ACACIAS Project: Physiological and Subjective Effects of High-fidelity Simulation During Delivery of Bad News in Oncology

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Abstract

Background: Delivering bad news is difficult and requires specific training, but this training can be accomplished through high-fidelity simulation (HFS). This prospective study was conducted to objectively evaluate the emotional impact of HFS as an effective tool to develop clinical proficiency.

Methods: This prospective feasibility study was conducted from January 2021 to May 2021. Students received a 1- or 2-day training course. The emotional impact of the intervention was evaluated by self-questionnaire and by an Affect-tag wristband that analysed Emotional power (EP), Emotional density (ED), and Cognitive load (CL).

Results: The study population included 46 students with a median age of 25 years (range 21–34 years). Participants were emotionally and effectively involved in the HFS training without being completely overpowered by emotions, which may be an inherent feature of the training format. Students who participated twice improved their EP ($p < 0.001$) and decreased their ED ($p = 0.005$). CL remained stable ($p = 0.751$). The mean time of the first and second training increased (1:41 vs. 2:16, $p = 0.02$). Skills improved as assessed by self-questionnaires and by outsiders (actor/nurse).

Conclusion: HFS is a good method for this type of training, considering the emotional impact. Training in delivering bad news was improved through objective practice and self-assessment by participants.

Background

Well-developed communication skills are important to ensure optimal patient care, and it is essential to improve breaking bad news (BN) skills among physicians. Patient expectations have changed drastically over the past decade; patients and their families now desire comprehensive information communicated with warmth and honesty [1, 2]. BN has negative effects on patient satisfaction about care [3], decisions about treatment options [4], and psychological adjustment [5]. Physicians must master communication skills to appropriately deliver BN, but they must also be able to identify patients' needs and expectations to tailor the information step-by-step.

Stress can negatively affect the quality of doctor-patient communication [6], and it is especially important to detect and respond to patients' verbal or nonverbal cues [7]. Communication skills are essential in medical oncology, particularly with regard to palliative care [8, 9]. Several oncological guidelines have been published to help physicians deliver BN, such as the SPIKES (Setting, Perception, Invitation, Knowledge, Emotions and Summary) protocol [10, 11]. However, many studies have confirmed that medical students continue to be uncomfortable with this kind of stressful challenging responsibility due to a lack of training [1, 12, 13].

Simulation technologies have been presented as an option to improve appropriate communication behaviour, including how BN is presented. This kind of technology has been advocated as a relatively safe method: students can to learn and practice skills in high-fidelity scenarios without involving actual patients. High-fidelity simulation (HFS) training and its benefits are now well accepted in undergraduate and postgraduate educational settings. Studies have been conducted to train surgeons, resuscitators, and emergency physicians, and the results have led to increased interest in HFS training [14–16]. Hureaux *et al.* reported that interpersonal skills, which are among the competencies needed by health professionals, can be developed through HFS training [17]. In France, the curricula of most medical schools do not include any content related to breaking BN. For the first time, we emphasize simulation and its benefits in medical oncology [18]. Nevertheless, we lacked an objective evaluation of the benefit of this technique. The stress felt by students can give rise to objective evaluation [18]. Perceived stress in all students was reduced by the simulation training, regardless of their background. The HFS did not generate negative stress in the participants but did recreate the stress expected for a consultation, as previously shown [19].

Different techniques are available to assess stress, including heart rate, blood pressure [20], and biochemical markers such as cortisol [21]. However, these techniques are difficult to implement routinely and do not directly evaluate emotions. The emotional environment generated during a simulation session can affect training. Therefore, we chose an innovative technique to assess emotional impact. NEOTROPE has created the complete Affect-tag system, which is a mobile solution for measuring affective and cognitive reactions using physiological data [22].

After highlighting the feasibility of HFS training for the BN consultation [18], this prospective study objectively evaluated the emotional contribution of HFS as an effective tool to develop clinical proficiency using the new method of Affect-tag.

Methods

Population

A single-centre prospective study was carried out in the simulation centre of Limoges University Hospital between January 2021 and April 2021. HFS sessions were offered to students in the departments of medical and surgical oncology. Three 3-day sessions were offered to students, for a total of nine sessions open to students. Each student was encouraged to follow two sessions, and 4–6 students were assessed per half-day.

Study design

The details of the training have been published previously [18]. The simulation session lasted 10 min. Students played the role of the physician and a medical coach played the role of the patient. The coach had oncological practice experience and had attended oncology consultations to gauge actual patients' reactions.

