modulation has increased (mainly suppression) from pre to post. Situation selection and modification have also mainly increased from pre to post.

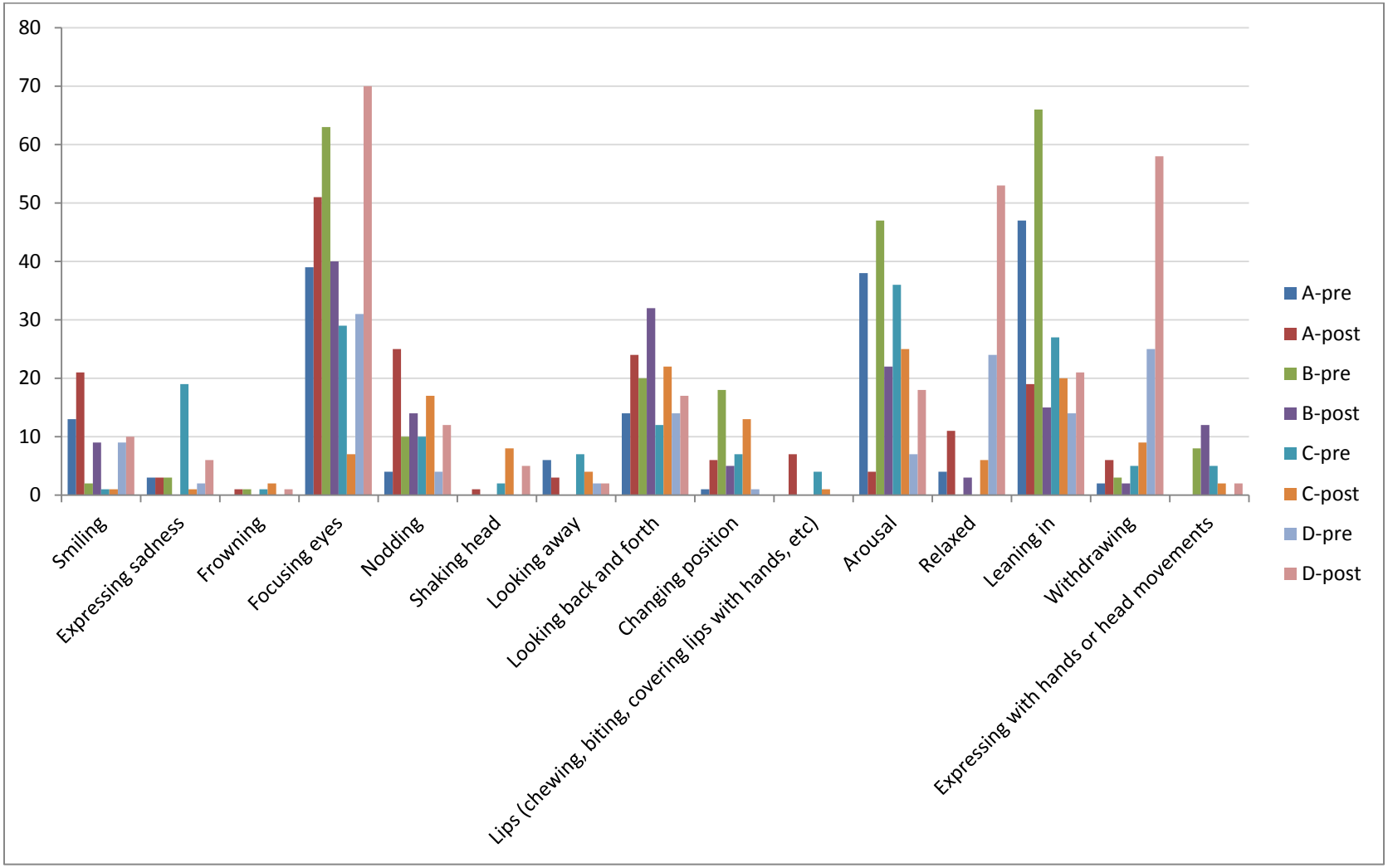


Figure 57. Cross case comparison of motor expressions.

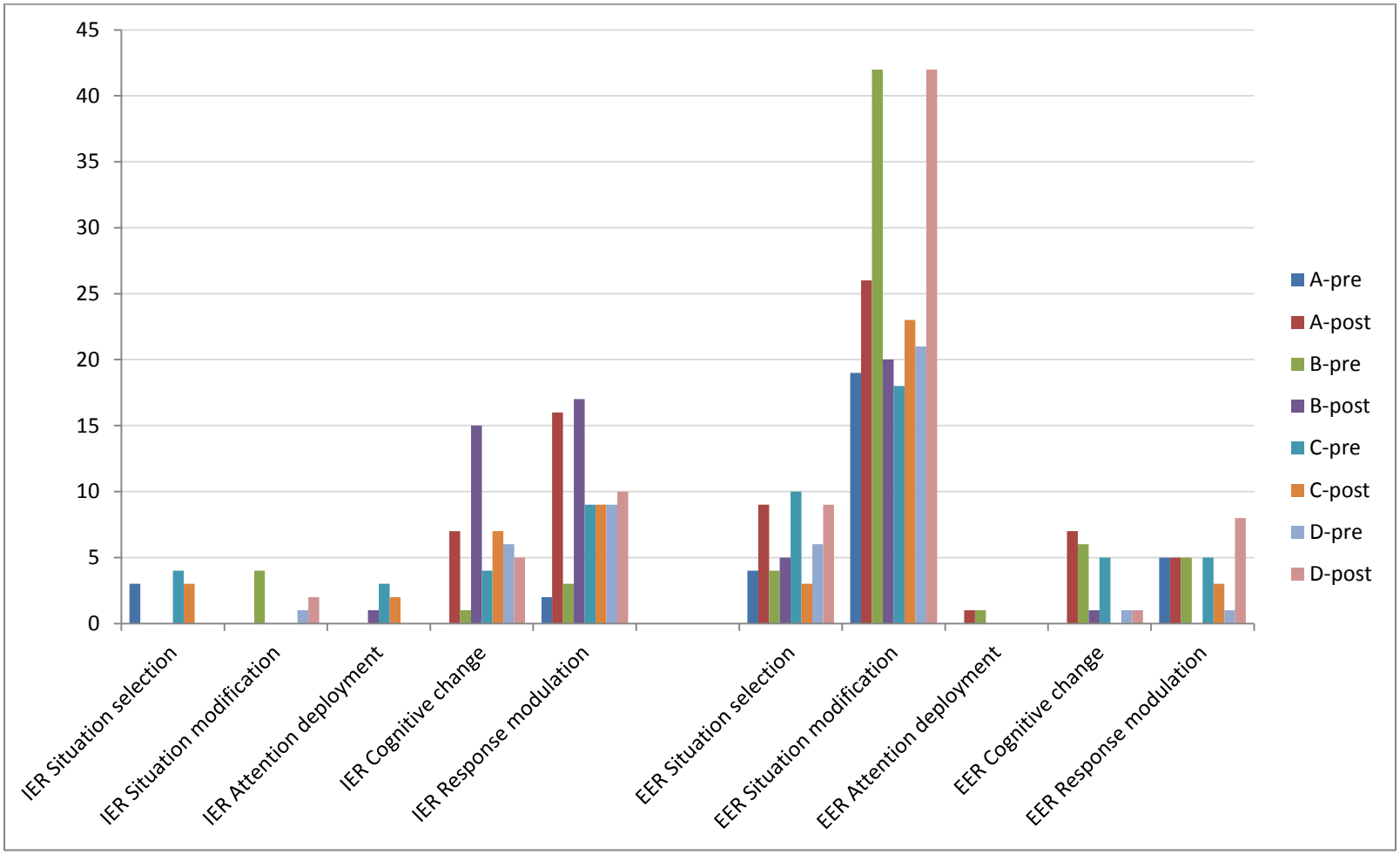
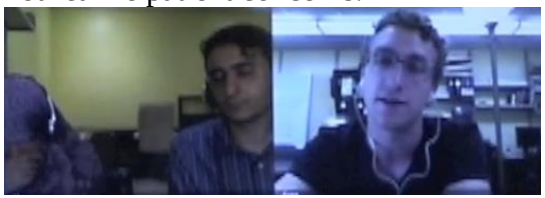
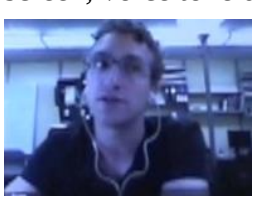
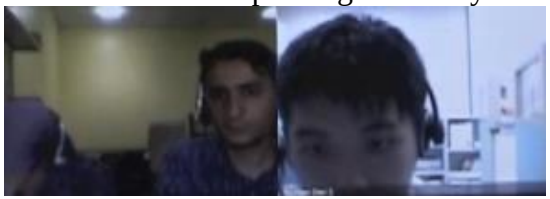


Figure 58. Cross case comparison of intrinsic (IER) and extrinsic (EER) emotion regulation strategies.

Table 5

Summary of emotion expression channels (verbal, vocal, behavioral) indicating evidences of IER

IER Situation selection	Denial	Physician leans back while smiling and confidently speaking. He assures SP that this is not the case and she won't die of the disease. He denies the stressful situation and does not realize patient concerns. 
	Acceptance	Physician has realized the stressful situation: voice volume and tone decrease, face looks sad and attention tends towards information search 
	Behavior disengagement	Physician relaxes after transferring info to patient, he looks down at notes and drinks water while calmly waiting for translation (disengaging in regular behavior which was concentrating on patient while leaning in and activated) 
	Self-isolation	NA

	Planning	Attention tendencies towards information search, eyes focusing elsewhere than the main screen, voice tone decreasing, leaning outwards  
IER Situation modification	Seeking instructional support.	Looking back and forth, voice volume and tone decreasing, speaking hesitantly; e.g. yeh sure, um, um, I can … yeh, yeh, there is still a lot of time for you …"  
	Seeking empathical support	Becoming activated, looking surprised and sad as patient starts crying, voice volume and tone decrease and speaking hesitantly 

IER Attention deployment	Distraction.	Not looking directly at the patient while revealing the unfavorable news  Ok, so um [looking around] unfortunately um the result is um comes out that you have a dis…ease". In this example A looked down and to the side while (un)consciously not looking directly into the screen.
IER Cognitive change	Optimistic refocusing.	The SP thanked the physician for his understanding and he smiled with satisfaction saying: "You are welcome. It is my pleasure to work along with you…." Here the physician reappraisd the situation positively and smiled although the situation was yet stressful.  Self-reflections: "When the patient said thank you, I thought the patient can feel my support and I found a sense of satisfaction".
	Positive reappraisal.	Nodding, smiling and changing position: "Actually, I've noticed um Miss A… do you um you do know some sort of, like your English is still ok, like you can understand what I am saying, can I? Is that right?" 
	Catastrophizing	NA

Rumination	Also confirmed via self-reflections, physician “broke 'eye contact' and looked up and to the right as he tried to recall information about Hodgkin’s Lymphoma”.  The physician responded: “Well um for this sort of lymphoma, um there are standardized treatments for it…and we will try our best to provide our care to you”. Since the physician was activated, speaking with a low pace and volume as if he were processing what to say while speaking, and since he looked back and forth at the screen this instance was coded rumination.
Self-blame	Looking away, changing position on seat, slouching, pressing lips together, raising eyebrows “After enquiring the whereabouts of the patient's family (father? mother? sons? daughters?), I realised the patient's emotional state worsens, only learning that she is separated from her love ones alone in Canada. I shouldn't have been specific by asking for specific members of the family as it could draw back poor memories. An more appropriate way would be to ask "Is there anyone close to you that you can talk to?"
Blaming others/Referring to others.	“Well, its um Hodgkin Lymphoma, and actually it’s not my particular area of expertise. Her usual physician will be able to meet with her um, again once he or she is back, and he will be able to provide you with more information”
Putting into perspective	NA

