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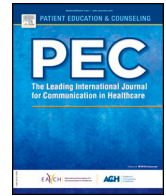
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Patient-centered innovation

Relationship between self-reported cognitive and behavioural empathy among medical students

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ABSTRACT

Objective: The aim of this study was to explore the relationship between cognitive and behavioural empathy in medical students.**Methods:** Fourteen 4th year medical students recruited on the basis of their scores on the self-reported Jefferson Scale of Empathy (JSE-S) were divided into two groups: low JSE-S scorers ($n = 8$) ($M = 96.75$, $SD = 10.3$) and high JSE-S scorers ($n = 6$) ($M = 121.3$, $SD = 2.94$). They were discreetly videotaped while taking history with an incognito standardized patient. Students' behavioural empathy was measured using the Verona Coding System (VR-CoDES-P) and rating of non-verbal behaviour.**Results:** Patients expressed the same number of concerns per encounter in both groups but gave more cues to high-scorers ($p = 0.029$). However, students of both groups demonstrated the same amount of verbal empathy (high: 16% vs low: 15% $p = 1.00$). High JSE-S scorers' non-verbal communication tended to be rated slightly higher than low JSE-S-scorers with a higher use of facial expression ($p = 0.008$).**Conclusion:** This study did not reveal any differences of students' verbal empathy to patients' cues and concerns between low and high JSE-S scorers.**Practice implications:** The VR-CoDES-P is a useful tool to assess medical students and physicians empathic behaviour, allowing to disentangle the different components of empathy.

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1. Introduction

Physician communication style is commonly considered a critical aspect of health care. An empathic communication style by the physician improves patient outcomes [1] such as physical symptoms [2–4], satisfaction and adherence [3,5], and decreases patient anxiety and distress [6]. Despite the lack of a global clear-cut definition of the concept of empathy, it is commonly accepted that empathy is a multidimensional construct comprising cognitive, affective and behavioural dimensions [7–11]. It is often summarized as thinking, feeling and acting processes [8]. Cognitive empathy involves the process of recognizing and understanding another person's perspective [12]. Affective empathy includes being emotionally sensitive to and concerned for another person [13,14]. It is the individual's

vicarious emotional response to perceived emotional experiences of others [15]. Behavioural empathy comprises both verbal and non-verbal expressions of understanding, respect, and support for another person [16,17].

Different measures of empathy have been developed to assess health professionals' and medical students' empathy. Empathy may be measured from three different perspectives as follows: (1) Self-rating (first-person assessment) (2) patient rating (second-person assessment)— and (3) observer rating (third-person assessment) [18]. The most commonly used scales in medical education include the Jefferson Scale of Physician Empathy and the Interpersonal Reactivity Index IRI [14,19–21]. Hojat et al. defined empathy in the patient care environment as “a predominantly cognitive attribute that involves an understanding of the inner expectations and perspectives of the patient, combined with a capacity to communicate this understanding to the patient” [22]. As such, the JSE has been conceived to essentially measure the cognitive dimension of empathy. The Interpersonal Reactivity Index (IRI) was developed to assess the cognitive and affective empathy simultaneously [14]. A

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recent review on medical empathy reported that 61% of the studies investigating the development of empathy among health professionals during their training exclusively used self-reported questionnaires and JSE was the most frequently employed [20]; moreover, 17% of the studies relied on patients or standardized patients' reports, and 26% used a third-party report. Although the majority of papers conceptualized empathy as a global construct, only 13% used reports from multiple perspectives [8]. In addition, the dimensions of empathy measured by the referred studies are often not well defined [17,18,23]. Although most researchers assume a positive relation between cognitive, affective, and behavioural empathy [7,10,14], few empirical studies have reported on such issue [20]. Behavioural empathy can be measured by global ratings, checklists or analysis of sequences of verbal interactions in dyadic clinical communication. Several studies measured medical students' behavioural empathy in OSCEs from simulated patients, clinical examiners' or Faculty perspectives using global empathy rating [24–26]. They showed various degrees of agreement between self-assessment of empathy and external assessment of behavioural empathy. A study reported some degree of correlation between JSE total score and students' responsiveness to patients' emotions according to Roter Interaction Analysis System (RIAS) composite score [27]. This score included students' expressions of concern, reassurance, partnership, and empathy as measures of elements of patient-centred communication and a proxy for empathy. However, the RIAS does not code patient's emotional distress beyond the detection of explicit concerns and may miss more subtle expressions of distress. The Verona coding definition of emotional sequences represents an interesting analysis system of verbal interaction sequences. It was developed by the Verona Network on Sequence Analysis to facilitate research on patients' expressions of emotional distress and health professionals' answers to such distress during medical consultations [28]. It allows the coding of not only explicit concerns but also cues indicating underlying emotional distress (VR-CoDES) and analyses providers' answers to such cues and concerns (VR-CoDES-P) [29]. It has been used to analyse students responses to simulated patients' emotions in OSCEs but was never compared to self-reported measures of empathy [30].