Each participant was confronted with an original and unique clinical case, which was not broadcast before the simulation. One or two educational objectives were defined before the simulation. The objectives were specific, different for each student, and graduated according to seniority. The scenarios were prepared by two oncological senior practitioners in collaboration with the coach. Communication between the coach and oncological seniors was established via an earpiece during the consultation to modulate the course of the session, if necessary.

A nurse with 25 years of experience in accompanying consultations played the role of facilitator. She helped the residents prepare the BN announcement before the start of the simulation and attended the announcement consultation. She could intervene during simulations to help students in difficulty.

At the end of each simulation, a group debriefing was carried out: interns engaged in self-examination of their feelings and what they perceived were their strengths and limitations. In addition to this debriefing, theoretical training on communication was offered to the students to summarise the essential information of the day.

Objectives

The main objective was to evaluate the impact of HFS training on participants. Participants all wore an Affect-tag wristband to capture and analyse emotions (https://affect-tag.com). The **Affect-tag** system is composed of a light and wristband capable of measuring the wearer's heart rate and electrodermal activity or micro-sweating as well as a computerised solution for real-time calculation of cognitive and affective indicators [22]. The system allows the wearer's vitals to be monitored in real-time on an iPad. In this study, it was used to collect information on three main parameters:

- - **Cognitive load (CL**) (scale from 0–100): represents the level of attention and engagement over a given time. A high CL reflects a high level of stress with the risk of focusing only on the consultation content and not on the form and therefore not on the patient. In contrast, a low CL reflects a lack of interest by the wearer. In both cases, this would lead to a "poor" announcement consultation.
- - **Emotional density (ED)** (scale from 0–100): represents the endurance or the frequency of emotional reactions during a given period. The greater the increase in the ED score, the higher the frequency of emotions during the measurement period, as indicated by bursts of sympathetic activity.
- - **Emotional power (EP)** (scale from 0–100): represents the level of intensity of an emotional reaction during a given period. The greater the increase in the EP score, the greater the intensity of emotions during the measurement period, as given by the measure of sympathetic activation strength.

Additionally, the **time to the first emotional peak (TEP**) was defined as the time between the start of the simulation session and the first emotional peak at 100. The Affect-tag parameters were evaluated for all students during each coaching session, and the coach only during the first 10 coaching sessions.

Sensitivity parameter was assessed during the BN announcement consultation at the first HFS training (T0) and the second HFS training (T1); each intern self-reported their own findings.

The secondary objectives were to:

1. Evaluate the change of competence by subjective skills. Competence levels were assessed using a self-questionnaire with a Likert scale. This questionnaire was based on French recommendations [23] and has been validated previously [18]. The skills were assessed pre-HFS and before each training session using a 4-point Likert scale and grouped into three categories of verbal, feeling, and relational skills [18].
2. Correlations between skills were assessed by each student and the professional who also participated in the training (coach or nurse). A competency evaluation questionnaire was completed by the student, the nurse, and the coach for each course.

Ethics statement

Students provided oral consent to participate in the study, and no video recording was stored after the session. The Affect-tag RX is a 100% anonymous system: it does not collect any personal data that could identify study participants. Individual results were accessible, but entry was only in the form of a participant number. The project protocol was validated by the Ethics Committee of the Medical University of Limoges (N°2019-1).

Statistical analysis

Nominal variables were compared among the groups using Fisher's exact test, as appropriate. Means were compared using the non-parametric Wilcoxon test or the two-tailed Student's t-test for continuous variables. A p-value < 0.05 was considered significant. Statistical analyses were performed using XLSTAT 2021.2.2® software (

Results

Characteristics of the overall population

In total, 46 students (25 women and 21 men; median age, 25 years; range, 21–34 years) participated in the HFS training. Among them, 16 participants practised two training sessions (20%). Twenty participants were undergraduate students (43%) and 26 were residents/fellows (57%). Twenty (77%) had already undergone role-playing and/or HFS training in medicine and/or surgery (mean of training: 1.95 ± 1.05). Among the residents/fellows, 19 had a medical (73%) specialty and seven had a surgical specialty (27%). Twenty had already delivered BN (77%) and 14 (53%) had completed a work placement in an oncology or haematology department.