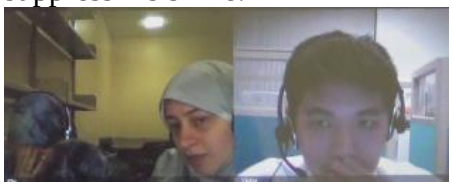
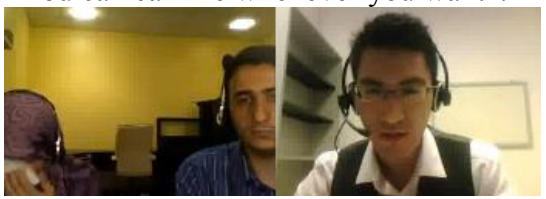
IER Response modulation	Venting of emotions.	Showing confusion when patient does not respond as predicte: A-pre showed expressions of surprise (as he leaned back and raised his eyebrows, saying oh).  
	Restraining	Physician holds back until the session is ended and then expresses his emotions. 
	Suppression.	As seen in reduced playback speed of the video, physician covers lips in order to suppress his smile:  Physician expresses surprise of patient's response, leaning in and raising eyebrows, becomes silent shortly and starts to speak with hesitation. Expression of non-verbal surprise, but blocking it through tranquil words: 

Table 6

Summary of emotion expression channels (verbal, vocal, behavioral) indicating evidences of EER

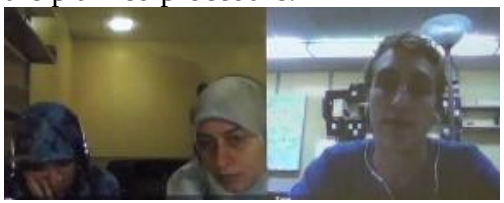
EER Situation selection	Enabling acceptance.	"I understand that this can be um, a very um difficult to process, digest and understand.. And it is important to accept that this is the situation and this is what it is! But that there are things that can be done and as a team we will find solutions to treat this and maybe get through it".
	Keeping appropriate distance	Providing a short silence during the session, and time to think alone after the session; e.g. "I think you need time to digest the news"
	Arranging privacy	Inhibiting from looking directly at patient's face when s/he is trying to isolate or is feeling uncomfortable. 
	Warm greetings.	Smiling, taking time to introduce, ice-breaking and building mutual trust 
EER Situation modification	Referring causality away from patient	"Is this something that I could get from my husband?" "Well, no, we were not, eh, you know, we don't actually know where you've had it from, but we normally eh, have some things we'd like to talk about in terms of how it's transmitted".

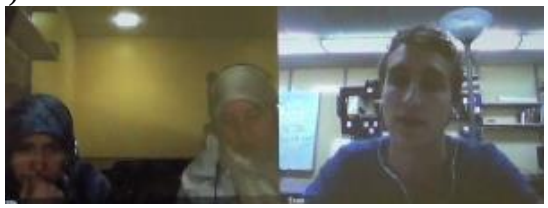
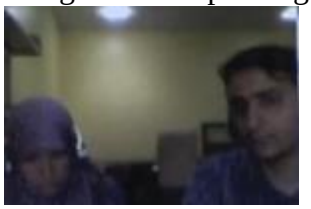
	Putting into perspective.	"For example , if patient had friends who had like um some kind of in-operable brain cancer, with very different situations, while there are treatments that are um, available for Hodgkin Lymphoma and that isn't necessarily mean that patient is going to die or go through the same path".
	Turning to religion	NA
	Planning	"At the moment I think you can try to talk with your husband about this disease, and also we can arrange some follow ups…"
	Providing instructional support	"I will explain the details to you".
	Providing empathical support	"But please don't be afraid". "You can call me whenever you want".  While patient is crying, physician asks translator to give her tissues and tells the patient "don't worry, the disease has very good prognosis and we will be with you the entire way" The patient then assertively spoke while looking away from the screen: "I am very young. How can this happen to me?" Here, the physician leaned inwards again and as he was activated (eyebrows raised) and expressing sadness, replied with a low pace and volume: "Yes this is very difficult to accept, but at least I can say because you are young, there will be more treatment option for your disease". This instance has thus been coded as Situation modification – providing empathical (and instructional) support.
EER Attention deployment	Distraction	"Maybe we can talk about the biopsy a little bit later".

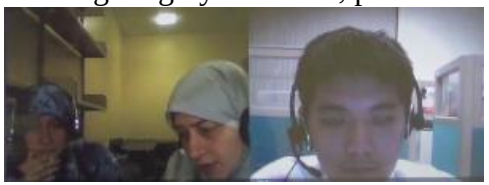
EER Cognitive change	Positive reappraisal	[trying to calm activated patient:] I want to know your current situation first, before we talk about the results
	Rumination	so do you have any special expectations for this biopsy?
	Easing venting of emotions.	Responding attentively, with care and empathy "Please let me know if you have any other concerns"
EER Response modulation		"I have children" "You do? How old are they?"
	Easing suppression of emotions	Its ok, don't worry too much this disease has very good prognosis and I will be on your side to help you treat this disease, so don't worry
	Enabling suppression of competing activities	NA

Table 7

Summary of emotion expression channels (verbal, vocal, behavioural) indicating evidences of ER for patient

Situation selection	Denial Acceptance	"I can't believe this has happened to me, I'm very young". patient nods although sadly after a long while of denying the situation, when listening to the planned procedure. 
	Behavior disengagement.	Not reacting to what physician says and being quiet: 
	Self-isolation.	Patient moves away from screen  Another example is when physician asks patient: "You are still crying. Is there any way in which I can help you?" and patient responds that "No I just need some time to think about it".
Situation modification	Planning-cognitive	"I need to go home and think about it"
	Seeking	"What should I do now?"

	instructional support	
	Seeking empathical support	Looking distressed but towards doctor rather than looking away (which was more often after receiving bad news)  
Attention deployment	Distraction	Not looking at doctor or trying to change center of attention
Cognitive change	Optimistic refocusing	NA
	Positive reappraisal	NA
	Catastrophizing.	Patient responds assertively while shaking head as her doctor tells her this disease might have a genetic cause: “no one has this in the family”
	Rumination	being silent or speaking with low pace, focusing eyes 
	Self-blame	NA
	Blaming others.	Assertive voice, activation, leaning in “Is this something I could get from my husband?”
	Putting into perspective	NA

Response modulation	Venting of emotions	Any expressions of emotional behavior 
	Restraining.	Although highly activated, patient does not speak or express feelings: 
	Suppression.	In this instance although patient replies back to the physician “thank you” after physician showing his support, but her non-verbal behaviours indicate that she is still worried and is “suppressing” her thoughts and feelings: 
	Suppression of competing activities.	Patient does not speak while physician tries to calm the situation. After 55 seconds of silence, she says: “What's going to happen to me? What are the side effects of that disease? Can you explain more?” This means that she is focusing on this topic and thinking about it rather than neglecting it.

CHAPTER 4

DISCUSSIONS

The objective of this thesis is to provide methodological perspectives to better detect regulated emotion, those that we consciously or unconsciously exhibit while adapting ourselves and others in an emotion provoking situation. This research examines ER in medical students and identifies methodological approaches for assessing ER within a social and intercultural TRE. In particular, the methodologies are designed to identify how medical students regulate themselves and their patients when communicating bad news in a culturally-diverse multilingual technology-based environment.

This thesis addressed the following research questions: (1) How is (un)conscious *intrinsic* emotion regulation of physicians captured in an emotional dialogue such as bad news delivery?; (2) How is (un)conscious *extrinsic* emotion regulation of physicians captured in an emotional dialogue such as bad news delivery?; and (3) Do ER strategies (applied by the medical students) change from pre to post as a function of the PBL intervention stages?

This chapter is divided into four sub sections. The first two sections address the research questions and provide an interpretation of the findings. These interpretations are described in terms of Gross and Thompson's (2006) ER model and document the ways in which observational methods can be used to capture ER. The third section describes the potential limitations of this thesis and the fourth section summarizes the theoretical and methodological contributions of this thesis followed by the last section that describes the future directions that stem from the research findings.

Research Questions 1 & 2

The first two research questions explored the (un)conscious intrinsic and extrinsic ER of medical students using observational approaches. Mayer et al. (2001) proposed that emotion recognition occurs prior to emotion regulation because regulation is only possible after recognition has occurred. In other words, emotion recognition is a prerequisite to emotion regulation. However, emotion recognition does not necessarily have to be a precursor in detecting ER (Campos, Frankel, Camras, 2004). In this study we saw that instances of ER application were identified, without attempting to distinguish the emotions participants experienced. As an example, A-pre tried to distract himself (by shifting gaze to another point away from the patient (and translator) when delivering bad news to the patient. That situation was an instance of ER-attention deployment even though we were unable to assess the emotions the physician was experiencing at that moment. The emotion generation model of Gross (1998) can better explain this claim. According to this model, ER occurs in five stages, in which four stages are antecedent-focused (prior to activating emotional responses) and the other stage addresses emotional response tendencies that have been activated and/or expressed. Therefore, four types of ER strategies are derived before an emotion is actually elicited (experientially, physiologically and/or behaviorally). As a consequence, only response-focused ER strategies may be detected from elicited emotional responses, and the former four strategies (i.e. situation selection, situation modification, attention deployment and cognitive change) cannot be identified based on recognition of an emotion. In fact, it may not even be possible to recognize ER from emotions that have not been activated yet. Gross and Thompson (2007) explains that anticipated (future) emotional responses yield

to antecedent-focused ER strategies. For example, the *probability* of becoming more anxious when concentrating on a specific scene with the patient, will lead A-pre to divert attention to a point external to the scene or the person in order to reduce *anticipated* emotional burdens. In consequence, although A-pre has not yet experienced the anxiety, he has applied an ER skill, specifically in the form of an antecedent-focused strategy, in order to weaken the possible emotional pressure. Therefore apparent "two-step manifestations of emotion then regulation" (Campos, Frankel & Camras, 2004, p. 379) should not be considered as the exemplar to ER application and detection. Two-step processes of ER; e.g. becoming anxious then drinking water, are actually only part of the whole process of emotion regulation strategies.

The idea of independence of ER detection from emotion recognition can also address another issue that pertains to the validity of ER detection methods. If ER strategies are detected in relation to emotional experiences, they will have double-fold imprecision assuming emotion (being an indeterminate construct) is the precursor to ER. However, as previously explained, four ER types are applied prior to emotion generation and thus cannot be invalidated due to initial emotion recognition inaccuracy. Therefore, only response-focused strategies that are determined from changes in emotional behavior might have the issue of double-fold inaccuracy (i.e. emotion inaccuracy embedded in ER inaccuracy).

This research demonstrates the benefits of using a combination of observational methods to reveal instances of ER. These analyses reveal four methods of capturing ER through: (a) changes in emotion relative to regulatory behavior; (b) unexpected emotions; (c) dissociation between emotion channels; and, (d) use of multiple emotion channels to

demonstrate emotion regulatory responses. The rest of this section aims to elaborate on these methods.

Changes in emotion relative to regulatory behavior. This method was used to analyze changes in emotional states. An example of this case was when a participant stopped smiling and became serious. This change allowed us to infer an instance of ER, which was coded as situation selection – acceptance (of the reality of the stressful condition).

Unexpected emotions. The second approach identified unexpected emotions that occurred irregularly. This methodology was used when it was confusing to understand an emotion expression within the context. For example, in the midst of bad news delivery, the physician smiled as he politely asked the translator to provide the patient with tissues. In this instance of ER, a smile can be explained as embarrassment since the Hong Kong student smiled while delivering bad news. Studies have acknowledged the significance of cultural backgrounds in the experience and expression of emotions (Blanchard, Mizoguchi & lajoie, 2009; Peterson, 2006), and it has been shown that cultural norms have deep influence in stipulating "display rules" such as when and how we express emotions (Matsumoto, 1990).

This smile was thus an instance of ER which, explained through cultural norms, was coded as physician embarrassment and coded as Response modulation – venting of emotions. Studies have acknowledged the significance of cultural backgrounds in the experience and expression of emotions (Blanchard, Mizoguchi & lajoie, 2009; Peterson, 2006). Cultural norms have deep influence in stipulating "display rules" such as when and how we express emotions (Matsumoto, 1990).