A better understanding of the interrelation of cognitive and behavioural empathy is of importance in medical education since there is evidence that empathy declines in medical and healthcare students during undergraduate training [31]. However, these findings are debated and measures of empathy essentially relied on self-reports of cognitive empathy [32].

The aim of this study was to assess whether medical students' self-reported empathy as measured with the JSE-S was associated with behavioural empathy as measured by the VR-CoDES-P, including both verbal empathy and non-verbal communication.

2. Methods

2.1. Setting and design

We conducted a study at the Geneva Faculty of Medicine, Switzerland in 2016. The study is part of a large cohort project aiming at investigating how students' empathy trajectories develop throughout medical school and what factors can influence this development [33,34].

2.2. Medical curriculum

The undergraduate curriculum in medical studies lasts six years at the University of Geneva, divided into 3 pre-clinical and 3 clinical years. In the field of communication skills training, students attend lectures about the importance of the doctor-patient relationship in a "patient, person, society" module as well as a structured experiential

communication skills training (10 × 2 h seminars) on basic skills including empathy during the pre-clinical years. During clinical years, students rotate through various clinical clerkships of one- or two-month duration in the different fields of medicine and have 6 × 2 h seminars regarding more complex communication issues. Undergraduate medical training concludes with a licensing exam which consists of a written exam and 12 OSCE stations in which communication is assessed.

2.3. Participants

For the present study, 132 out of 142 4th year medical students completed the students' version of the Jefferson Scale of Empathy questionnaire (JSE-S). Their mean and median JSE scores were 113.95 (SD 10.76) and 115, respectively, and ranged from 75 to 132. The percentage of female students was 62 ($n = 79$), mean age was 23.64 years old (SD 1.45) with a range from 20 to 31. The 132 students were assigned to different primary care rotations by an administrator not related to the study. These rotations last for eight weeks and include 30 students. They take place five times over the year, either in private practices or in the hospital-based outpatient clinic. We selected among the 30 students of each rotation those scoring low (first deciles) or high (last deciles) in the JSE-S. This practically yielded to 38 students. However, for logistic reasons, we managed to involve incognito standardized patients in clinical encounters only in the hospital-based outpatient clinic. As a result, only 15 students out of these 38 students could be included in the study, based on their scores and acceptance to participate in videotaped consultations. Group A (low-scorers, $N = 9$) included the students with JSE-S scores between 83 and 109 (median=99), and group B (high-scorers, $N = 6$) the students with scores between 117 and 125 (median=122). Given the important difference in the JSE scores between both groups, we assumed that if there was a clear difference in the students' attitudes towards patients, it would be discernible even with a small number of students.

The Chair of the Cantonal Commission for Ethical Research (CCER) designated the current study as exempted from formal review since it does not involve collecting any personal health information (article 2 of the Swiss Federal Act on Research Involving Human Beings). However, participants gave a written informed consent when completing the JSE-S questionnaire in the context of the cohort project and for the present study.

2.4. Procedure

During the 4th study year, medical students are trained 8 weeks in a primary care clerkship. In this context they have two half days per week of supervised practice during which they see patients and practice clinical skills such as the beginning, the history taking and the physical exam sequences. The supervisor usually takes the lead for the explaining/planning and end of the encounter sequences. Before starting the clerkship, the 15 selected students who agreed to participate in this study signed an informed consent and received instructions about their task during a half-day consultation in the primary care outpatient clinic; in addition, they were told that one of the patients would be an *incognito* standardized patient. The half day consultation during which the incognito patient was planned was *discreetly* videotaped. Students were aware that the half-day consultations would be video-taped, but they did not know which one involved the simulated patient.