Parameters assessed by the Affect-tag (cognitive load, emotional density, and emotional power, as well as emotional peak)

Student results

The mean CL values were 38.7 ± 20.7 at T0 vs. 33.8 ± 6.6 at T1 ($p = 0.751$). The mean ED values were 12.4 ± 11.9 and 19.02 ± 6.76 respectively ($p = 0.005$), and the mean EP values were 29.4 ± 19.7 and 19.04 ± 9.4 ($p < 0.001$) respectively (Table 1 and Figure 1). The failure rate of the watch was about 15% at M0 and 18% at M1.

Table 1
Evolution of parameters assessed by Affect-tag

	Students			Coach	
	First training	Second training	P-value*	First training	P- value**
Number	37	16		10	
Cognitive load (mean ± SD)	38.7 ± 20.7	33.8 ± 6.6	0.751	39.11 ± 18.2	0.7
Emotional density (mean ± SD)	12.4 ± 11.9	19.02 ± 6.76	0.005	5.41 ± 3.8	0.039
Emotional power					
(mean ± SD)	29.4 ± 19.7	19.04 ± 9.4	<0.001	35.81 ± 14.4	0.5
Time to first peak (mean)	1:41	2:16	0.02	1:33	0.65
Number of students with EP < 6 min.	36	15	0.9	10	0.9
*Comparison between first and second training					
** Compared to students' first training					

The mean TEP of the students was 1:41 at M0 and 2:16 at M1 ($p = 0.02$). This peak appeared in the first minutes of the game in more than 90% of cases (Table 1).

Comparison of coach and student parameters

CL and EP were similar between coach and students at the first session ($p > 0.05$; Table 1). However, ED was less important for the actor/nurse compared to participants (12.4 ± 11.9 vs. 5.41 ± 3.8, $p = 0.039$). The TEP values were also similar (1:41 vs. 1:33, $p = 0.65$).

Subjective skills evaluation

Between the pre-test (self-questionnaire) and T0 (real evaluation), the means of the subjective skills according to the Likert scale were similar for all parameters ($p > 0.05$), except for “I feel comfortable in the consultation”, “I use appropriate vocabulary”, and “I felt empathetic”.

All of these competencies improved ($p < 0.05$) between T0 and T1, except “I know how to convey important messages/He was able to convey the important message” (Figure 2).

Assessments of the students by the coach and the nurse were similar ($p > 0.05$). Nevertheless, students underestimated themselves compared to nurse and coach assessments ($p < 0.05$). However, this difference decreased significantly after the second training ($p < 0.05$) (Figure 3).

Discussion

The findings of this study confirm the importance of using simulation when training medical students in delivering BN; this can improve communication between patients and the medical team. We used a new technology (Affect-tag) to analyse the emotional impact of HFS among medical students during BN training. After two training sessions, ED and EP improved significantly and TEP increased. HFS is a good method for this type of training, considering the emotional impact of delivering BN. We found that participants were emotionally and effectively involved in the HFS training without being completely overwhelmed by their emotions, which may be an inherent element of the training format. Individual feedback improved significantly on several dimensions. Together, these results confirm that Affect-tag can be used as an additional method to assess communication behaviour among clinicians.

Communication skills training research programs have been conducted in the last few decades. Brown et al. reported that physicians find that delivering BN is a stressful experience, particularly inexperienced and/or tired physicians [24]. Poor communication performance has been linked to burnout and fatigue, resulting in significant stress, which can be assessed physiologically [25, 26]. This is particularly interesting, as a meta-analysis revealed emotional exhaustion in 32% of oncologists [27]. Simulations can improve stress-related symptoms and thus the skills of surgeons [25], and can also help reduce emotional exhaustion [17].

Various methods are available to evaluate and improve physician confidence, knowledge, empathy, and skills in delivering BN [28]. Previous studies have demonstrated that student emotions, an important parameter when delivering BN, can be incorporated into coaching and medical simulations. In the present study, we explored unpredictable and unexpected emotions during the delivery of BN to investigate the usefulness of the Affect-tag system. We analysed three emotional aspects, and the results suggest that these parameters can be used as tools, rather than being feared or ignored. These emotional parameters can help teachers assess whether medical students are comfortable in a given situation.

Several factors explain the modification of these emotional parameters, such as EP and ED. In the initial encounter, students learned to control their emotions and those of others. Second, the training provided techniques for reducing the negative emotional impact, so students learned to detect certain markers in patients during interviews. Thus, the medical students included in this study had a high EP before the training and this parameter decreased significantly after coaching.