Dissociation between emotion channels. This method of detecting instances of ER was identified through divergence of multiple emotion channels. Gross and Thompson (2007) stated that dissociation between different channels of emotion expression, e.g. facial expressions and physiology, is indicative of suppression as a subcategory of response modulation. When different channels of representing emotions are not in alignment with each other we can conclude that the beholder of the emotions is undergoing emotional load which can elicit emotion regulation to manage the situation, specifically using suppression to modulate one's response. Examining multi-channels of emotion helps us distinguish between conscious and unconscious ER strategies. An example of discrepancy between emotional signals might be when people smile and use confident words but have a trembling voice or demonstrate motor expressions that show activation. This example, may indicate that responses are (un)consciously being modulated.

This idea is completely supported by the data in this study. For example when a physician says "Sure, we can discuss about this", but his voice is hesitant and his eyes look back and forth or his level of activation increases, there is a discrepancy between the verbal utterances (confidence) and non-verbal behavior (hesitation); which may allow us to infer that the physician is trying to cover his/her hesitation (i.e. response modulation-suppression).

However, the idea that inferences of emotion determine convergence by examining multiple channels to determine a unique emotional state is prevalent among AC researchers and "consistent with theories invoking the idea of *affect programmes*. When such programmes are activated, according to these theories, there should be

convergent outputs in emotional experience, physiology, and behaviour" (Mauss & Robinson, 2009, p. 227) (see Figure 60).

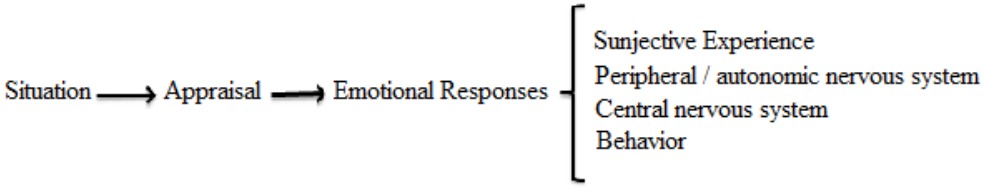


Figure 60. A consensual component model of emotional responding (Mauss & Robinson, 2009).

Nonetheless, AC researchers admit that the model has not been well supported in studies that have used convergence of response systems. As indicated before, correlations among multiple measures of emotion are moderate at best and inconsistent across studies (Barrett, 2006; Mauss et al., 2004; Ruch, 1995; Russell & Bachorowski, 2003). Mauss and Robinson (2009, p. 228) have identified three explanations and implications for the dissociation of emotional channels:

1. "The construct of emotion cannot be captured with only one measure considered alone.
2. Dissociations among different measures of emotion may be relatively normal rather than necessarily reflective of a dysregulated system. In this context, research that examines the mechanisms that mediate and explain particular response-system dissociations will be particularly useful.
3. Third, there are likely to be moderator variables that affect convergence across measures of emotion (Fridlund, Schwartz, & Fowler, 1984; Lacey, Bateman, & Vanlehn, 1953; Picard, Vyzas, & Healey, 2001). If this is the case, then a more

idiographic approach would be necessary to understand the nature of emotional response coherence".

Thus, AC research requires understanding the nature of emotional responses to determine if such responses should be coherent or if a discrepancy between elicited signals is normal. Based on Gross' (1998) consensual process model of emotion generation (view Figure 61), the idea of *evaluation* and *modulation* of response tendencies before expression is the key missing piece that needs to be implemented in AC models to lead to more valid systems of emotion detection, rather than attempting to converge emotional signals.

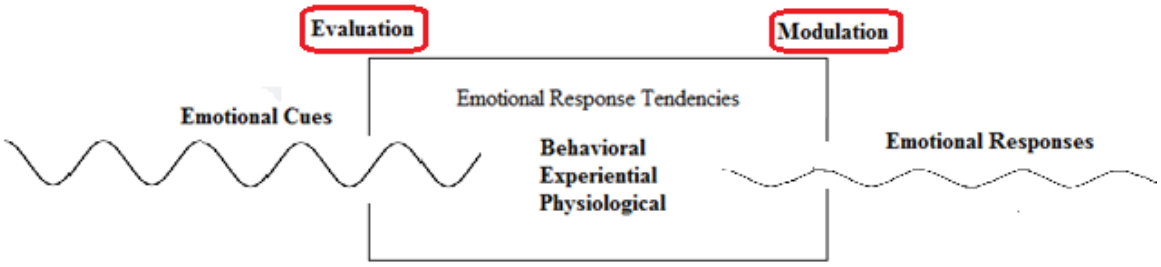


Figure 61. A consensual process model of emotion generation (Gross, 1998).

Campos, Frankel and Camral (2004) also challenge research approaches that search for the coherence of emotional response indexes. The authors propose that coherence of emotional behavior is neither typical nor expectable in studies of emotion regulation.

Use of multiple emotion channels (multimodality) to demonstrate ER responses. The last approach is based on the unification of the three formerly mentioned methods. For this purpose, qualitative descriptions of ER applications presented a blend of nonverbal and verbal emotion expression channels to make regulatory inferences. For

example, through blended analysis of a participant's attention tendencies (e.g. attention towards participants), voice (confident voice), motor expressions (smiling, nodding and pressing lips together) and text (expressing gratitude when praised in a stressful moment) we indicated that the participant was using positive reappraisal to cognitively change thoughts.

It is clear that detecting the response-focused ER strategy is easier than the first four antecedent-focused ER types due to the nature of response tendencies where emotions are in the process of being *expressed* behaviorally, experientially and/or physiologically. Our goal was to determine co-occurrence of emotional channels to recognize instances of intrinsic emotion regulation (IER) *and* extrinsic emotion regulation (EER), be they response-focused or antecedent-focused.

Co-occurrence of multimodals – Intrinsic and Extrinsic ER inferences. From the results of the multimodality analysis of emotion data, some noteworthy co-occurrences were revealed which could be used to recognize IER in a similar context, either from the lens of an individual for enhancing social communication, or as a model framework to be implemented in affective computing systems in order to enhance the quality of user-interface interactions. Referring to chapter one, intrinsic ER denotes those strategies that are applied to *self*-regulate emotions. Some examples of co-occurrence are "decreased voice pace" which was commonly associated with "rumination", which in the context of this thesis, referred to the physician being doubtful about his statements and thinking as he spoke; or "decrease in voice volume" which occurred mostly while the physician was sympathizing with the patient.

In order to have a comprehensive view, Tables 8 and 9 respectively provide an assembly of the intrinsic and extrinsic ER strategies versus the multiple emotion channels co-analyzed in this study.

As Campos, Frankel and Camras (2004) point out, it should be noted, "many behaviours can be in the service of an emotion, and the same behaviour can be in the service of many emotions" (p. 378). Since the underlying features of emotions and their regulation are similar, extraordinary caution is required to reliably recognize emotion regulation instances. This difficulty, as a consequence led us to identify the regulatory processes of emotions through a multi-analysis of observational channels of attention (action) tendencies, vocal characteristics and motor expressions, as well as oral transcripts of participants.

Table 8

Intrinsic ER (IER) subcategories and emotion channels in association

IER Category	IER Sub-category	Attention Tendency	Voice	Motor Expressions
Situation Selection	Acceptance [of stimulus]	Information Search	Voice volume decreased Voice pace decreased	Slouching Gazing Nodding
	Denial [of stimulus]	Non-specific	Confident voice	Leaning out Head inclined Shaking head
	Behavior disengagement	Self-centered Away from participants	Silence Normal voice	Leaning out Looking away Inactivity
	Self-isolation	Self-centered	Silence	Covering face Looking away Head declined
Situation Modification	Planning	Information search	Voice pace decreasing Long pauses	Looking back and forth Leaning out
	Seeking instructional support	Information search	Hesitation (frequent um's)	Activation Leaning in Raising eyebrows
	Seeking empathetical support	Directed towards participants	Voice volume decreased	Slouching
Cognitive Change	Positive reappraisal	Attention towards participants	Confident voice	Nodding Smiling Pressing lips together

	Rumination	Information search	Voice pace decreased	Looking back and forth
	Blaming others	Attention towards participants	Confident voice Assertive voice	Shaking head Leaning out
Response Modulation	Venting of emotions	Non specific	Change in voice volume	Crying Smiling Frowning Sinking in
	Suppression	Channels divergent	Channels divergent	Channels divergent
	Restraining	Non specific	Silent	Non specific

Table 9

Extrinsic ER (EER) subcategories and emotion channels in association

EER Category	EER Subcategory	Attention Tendency	Voice	Motor Expressions
Situation Selection	Enabling acceptance	Attention towards participant	Voice volume decreased Voice pace decreased	Nodding Raising eyebrows Leaning in
	Arranging privacy	Away from participant Elsewhere	Silence	Leaning out Looking away
Situation Modification	Planning	Information search	Voice pace decreasing Long pauses	Looking back and forth Leaning out

	Referring causality away from patient	Attention towards participant	Voice volume decreased	Shaking head Leaning in Looking back and forth
	Providing instructional support	Attention towards participant	Non specific	Non specific
	Providing empathetical support	Attention towards participants	Voice volume and pace decreased	Leaning in Expressing sadness Nodding Raising eyebrows
Cognitive Change	Positive reappraisal	Attention towards participants	Confident voice	Nodding Smiling Pressing lips together
	Rumination	Attention towards participant	Non specific	Focusing at participant
Response Modulation	Easing venting of emotions	Attention towards participant	Voice volume decreased	Leaning in Pressing lips together Expressing sadness
	Easing suppression of emotions	Attention elsewhere Information search	Confident voice Normal voice	Leaning out Looking away Relaxed

Research Question 3

This question sought to verify whether and how ER was different in post- compared to pre-test. The results showed that after the PBL sessions medical students shifted their focus from elaborating in the explanation stage to initiating and closing the session. These three stages are defined in Table 10.

Table 10

Stages of delivering bad news to patients (adapted from Baile et al., 2000; Silverman, Kurtz & Draper, 2005)

Stage of medical interview	Description
Initiation of the session	Setting up the interview by arranging privacy, making connections with the patient, involving significant others and gathering information from the patient
Explanation	Providing correct information, aiding accurate recall, achieving a shared understanding
Closing the session	addressing the patient's emotions with empathic responses, summarizing the discussions and forward planning

As can be seen in Table 10, the initial and closing parts of the session are aimed toward the emotional needs of the patient. When the medical student shifts attention towards these sections it can be seen as an indicator of the students' raised awareness of the importance of sympathizing with and externally regulating the patient.

Focusing eyes, activation and leaning in were three motor expressions that tended to occur together and were more frequently observed in pre-test sessions of the four participants. These three codes revealed the extent of alertness of a participant and the level s/he was engaged

in the task of bad news delivery. Hesitant speech and changing position on seat (an indicator of intrinsic ER) also occurred more in pre-test than in post-test.

On the other hand, pressing lips together and nodding were more frequent in post-test in comparison to pre-test, which were indicative of positive reappraisal (of the situation). Intrinsic ER instances were less visible in the post-test participants, which might be because emotional inducers were less frequent. The fewer emotion provoking instances in post-test might be explained by the fact that the procedure of data gathering remained the same. Therefore, the participants were more acquainted with the multicultural, bilingual TRE session, as well as the task itself (knowledge about Hodgkin's Lymphoma and effective communication skills) and learned how to better communicate bad news through the PBL intervention.

However, the students were more attentive to the patient in pre than post, while in post-test they looked more back and forth at the screen. Specifically, their attention tendency was down towards notes (taken from the PBL sessions) which showed their dependence to notes, especially during translation times.

Looking at the cross-case diagrams two main attention tendencies were observed throughout the eight sessions. These were attention towards the patient, and information search (with more weight on attention towards patient). The most important method of sympathizing is attending to the person in need (rather than attending elsewhere) and looking directly at him or her (Cole, 2001).

Regarding the motor expressions analysis of the cross cases, nodding and looking back and forth have increased from pre to post in all participants. Activation and leaning inwards have decreased from pre to post in three participants; participant D expressing more in the post-test.

The common decrease could be explained by the intervention effect of the PBL sessions where participant D realized the necessity of sympathizing with the patient.