New knowledge from the consultation helped students perceive the interview in new ways and also to perceive less noticeable but equally important stimuli during the interview. We found that the participants were emotionally involved in the HFS training without being completely overwhelmed by their emotions. BN training can also be improved through objective practice and self-assessment by participants.

CL theory was initially proposed in the 1980s by John Sweller [29]. According to Sweller, working memory is extremely limited and requires energy, whereas long-term memory, correlated to human experience, is immense and can be used immediately, without cognitive effort [30]. In this study, the CL was stable, which can be explained by Sweller's concept. During the first training, students learned something new using their working memory, and thus they were stressed and apprehensive, which generated mental load. Nevertheless, they were not focused on the coach's emotions. After the training, they delivered BN more easily because this concept was familiar using their long-term memory, but their CL was stable compared to the first session because they intellectualised the interview. Finally, the CL was not lower but was more focused on the essential elements during the interview. This CL parameter confirmed that most of us can only process some bits of information at a time and the repetition of pedagogical exercises can help medical coaches with their teaching.

One solution is HFS, which has been shown to improve not only self-efficacy (subjective performance) in doctors and nurses, but also communication skills (objective performance) [31].

HFS can reduce stress during a BN consultation, but paradoxically it can generate stress during training. The environment created by the HFS could affect participant motivation to learn, so it was important to assess the impact of the emotions generated by the HFS. Positive emotions improve attention and ability to process information, thereby facilitating learning, whereas negative emotions reduce working memory. To date, most studies have indirectly evaluated emotions by assessing physiological data [32, 33]. Some have found that simulation is associated with increased learner anxiety [34] and that it may have negative consequences on student performance and the learning experience [35]. One study reported that HFS training increases heart rate but not blood pressure [36]. However, this finding should be interpreted with caution. The very purpose of HFS is to create a stressful situation before an actual BN consultation. Thus, it was difficult to differentiate what was related to training and what was related to the actual consultation. Some research indicates that students perceive the stress associated with role-play scenarios similar to that encountered in everyday life [37]. Moreover, training skills and familiarity with the environment do not necessarily reduce stress levels during simulated high-acuity scenarios [38]. Physicians experience increased stress during the pre-information phase (briefing) with a significant decrease in heart rate ($p < 0.0001$) between the beginning and end of a BN consultation [26]. Finally, the benefit is similar whether we consider undergraduate students or health professionals [18, 39].

A common criticism of using HFS is that it may not produce a valid interview experience. However, studies on undercover simulated patients visiting practicing physicians have reported low detection rates, suggesting that the simulations can be very authentic [31]. Using a trained coach experienced in the field of medical communication may have limited between-subject variance in this study. This study had some biases, including a few students who had completed simulation training before this study but we evaluated the kinetics of some parameters and each student engaged in self-reporting. We were also limited by the number of participants, but the study population was larger than in previously published studies. Finally, an insufficient number of students underwent two training sessions, which can be explained by the difficulty including students, as documented by a recent study [4].

Conclusion

Our results demonstrate the value of HFS training and objective validation of its emotional impact. BN training was improved by objective practice and self-evaluation by participants. A prospective study is needed to confirm these results. We confirmed that training in delivering bad news was improved through objective practice and self-assessment by participants and we highlighted that HFS is a good method for this type of training, considering the emotional impact. To validate these points, we are setting up a prospective randomized clinical trial comparing HFS vs traditional training (ACACIAS 2).

Abbreviations

BN: bad news

CL: cognitive load

ED: emotional density

EP: emotional power

HFS: high fidelity simulation

SPIKES: Setting, Perception, Invitation, Knowledge, Emotions, and Summary protocol

TEP: time of first emotional peak

Declarations

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Ethics approval and consent to participate

Institutional Review Board Statement: N°2019-1

Consent for publication

Not Applicable.

Conflict of interest statement

The authors declare that they have no conflicts of interest in relation to this study.

Availability of data and materials

Data are available from the corresponding author upon reasonable request.

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None.

AUTHOR CONTRIBUTIONS

Conceptualisation, E.D.; methodology, E.D.,SL.; formal analysis, SB.; writing - original draft preparation, E.D, AT.; writing - review and editing, E.D, H.S, S.L, T.F-J, A.T, F.C, L. F, A.T; validation, E.D, H.S, S.L, T.F-J, A.T, F.C, L. F, A.T.; supervision, E.D. All authors have read and agreed to the published version of the manuscript.

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Figures

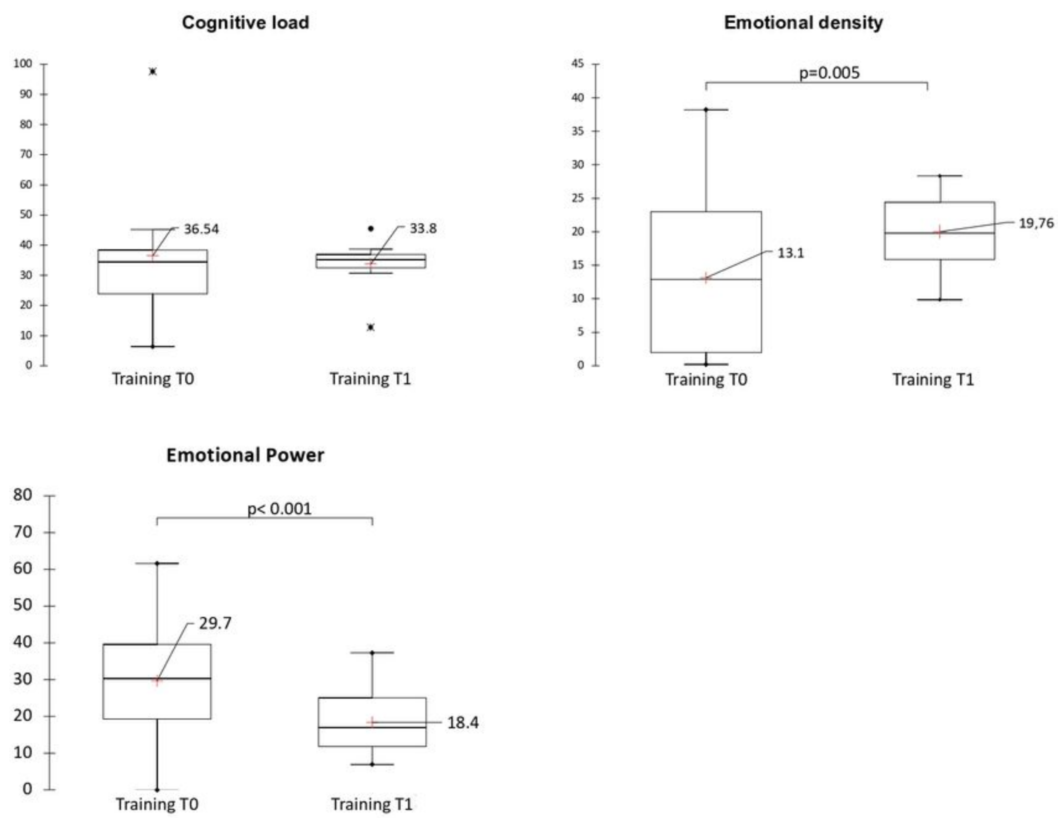

Figure 1

Cognitive load, emotional density, and emotional power assessed by the Affect-tag