Analysis of the vocal characteristics revealed that "decreased voice volume and pace" were more frequently used by the participants. As described earlier, decreased voice volume pertained to participants' attempts to sympathize with the patient, and decreased voice pace referred to participants IER - rumination. Interestingly, throughout all cases the frequency of using "decreased voice volume" dropped from pre to post, which again might be explained by participants' familiarity with the scenario in the post-test.

An interesting issue is the relative power of voice as a unique channel to regulate emotions. As an example, in participant D, we saw that although the participant used emotion-expressive embodiments (leaning inwards, making eye contact, etc.) her voice was normal and confident, which overall was not effective in empathizing with the patient. In another instance however, D could express sympathy through her voice (decreased volume) although not leaning inwards and not looking at patient.

Observational ER detection methods yield an important approach to analyze participants' communication skills. Participant D in the current study showed the highest change from pre- to post-test in attempts to extrinsically regulate the patient, which demonstrates an improvement in her communication skills. Participant B showed a decrease in EER as well as IER application. This decline however, is not necessarily a negative outcome since B expressed over-empathetic responses in the pre-test. Participants A and C showed an increase in EER strategies as a result of the discussions in the PBL sessions, although their IER strategies decreased. Again, the decrease in IER strategies at post-test might be due to familiarity with the context that reduced emotional triggers leading to fewer instances in need of intrinsic regulation.

The main IER applied by the participants in pre was response modulation with the subcategory of suppression, and the main EER applied by the participants was situation modification with the subcategory of providing empathetical and instructional support. IER suppression had two sources: either the physician was trying to hide his uncertainty in delivering information to the patient (main cause) or he was trying to hide non-corresponding emotions (e.g. smile). Gross (1998) found considerable evidence that antecedent strategies result in more effective regulation outcomes than response-focused strategies. There is however variation between the impact of subcategories of antecedent-focused ER strategies. In the case of this thesis, attention deployment was the strategy that was least used and attempts to modify the situation were more strategized than attempts to distract attention. This finding might be explained by the necessity for the patient to realize the stressful situation instead of deliberately forgetting it, in order to plan further follow-up sessions and discuss treatment options. Thus in serious situations where one needs to take actions to control an emotion provoking stimulus, not attending to the stimulus is not the best approach and thus should be least applied. Sometimes the emotional stimulus can lead to disastrous outcomes; e.g. when physicians cannot control a deteriorating patient (Wiseman & Snell, 2008), when firefighters cannot control a widespread fire (Scott & Myers, 2005), and in avionics when a pilot cannot a crashing airplane.

ER Detection as a Means to Evaluate IER and EER Application. The importance of regulating emotions in medical settings has been emphasized in medical literature (Larson & Yao, 2005; Maes & karoly, 2005; Taylor, Bagby & Parker, 1999). *Observational* methods, in comparison to self-reports that are traditional methods of evaluating ER, can be beneficial to medical educators. Medical instructors can evaluate the manner in which their students acquire the appropriate abilities to communicate with and manage patient needs by comparing the

changes their students make in pre- to post-test scenarios where intrinsic and extrinsic ER strategies are critical to successful practice.

The small group PBL sessions that serve as the learning context in this study can also be thought of as a platform for increasing awareness of ER detection methods. As an example, using the power of voice, as a channel of extrinsic ER, can be highlighted in educational settings and students can become more aware of the relative weight of this channel in comparison to other nonverbal behaviour in enhancing their competencies in EER application.

Cultural considerations in analyzing ER. Cultural issues should be considered while coding instances of IER and EER; e.g. when A-pre told the patient that he had all the details of the disease, but he needed her to calm down first, he *smiled* and looked back and forth while requesting her to calm down. Smiling in a stressful situation was also viewed when the physician noticed that the patient had tears on her face and asked the translator to give her a tissue box while a smile appeared on his face (see Figure 62). Since this conversation is at the heart of bad news delivery, a smile was probably due to embarrassment (http://www.intercultures.ca). This instance was thus coded as an ER strategy applied by the physician in order to alleviate his emotions (under the "response tendencies-venting of emotions" category).

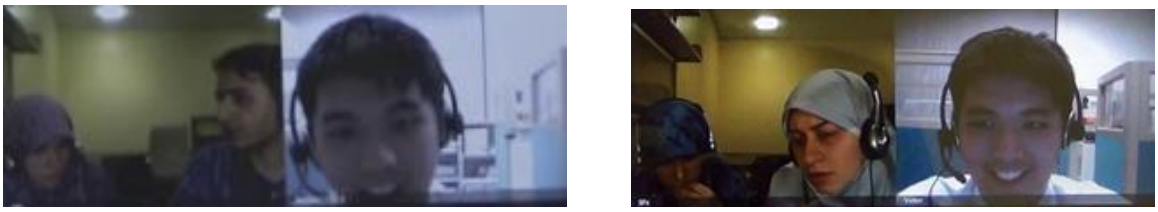


Figure 62. Smiling in a stressful situation. Right image: A-pre, left image: A-post.

This instance should be coded with care, both for the medical student and the patient (who were from multicultural backgrounds), since the patient's tears could be coded as venting

emotions or suppressing oneself from crying out loud. B notes this ambiguity in his post reflection notes: “I noticed the patient was in tears and her eye contact was broken. I looked away from her face and asked the translator to give her some tissues which I thought would be useful since it is an Asian culture to be embarrassed by teary eyes and thus, would 'hide tears' despite how much they wanted to cry. I too felt the need to give the patient time while she recomposed herself, thus waited for her to speak again”.

Limitations

This study has several limitations. A major issue was the low quality (lack of sufficient light) of the videos and asynchronous audio and video data. The quality was difficult to control since images were taken from the computer screen recordings of individuals communicating with each other through the use of Adobe Connect software. This limitation challenges researchers in their ability to make proper inferences of emotions or emotion regulation strategies. Future data gathering will need to consider better image and video quality for more accurate results.

The technology sometimes presented time delays in communication which led to a poor correspondence between “regulation of emotionally triggered events” and “post-reflection notes of participants”. Two of the participants (D and B) found that the videos of their performance did not stream perfectly and there was asynchrony of audio and video, choppy images, etc. which made it difficult for them to reflect on their performance and provide a proper reflection sheet. Having such a one-to-one correspondence between the coded videos and reflection notes of participants would increase the validity of the measures. Campos, Frankel and Camral (2004) have acknowledged the indeterminate construct of emotion and the challenge of detecting regulated emotions, and suggest a combination of observational analysis with confirmatory ethnographic reports to increase the generalizability of results.

One other issue refers to the patient's orientation on their chair. The patient declined her head and looked away (sometimes downward and sometimes to the side) after the delivery of bad news, struggling to self-isolate herself. But when the patient was in this position, she could not distinguish postural EER strategies applied by the medical student who attempted to emotionally regulate the session. As an example, participant K leaned in and tried to look at the patient's eyes to make more connection with her, but he couldn't have eye contact. This issue (the patient's out-of-screen orientation) might have been noticed by the participants and thus affected their postural emotion expression, eliciting some EER behaviors that otherwise might have not been expressed; e.g. looking at notes several times (see Figure 63).

Figure 63. Physician looking at notes while patient is attending elsewhere.

However, the participants still communicated through decreased voice volume, probably because through this channel they could convey more sympathy to the head-down patient. One can conclude that based on the context of the interaction, empathizing using vocal characteristics (Matsumoto & Kishimoto, 1983; Morton & Trehub, 2001) can sometimes be more efficient than postures for external emotion regulation.

Another concern that affected internal and external ER strategies was the issue of translation. Regarding intrinsic emotion regulation, the time for translation allowed the physician to think of further actions, focus on the patient's nonverbal emotion expressions and act accordingly to further regulate the situation. On the other hand, the presence of a translator affected the ability

to extrinsically regulate the patient since the translator was not always able to transfer similar non-verbal behaviours that resulted in incomplete translation (Simon, 2004). A translator's linguistic and cultural background may influence what is or is not translated and communicating bad news in another language and culture through a third party complicates the issue. Consequently, when the physician attended to the translator to understand the patient's thoughts, the translator's actions (un)consciously inversely affected the communication; e.g. as the translator was telling the physician "patient wants to say goodbye", she smiled which caused a smile in the physician too (see Figure 64). This nonverbal behavior was accounted for in the frequency counts.

Figure 64. Translator's smile caused the physician to smile too.

However, in instances when the translator clearly understood the message of the patient/physician, he or she transferred information similarly to what s/he received, but when he or she did not grasp the meanings of utterances; he or she transferred the message different than what was actually said. As a result, B-pre wrote in his reflections: **"**For the fourth time when the patient said she was confused and asked how could it happen, I realised I wasn't perceptive enough to pick up her real concern, which was masked by the translator's meaning of 'confused'…". This reflective thought shows how communication through a multicultural TRE can be even more challenging via an indirect communication, through a translator. Again confirmed through B-pre's reflections, "When the translator said 'no, no its ok with her', I couldn't understand the meaning since I asked the patient to return in 1 week time. Then it felt

like the original message was lost in translation, which adds a certain level of doubt in whether my words were communicated accurately to the patient via the translator" (view Figure 62).

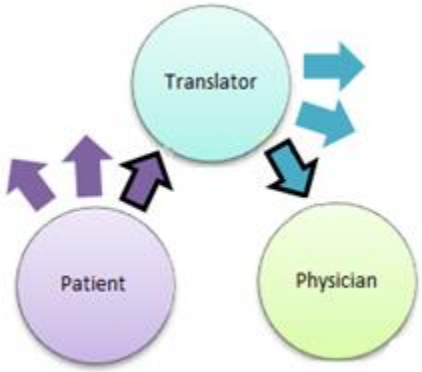


Figure 65. Incomplete translation (considering context and the translated language)

The use of standardized patients portraying emotional reactions may be a limitation of this study since the medical students are aware that they are communicating with a standardized patient. However other literature (Beullens, Rethans, Goedhuys & Buntinx, 1997) has highlighted the advantages of using SPs in medical instruction given that this is a difficult skill to practice with real patients.

Contributions and Future Directions

The process model of emotion regulation (Gross, 1998) was used in order to categorize different strategies applied by medical students in the context of a multicultural technology-rich setting where a cancer diagnosis was revealed to a patient. The design of an observational coding scheme of capturing intrinsic and extrinsic ER was driven by the emotion regulation and coping literature, and methodological techniques were extended from the field of affective computing. This study makes important contributions to the methodological foundations of scientific examination of ER in AC research. This work is also important in improving the design

of TREs to embed dynamic ER detection mechanisms that enable the system to adapt instructions based on different needs of individual students.

Another issue in need of further investigation is how culturally-manipulated nonverbal behavior might indicate instances of ER. Culture regulates emotions by making emotional responses that are aligned with cultural models, and studies have shown that appraisal of positive vs. negative emotion regulation strategies differ greatly among cultures (Mesquita & Albert, 2007). Future studies investigating ER in technology-based learning environments need to examine whether the results of this thesis generalize to other emotionally triggered multicultural contexts. This is a small case study involving Canadian and Hong Kong Students examining a patient from a different culture than their own. More data would need to be collected to make strong inferences or generalizations about culture. In this venue, further research would be valuable to respond to or meet the affective and cognitive needs of culturally diverse patient populations.

This research showed the importance of voice in extrinsic ER in the intercultural context of delivering bad news in medical settings. Further research is required to generalize the findings and analyze whether various channels of emotion expression and their weight of internal/external regulation are different in other contexts. In other words, is there an emotion modality which can better transfer the emotions one is experiencing or one wants others to think one is experiencing, and if so, is it context-dependent? What is the relative power of words (text), voice, embodiments, attention tendencies, etc. in extrinsic emotion regulation in other contexts? Studies have shown that basic emotions (Ekman, 1978) of sadness, anger, and fear are best identified through vocal characteristics; but disgust is the hardest to be identified through paralinguistic measures (Calvo & D'Mello, 2010). Further research can examine whether there is

an ER mediator effect in detecting which emotion channels can be used to infer specific emotions. As an example, is there an ER mediation effect that hinders a clear identification of disgust through the channel of implicit vocal features?

Emotion regulation may change the degree to which emotion response components converge as the emotion unfolds, such as when large changes in emotion experience and physiological responding occur in the absence of facial behavior. In this thesis, suppression was shown to be the result of discrepancy between emotion channels. Suppression is a subcategory of response-focused strategies, and as Brackett, Mayer and Warner (2004) have pointed out, it is not an intelligent form of regulating emotions in comparison to antecedent-focused strategies. Further investigation is needed to examine whether there is a relation between the extent of dissociation between emotion channels and level of competence in emotion regulation. Studies are also need to determine if there are differences between novices and experts in their awareness of relative costs and benefits of applying different forms of emotion regulation. Results of such studies can shed light on the trajectories of expertise (Lajoie, 2003) towards more intelligent application of ER strategies.

Another direction for future research is studying expert physicians in bad news delivery in order to detect whether there are appropriate IER and EER strategies that experts share. Through comparison of the strategies which medical students apply with the corresponding coding scheme, individually-based prompts can be provided to enhance the regulatory skills of the students.

This thesis also illustrates the need to identify the relation between emotion regulation and other forms of self-regulation. Research has shown that emotional distress damages self-regulation (Gross & Thompson 2007). Studies could be conducted to analyze whether the

processes used to regulate emotions are similar to those used to regulate cognitions. An important factor impacting cognitions is working memory capacity (WMC). Higher WMC results in a greater wealth of resources and past experiences available (Barrett, Tugade & Engle, 2004). Thus studies can examine whether individuals with higher WMC can better implement regulatory strategies, cognitive or affective, leading to more control of attentional resources for regulatory purposes.

Closing Comments

In fulfilling the requirements of this Master's thesis, this exploratory mixed methods multiple case study has led to advances in methodological approaches to identifying ER in an emotionally triggered multicultural TRE. Four methods of capturing intrinsic and extrinsic ER, either unconscious or conscious have been identified. We hope that educators and researchers will benefit from these approaches in order to enhance the quality of affect detection in various domains including learning environments, medical simulations, etc.

In closing, I would like to make reference to the following quotation by Rebecca Eanes: "In between every action and reaction, there is a space. Usually the space is extremely small because we react so quickly, but take notice of that space and expand it. Be aware in that space that you have a choice to make. You can choose how to respond but choose wisely".

…The wisdom lies beneath awareness of this space, choosing how to expand it from situation selection to cognitive change, and then responding according to the observed actions, embodiments and sounds…

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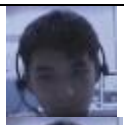
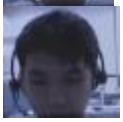
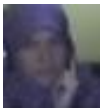
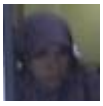
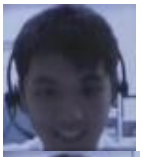
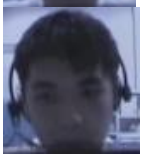
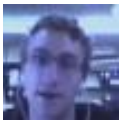
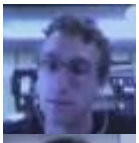
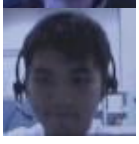
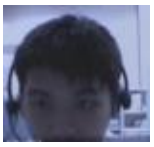
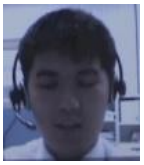
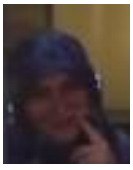
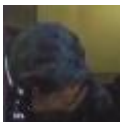
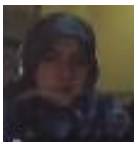
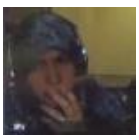
Appendix 1: Emotion channels and their subcategories

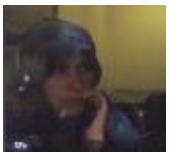
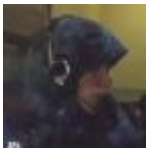
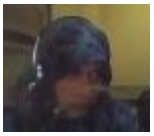
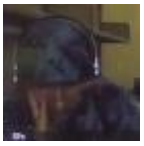
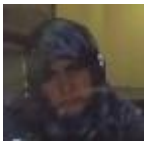
Emotion Channel	Subcategories	Description	Example
Action Tendencies (S) (Scherer, 2005)	Attention towards patient	Participant looking directly at patient and/or speaking to her	
	Attention away from Patient	Participant looking elsewhere (while speaking with patient)	
	Attention self-centered	Participant appearing to be not responding to patient needs accurately	
	Information search	Participant looking *back and forth* at patient, trying to pick clues or reading from notes	
Action Tendencies (P)	Attention towards doctor	Patient looking straight at doctor	
	Attention away from doctor	Patient looking away from doctor (doctor on the right side)	
	Attention self-centered	Patient is focusing on self and not responding to physician correctly	
	Information search	Looking for more information: Frowning, focusing eyes and leaning in	
Voice (S) Paralinguistics	Silence	Not speaking	
	Normal voice volume and pace	Confident regular speech mainly at the "gathering" stage	
	Speaking hesitantly (saying "um", coughing)	Participant speaking with decreased pace and/or volume, (e.g.	"Sure Um, Ok so Um…"

		repeating words like *um)*	
	Voice volume increased	Speaking with a higher volume than normal (e.g. to control the situation)	"We have everything under control"
	Voice volume decreased	Speaking with a lower volume than normal (e.g. to show empathy)	"Please don't worry too much"
	Voice pace decreased	Being doubtful in speaking (e.g. as ruminating)	"That's quite a good question. This disease doesn't really have a definite cause"
	Voice pace increased	Trying to confirm an idea	"But we will be here the entire way"
Voice (P) Paralinguistics	Silence	Not speaking	
	Normal voice volume and pace	Confident regular speech mainly at the "gathering" stage	
	Voice volume increased	Speaking with a higher volume than normal	"Yes, I am very eager to know the results"
	Voice volume decreased	Speaking with a lower volume than normal	"I can't believe it…"
	Voice pace increased	Trying to confirm an idea, being confident	"What does it exactly mean?"
	Voice pace decreased	Voice pace slower than normal: being depressed or thinking while speaking	"I don't know now"
	Voice trembling (or crying)	Speaking with trembling or sad voice	"What do you mean that I have cancer?"

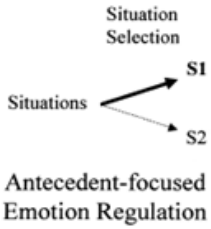
	Assertive voice (activated)	Replying with confusion and partially anger	"What are these questions for?"
Motor Expressions (S)	Smiling	Lips forming a smile, either mild or strong	
	Becoming upset (or expressing sadness)	Showing sadness accompanied by low voice and/or decreased pace	
	Nodding	Moving head up and down in order to confirm something	
	Shaking head	Moving head left and right in order to disconfirm something	
	Looking away	Looking away from patient	
	Looking back and forth	Trying not to gaze at patient consciously or unconsciously	
	Looking at screen	Looking at patient or translator, not elsewhere (not to the corner, down, etc)	
	Frowning	Eyebrows getting closer in order to focus, showing confusion or anger	"Does she know anyone who has had cancer?"
	Focusing eyes	Looking straight at patient/translator, gazing	
	Pressing lips	Participant presses lips together to confirm	

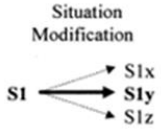
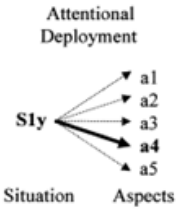
	Opening mouth	Opening lips while not speaking	
	Expressing with hands or head movements	Using body movements to help express thoughts and feelings	
	Activation	Becoming highly aware and conscious, focusing eyes [(1)], biting lips, chewing lips, frowning	
	Relaxed	Deep breath, leaning back out	
	Changing position	Moving on seat, turning to another side	
	Leaning in	Leaning towards the screen, towards the participants	
	Leaning out	Withdrawing, Leaning back on seat, further away from screen and participants	
Motor Expressions (P)	Smiling	Lips forming a smile, either mild or strong	
	Becoming upset	Showing sadness accompanied by low voice and/or decreased pace	

Nodding	Moving head up and down in order to confirm something	
Shaking head	Moving head left and right in order to disconfirm something	
Leaning head on hand	Head inclined and based on hand	
Covering face (partially or full)	Hiding face and emotional reactions, trying to isolate from others	
Looking away	Conscious/unconscious turning away from physician and translator	
Looking at doctor or translator		
Crying (or wiping eyes)	Rubbing hand or tissue paper to wipe tears	
Frowning	Eyebrows getting closer in order to focus, showing confusion or anger	
Focusing eyes	Looking straight at patient/translator, gazing	

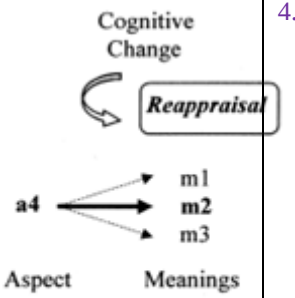
Playing with lips	Putting hands on lips, chewing lips, covering lips, squeezing lips	
Expressing with hands or head movements	Using body movements to help express thoughts and feelings	
Changing position	Moving on seat, turning to another side, raising head from an inclined position, etc.	
Activation	Becoming highly aware and conscious, focusing eyes, sitting upright	
Leaning in	Leaning towards the screen, towards the participants	
Sinking in	Slouching in seat, not responding spontaneously, expressing depression	
Leaning out	Withdrawing, Leaning back on seat compared to the previous situation	

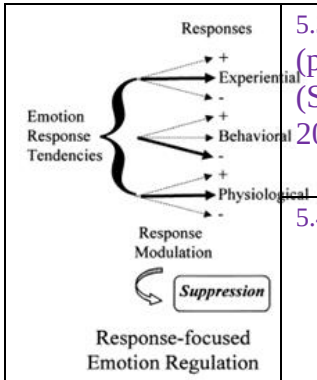
Appendix 2: Intrinsic Emotion Regulation (IER) codes of physician or patient

ER Strategy	ER Style	Behavioral Description	Example
1.Situation Selection: Experiential, Behavioral, Physiological (Gross, 1998)  	1.1. Denial (patient) (Skinner et al. 2003)	Refusing to accept the reality of the stressful situation. (cognitive situation selection)	○ The patient refuses to believe that this is happening to him/her. ○ The patient acts as though this hasn't happened to him/her.
	1.2. Acceptance (patient & doctor) (Skinner et al. (2003)	Accepting the reality of a stressful situation. (cognitive situation selection)	○ The person thinks that he cannot change anything. ○ The person accepts that he should realize the situation.
	1.3. Behavior disengagement (patient & doctor) (Skinner et al. 2003)	Giving up attempts to face the situation. (behavioral and cognitive situation selection)	○ The person turns his back or his face to the other. The person leaves the room.
	1.4. Self-isolation (patient & doctor) (Skinner et al. 2003)	Trying to be alone. (behavioral and cognitive situation selection)	○ The person wants to rest. ○ The person wants to be alone to think about the problem without distraction.
	2.1. Turning to religion (patient & doctor) (Skinner et al. (2003)	Using religion to help cope with stressor.	○ The person seeks spiritual support.