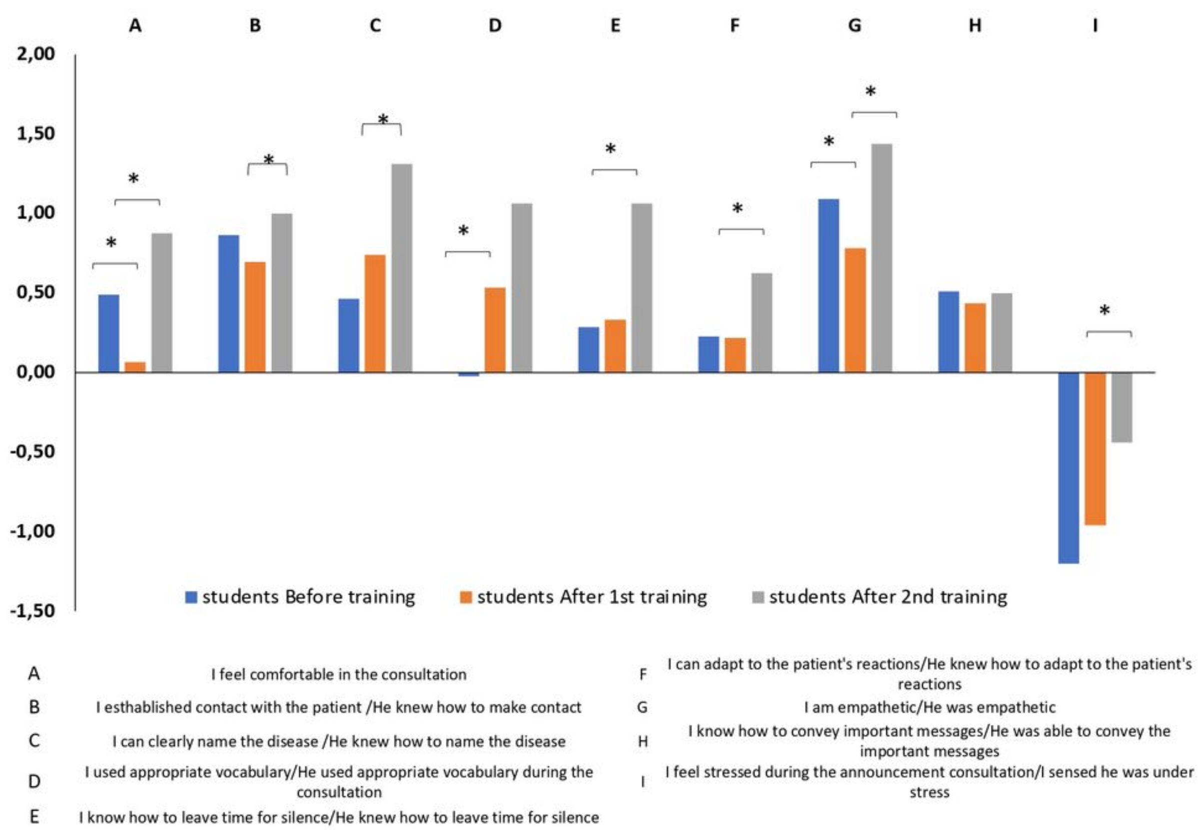

Figure 2

Subjective skills evaluation during high-fidelity simulation

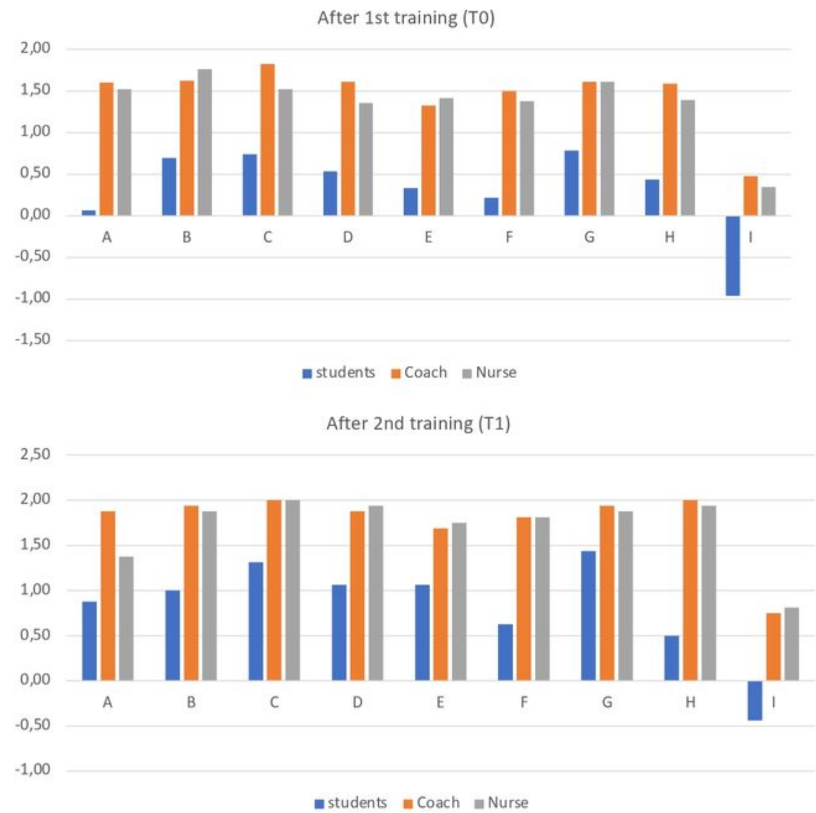

Figure 3

Relationship between the learner's self-assessment of skills and the coach's and nurse's assessment

Supplementary Files

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