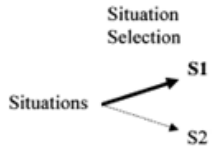
2. Situation Modification (Gross, 1998)  Antecedent-focused Emotion Regulation	2.2. Planning (patient & doctor) (Skinner et al. (2003)	Coming up with action strategies, thinking about what steps to take and how best to handle the problem, or acting responsibly.	○ The person wants to know about the disease prognosis and long and short-term effects in order to start planning. ○ The person thinks how to change the situation. The person thinks about how he/she can plan to do best or how to best cope with the situation.
	2.3. Seeking instructional support (patient & doctor) (Skinner et al. (2003)	Seeking advice and assistance for more information	○ The person wants to talk with a professional to get more advice on what to do, and get information about the situation.
	2.4. Seeking empathical support (patient & doctor) (Skinner et al. 2003)	Looking for moral support, understanding and sympathy from other people.	○ The person wants to communicate with caring and concerned friends.
3. Attention Deployment (Gross, 1998)  Antecedent-focused Emotion Regulation	3.1. Distraction (patient & doctor) (Skinner et al. 2003)	Seeking distraction to avoid thinking about the problem. Active forgetting.	○ The patient reduces effort to try understanding the situation and finding treatment options. ○ The doctor tries to distract him/herself shortly to calm down. ○ The person tries to use humor

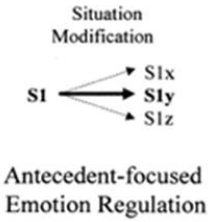
4. Cognitive change (Gross, 1998)	4.1. Optimistic (positive) refocusing – CERQ labels, (patient & doctor) (Garnefski & Kraaij, 2007)	Developing reassuring and comforting thoughts.	The person thinks of general pleasant experiences.
	4.2. Positive reappraisal – CERQ labels, (patient & doctor) (Garnefski & Kraaij, 2007)	Seeking for positive sides of the experience.	○ The person thinks of positive things that he/she has experienced when facing this problem. ○ The person feels he/she can learn something from this situation. The person thinks that the situation also has its positive sides.
	4.3. Catastrophizing CERQ labels, (patient & doctor) (Garnefski & Kraaij, 2007)	Comparing self with better occasions.	○ The person thinks that what he/she has experienced is much worse than what others have experienced/ than what can happen to a person.
	4.4. Rumination – CERQ labels, (patient & doctor) (Garnefski & Kraaij, 2007)	Focusing on thoughts and feelings the situation has evoked in one.	○ The person wants to understand why he/she feels the way he/she does about the problem. ○ The person dwells upon feelings the situation has induced in him/her.
	4.5. Self-blame (patient & doctor) (Skinner et al. (2003)	Thinking that the cause of the problem lies within oneself.	○ Thinking about the mistakes one had done in causing the issue. ○ The person thinks that the responsible person for what has happened is he/she.
	4.6. Blaming Others	Thinking that the	○ The person thinks about the mistakes others have

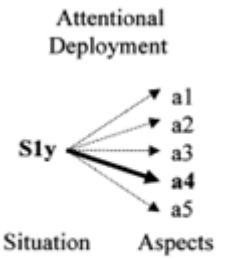
	- CERQ, (patient & doctor) (Garnefski & Kraaij, 2007)	cause of the problem lies within others.	made in this matter and feels that others are to blame for it.
 Antecedent-focused Emotion Regulation	4.7. Putting into perspective – CERQ labels, (patient & doctor) (Garnefski & Kraaij, 2007)	Comparing self with worse occasions.	○ The person thinks that it all could have been much worse. ○ The person compares him/herself with people who undergo much worse experiences.
5. Emotion Response Tendencies: Experiential, Behavioral, Physiological (Gross, 1998)	5.1. Venting of emotions (+) (patient & doctor) (Skinner et al. 2003)	The tendency to focus on whatever distress one is experiencing and to ventilate those feelings (experientially, behaviorally, physiologically). Depressive coping (UCL-A, 1994)	○ Revealing frustration or sadness about the problem. ○ Becoming overwhelmed by the problem and showing depression.
	5.2. Restraining (patient & doctor) (Skinner et al. 2003)	Waiting until an appropriate opportunity to act presents, holding back and not acting prematurely.	○ Not being expressive until a certain moment.

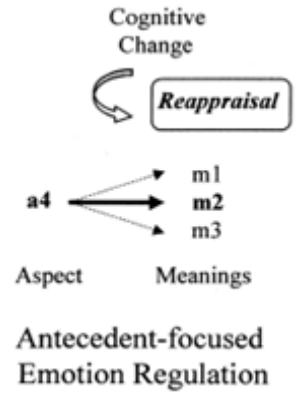
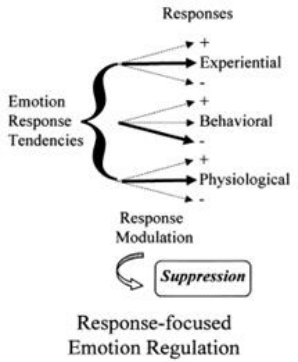
	5.3. Suppression (-) (patient & doctor) (Skinner et al. 2003)	Avoiding expressing emotions (experientially, behaviorally, physiologically).	○ The person tries to hide his/her emotions. ○ The person finds it hard to talk to another person about his/her feelings.
	5.4. Suppression of competing activities (patient & doctor) (Skinner et al. 2003)	Putting other projects aside and trying to not become distracted to effectively deal with the stressor.	○ The person doesn't want to be distracted by unrelated information. ○ The person neglects phone calls or interrupters during meeting (and after).

Appendix 3: Extrinsic Emotion Regulation (EER) of physician towards patient

ER Strategy	ER Style	Behavioral Description	Example
1.Situation Selection: Experiential, Behavioral, Physiological (Gross, 1998)  Antecedent-focused Emotion Regulation	1.1.Enabling acceptance (Skinner et al. 2003)	Aiding patient to accept the reality of a stressful situation.	The doctor aids patient to accept to believe the situation faster.
	1.2.Keeping appropriate distance (Skinner et al. 2003)	Enabling patient to feel comfortable by not interrupting much.	Enabling patient to be alone to think about the problem without distraction.
	1.3.Arranging silence (inductive)	Managing time and utterances for patient comfort.	Allowing time and not rushing through details by appropriate quietness.
2. Situation Modification Gross, 1998	2.1. Referring causality away from patient CERQ,(Garnefski & Kraaij, 2007)	Stating that the cause of the problem was out of control.	The doctor ensures patient that it is something that has happened and nobody is to blame for it.
	2.2. Putting into perspective CERQ labels, (Garnefski & Kraaij, 2007)	Comparing with worse occasions.	○ The doctor says that it all could have been much worse. ○ The doctor compares patient with people who undergo much worse experiences.

ER Strategy	ER Style	Behavioral Description	Example
 Antecedent-focused Emotion Regulation	2.3. Turning to religion (Skinner et al. 2003)	Using religion to help cope with stressor.	The doctor refers patient to seek spiritual support.
	2.4. Planning (Skinner et al. 2003)	Coming up with action strategies, thinking about what steps to take and how best to handle the problem.	○ The doctor appropriately identifies possibilities of treatments and different steps. ○ The doctor discusses about the disease prognosis and long and short-term effects in order to start planning in short manageable chunks.
	2.5. Providing instructional support (Skinner et al. 2003)	Advising patient to seek guidance and assistance for more information	○ The doctor refers patient to talk with a professional to get more advice on what to do, and get information about the situation.
	2.6. Providing empathical support (Skinner et al. 2003)	Supporting patient morally and showing understanding and sympathy.	○ The doctor appropriately shares his/her emotions. ○ The doctor wants to communicate with family members.

ER Strategy	ER Style	Behavioral Description	Example
3. Attention Deployment (Gross, 1998)  Antecedent-focused Emotion Regulation	3.1. Distraction (Skinner et al. 2003)	Disrupting patient to avoid thinking much about the problem.	○ The doctor seeks distractives for uncontrollable causes of problem. ○ The doctor tries to use humor.
4. Cognitive change (Gross, 1998)	4.1. Optimistic (positive) refocusing, CERQ labels, (Garnefski & Kraaij, 2007)	Developing reassuring and comforting thoughts.	The doctor reminds patient of general pleasant experiences.
	4.2. Positive reappraisal – CERQ labels, (Garnefski & Kraaij, 2007)	Exaggerating positive sides of the experience.	○ The doctor emphasizes positive things that patient has experienced when facing this problem. ○ The doctor tells patient can learn something from this situation. The doctor reminds patient that the situation also has its positive sides.

ER Strategy	ER Style	Behavioral Description	Example
 Antecedent-focused Emotion Regulation	4.3.Rumination – CERQ labels, (Garnefski & Kraaij, 2007)	Focusing on thoughts and feelings the situation has evoked in one.	The doctor appropriately helps patient think about what he/she has experienced. The doctor appropriately allows patient think about feelings and emotions the situation has induced in him/her.
5. Emotion Response Tendencies: Experiential, Behavioral, Physiological (Gross, 1998)  Response-focused Emotion Regulation	5.1.Easing venting of emotions (Skinner et al. 2003)	Allowing patient to ventilate feelings (experientially, behaviorally, physiologically)	○ The doctor asks patient to express thoughts and feelings. ○ The doctor arranges comfort and appropriate questions so patient can express thoughts and feelings.
	5.2. Easing suppression of emotions (Skinner et al. 2003)	The doctor helps patient appropriately suppress emotions (experientially, behaviorally, physiologically).	The doctor helps patient hide his/her emotions in front of others, or delicate family members. “I have all the required information, but I need you to calm down first”.
	5.3.Enabling suppression of competing activities (Skinner et al. 2003)	The doctor helps patient put other projects aside and try to not become distracted.	The doctor helps patient not become distracted by unrelated information to effectively deal with the stressor.

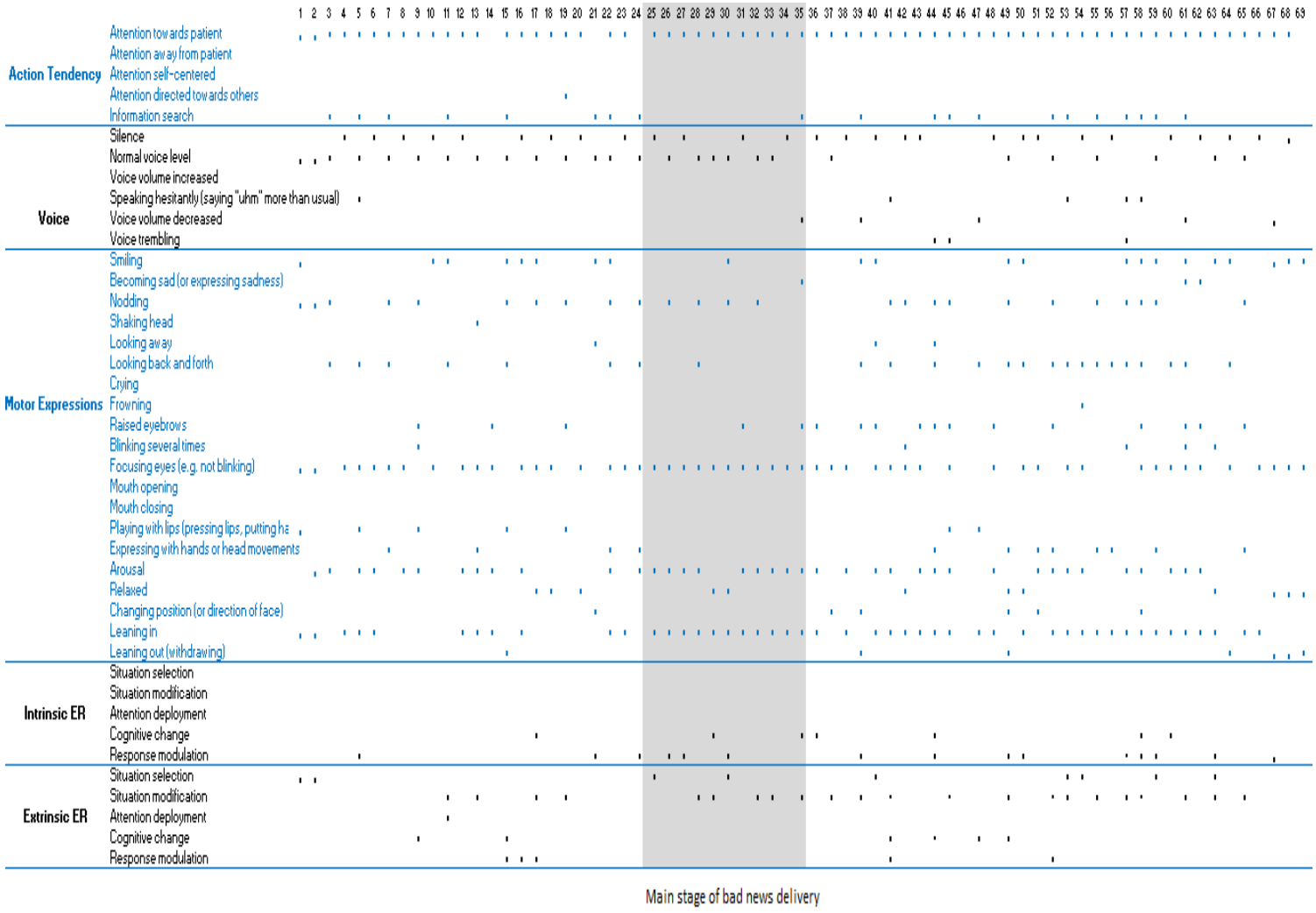
Appendix 4: Transcribed segments of bad news delivery to patient

Medical Student	Pre-intervention	Post-intervention
A	A: uhm uhm actually the result is not as good. SP: Pardon? A: Uhm the result is not as good. SP: uhum. What do you mean by that? A: Well uhm, because the results show that you are suffering from a disease called the Hodgkin's Lymphoma, uhm you're having a SP: She, she could not understand that, I mean can you explain? A: Sure, have you heard, heard about it before? Or anything about lymphoma? SP: No, no she hasn't heard anything Oh, euhm it's OK, maybe uhm I should eh, explain it to you step by. Lymphoma is a disease with the blood cells and that is what it caused the lump in your neck.	A: so uhm, unfortunately uhm the result is uhm comes out that you have a specific disease. The disease is called Hodgkin's Lymphoma. So uhm, so…. SP: Uhm I, I...She said that I can't understand what the disease is" A: Yes, uhm I understand that uhm it's difficult to understand from the name, but, I can always explain to you later.
B	B: um and um, the results came back, and I'm afraid Miss that it's not as optimistic as we thought it would be SP: and so what does it mean, what does it mean that it's not optimistic?	B: one of the tests we actually took some tissue samples from the neck SP: Yes, that's true B: yes and the results came back actually, and um unfortunately

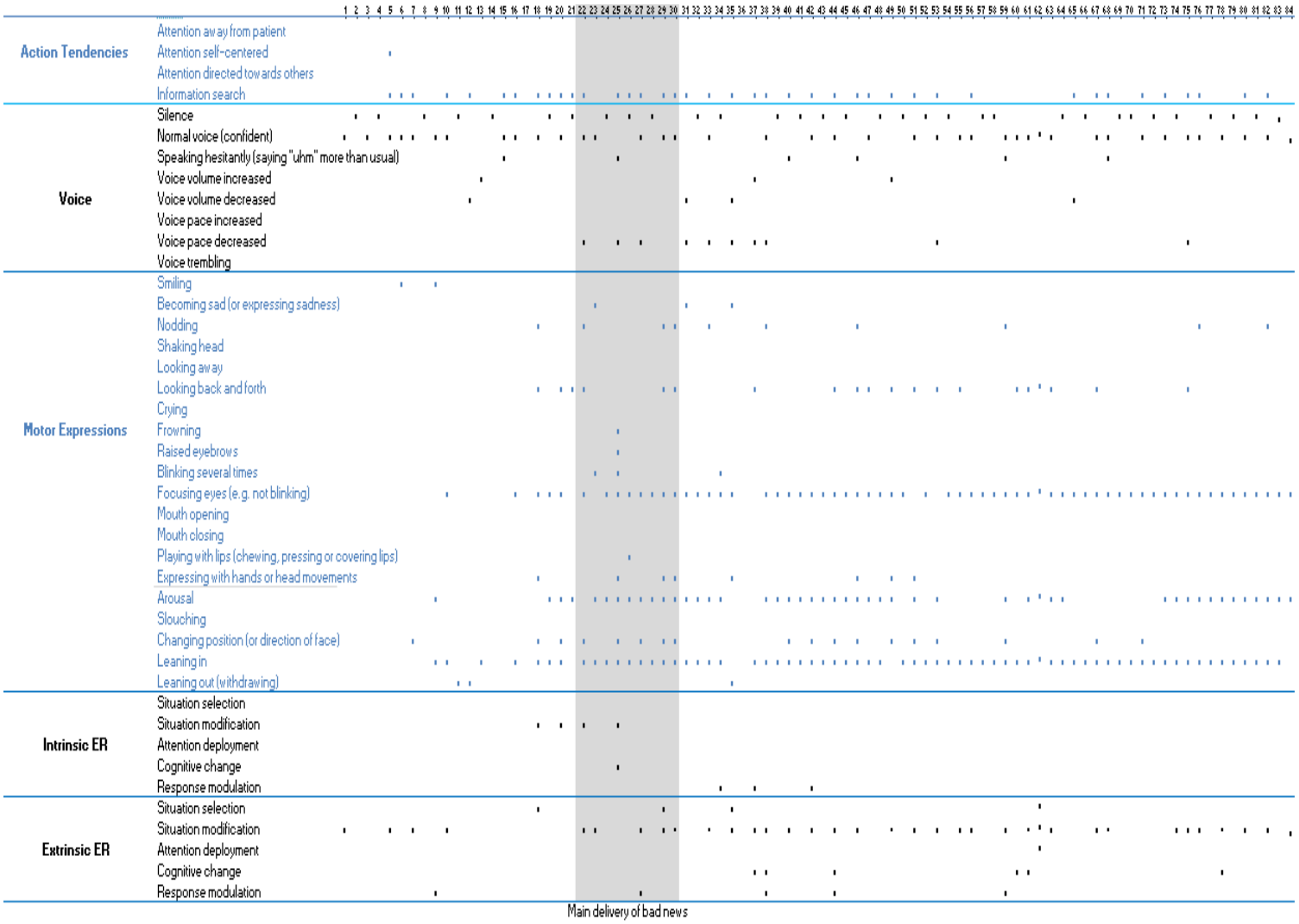
	B: right, and so what Miss has is a type of Hodgkin's lymphoma SP: ok, and what does that exactly mean? B: ok, that's a good question; Hodgkin's lymphoma is a very particular type of cancer in fact of the blood cells	they came back rather surprising. SP: She said, what do you mean? B: I'm afraid it's not the best of news I can give you SP: What do you mean by bad news? B: The tests came back positive for, and we are quite sure after checking, that Miss A… has the condition known as Hodgkin's lymphoma SP: What is this disease, I don't know this disease. What is it? B: That is perfectly fine, I'll explain to you about Hodgkin's lymphoma. Hodgkin's lymphoma is just basically a blood disease, and it is unfortunately related to a type of cancer.
C	C: So uhm, we saw the uhm, So we uhm, we have the results back, and uhm unfortunately uhm their not uhm their not very good, and it came positive, Hutchins Lymphoma, which is a, which is a type of a uhmcancer SP: Can you explain more, or pardon? C: Well, its uhm Hutchins Lymphoma, and actually its not my particular area of expertise, her usual physician will be able to meet with her uhm, again once he or she is back, and hope he will be able to provide her with more information.	C: Uhm so eh oh her, well, you're coming back today to uhm, to get the results of the tests I believe and uhm we have the results. SP: She said yes. C: Uhm, unfortunately uhm, there is some bad news. Actually the ... results came back positive for a cancer, called uhm, Hodgkins Lymphoma. SP: She said what? Can you …? C: Uhm its uhm so Ho Hodgkin's Lymphoma is a type of uhm cancer, uhm and uhm, the results for the test that we did, uhm came back to indicate that unfortunately she has this kind of

		cancer, and it, it is, so it is, it is a cancer, but it is a treatable kind of cancer, it is potentially curable.
D	D: ahm unfortunately we have something negative on the euh the results sorry not negative but we had eh something uhm that we're a little concerned about. Euh we saw some euh cells a typical presentation of Hodgkin's Lymphoma, euh so thats a disease that affects the blood SP: Euh can you explain more? D: yeah. so the Hodgkin's Lymphoma its euh its a cancer its a type of tumor that is in the blood and you can explain to Mrs Mehri that uhm we saw...what we saw on the biopsy is a very typical presentation and it has been confirmed and euh I'm just going to give you time to tell her and euh if she has any questions more, she can ask me.	D: Ok so ah now I want to talk to you about the results we obtained, and unfortunately I don't have very good news. And euh, if you can just tell that to Mrs Alavi... So what we found... SP: Euh, euh she said that what happened? can you explain? D: Yes of course. so what was found when we were looking under the microscope is that there were some cellular changes, there was, the tissue was changing so there was abnormal changes in the tissue and euh, it euh, the lymph node, the biopsy was of the lymph node. and euh we found some abnormalities, some euh tumour type abnormalities. Can you ask Mrs Mehri what she understands? SP: she asks that euh, what do you mean I've got a tumor on my neck? what does it mean? D: Does she understand what a tumor is? SP: Do you mean that its some kind of cancer tumor or...? D: Yes it is a cancer, it is a cancer what I'm referring to and euh, technically it means that there is an abnormal growth that cells are growing uncontrollably, its just that the cells have changed their properties and now their, their, because their changing the body is not able to control them anymore and there expanding, their growing, and that's why there is a bump on her neck.

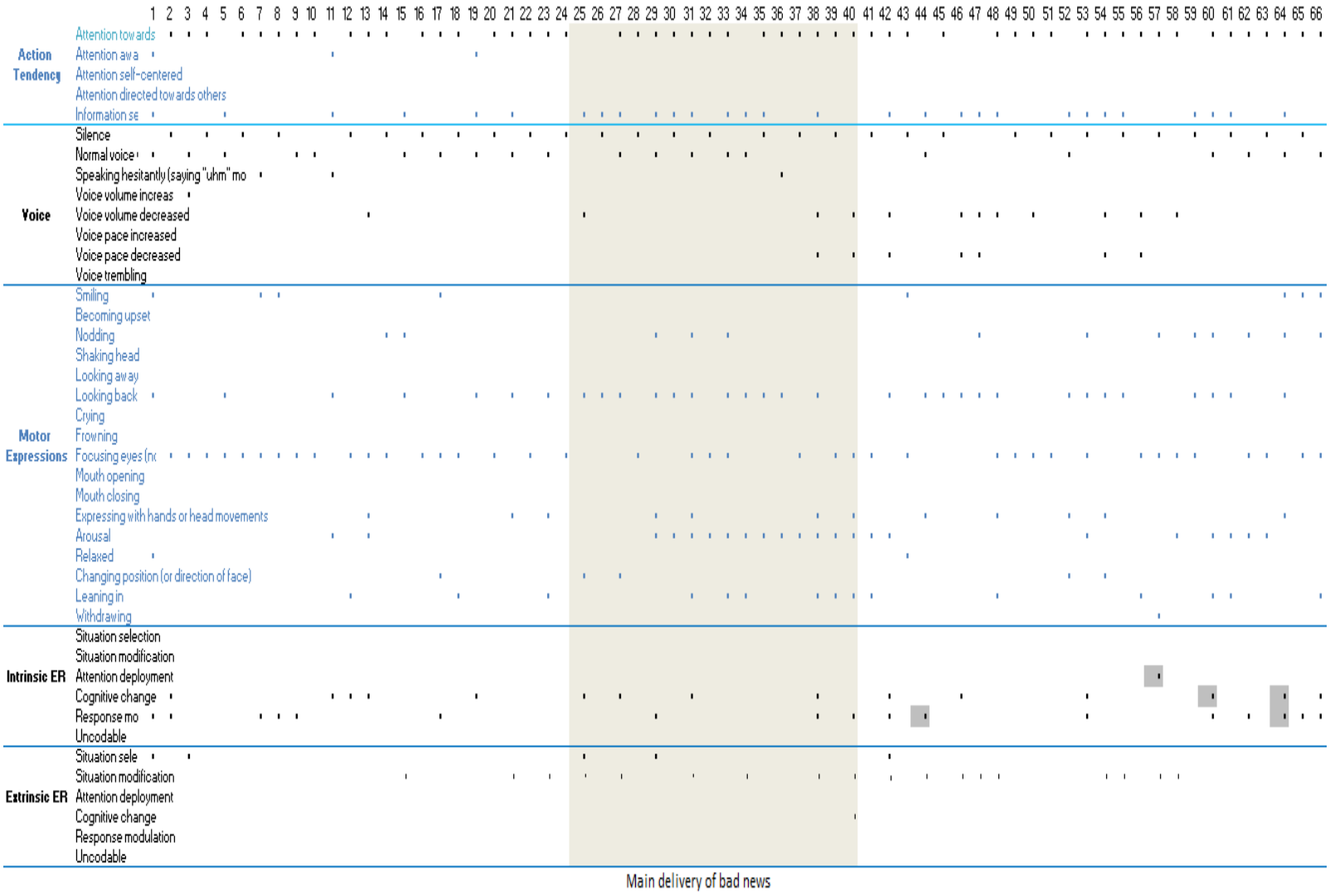
Appendix 5: CORDAVAM Diagram for A-post



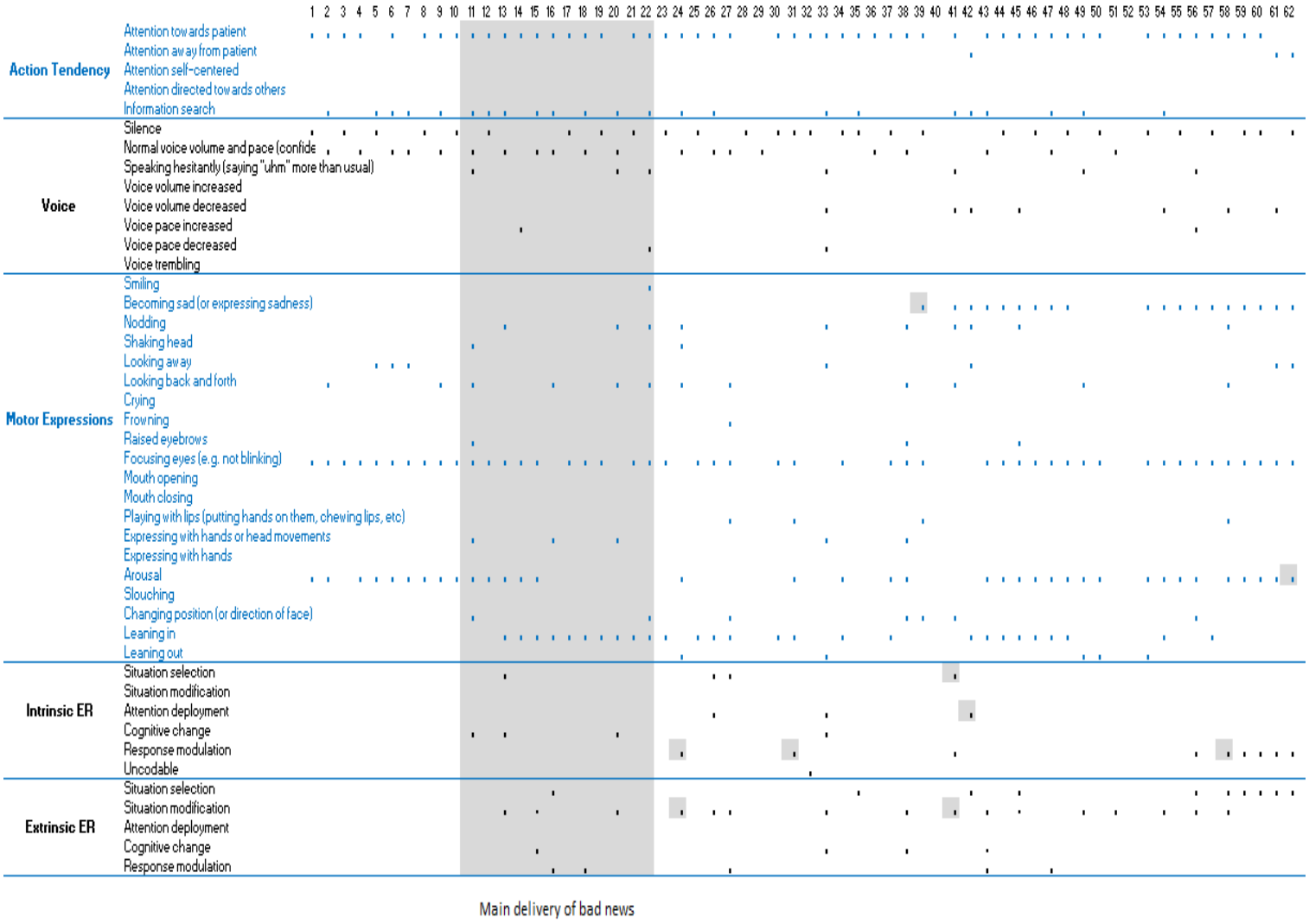
Appendix 6: CORDAVAM Diagram for B-pre



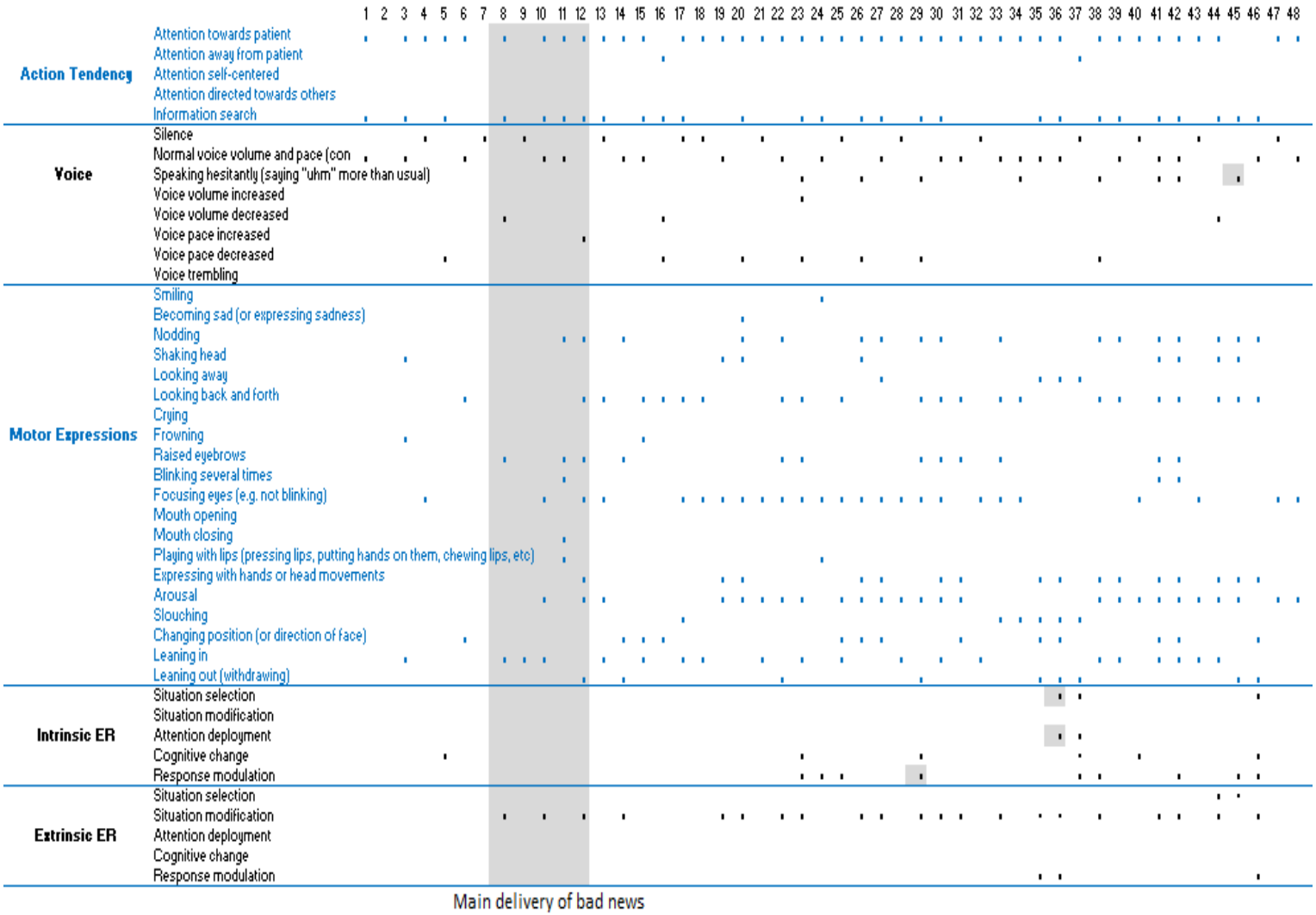
Appendix 7: CORDAVAM Diagram for B-post



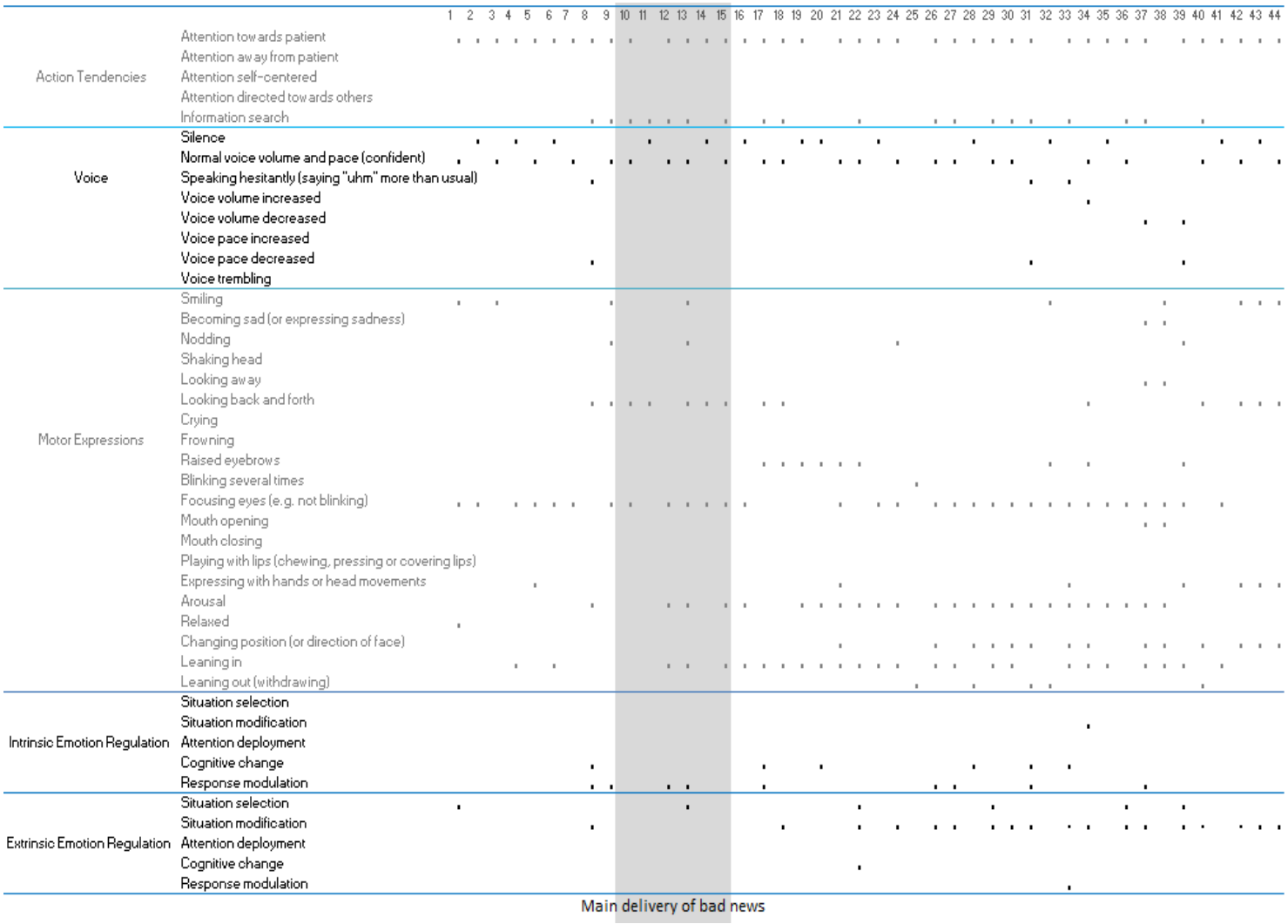
Appendix 8: CORDAVAM Diagram for C-pre



Appendix 9: CORDAVAM Diagram for C-post



Appendix 10: CORDAVAM Diagram for D-pre



Appendix 11: CORDAVAM Diagram for D-post