Six standardized patients (SP) were trained to mimic patients presenting with a common primary care complaint such as headache, abdominal pain or dizziness. We involved different patients with different symptoms to minimize the risk that participants would recognize them as standardized patients. For each complaint, NJP, a primary care clinical teacher wrote a scenario which included

concerns and worries regarding the pain (Appendix). These scenarios were trained during half a day in the presence of a research assistant and the primary care clinical teacher. Specific focus was put on when and how to express cues/concerns in response to students' questions or statements.

Once the clinical encounters were videotaped, they were transcribed verbatim.

2.5. Outcome measures

2.5.1. Self-reported scale of cognitive and affective empathy

Jefferson Scale of Empathy for Students (JSE-S) [35,36]: the S-version was developed for administration to medical students. It is very similar in content to the initial scale with only slight modifications in wording to make the text more appropriate for the target population [36]. It is composed of 20 items scored on a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). It contains three underlying components: perspective taking (10 items), compassionate care (8 items) and standing in patients' shoes (2 items). The overall reliability of the JSE-S measured by the Cronbach's alpha coefficient in the context of the study was 0.83.

2.5.2. Behavioural empathy

Behavioural empathy was measured through coding of verbal and nonverbal communication from the videotaped clinical encounters using the Verona coding definitions of emotional sequences [29,37]. It focuses on emotional talk during health care consultations and assumes that emotions are more often expressed as vague cues than explicit emotions [28,29]. With this instrument, patients' anxieties and worries are coded, as either a concern – a clear and unambiguous expression of an unpleasant emotion, or as a cue – verbal or nonverbal hints, suggesting an underlying unpleasant emotion that lacks clarity. Cues and concerns are either elicited by health providers (students in this case) – they may be given as response to health provider's questions or statements) or by patients (SPs in this case) – introduced by the patients without having been solicited or invited to do so. Health professionals' answers are neutrally coded as *explicit* – any response which specifically mentions either the content/topic or the emotion in the cue or concern or both vs *non explicit* – any response which does not explicitly mention either the content or the emotion of the cue or concern as specified above; *providing space* – gives space for further disclosure of the cue/concern – vs *reducing space* – reduces the space for or closes down further disclosure (Fig. 1) (Examples in Table 1) [37]. Similarly to RIAS emotional responsiveness score [27], verbal empathy is not strictly operationalized in the VR-CoDES-P.

Inclusion of all students' answers aiming at opening space to patients' cues and concerns gives a more global vision of students' verbal empathy characterized by the interest for, understanding of, and reactions to patients' more or less subtle expressions of emotional distress. However, verbal empathy can be specifically considered when the student explicitly acknowledges the affect related to SPs' cues and concerns, explicitly expresses empathy, or acknowledges and legitimate SPs' cues and concerns or emotions in an implicit way (acknowledgement and implicit empathy) (in white in Fig. 1) [38]. The VR-CoDES-P also allows to code nonverbal communication such as (a) Eye contact; (b) Facial expression: smiling, frowning, facial expressivity; (c) Head movement: head nodding, head shaking; (g) Tone of voice, voice expressivity which all contribute to behavioural empathy. Non-verbal communication was assessed using a rating scale (Likert scale 1–5) [39].

2.6. Analysis

Verona coding: three researchers (CKC, MWG, NJP) were formally trained in using the VR-CoDES. After a period of calibration during

which the three researchers coded 4 transcripts and discussed disagreements until agreements were reached, two researchers (CK and NJP) coded separately 6 videotapes over a three-month period between March and May 2019. Cohen's Kappa coefficients, used to check inter-coder reliability, were excellent: 0.85 for cues/concerns and 0.76 for provider responses. CKC coded the remaining transcripts and asked NJP in case of doubts. Frequencies of cues/concerns and empathetic responses as well as students' answers – explicit/non-explicit and providing space/reducing space – were then computed. For non-verbal communication, interrater reliability measuring the intraclass correlation was 0.80. We used Wilcoxon rank sum tests to analyse general distribution between cues and concerns, cues and concerns' elicitation by students or SP as well as distribution of students' responses between reducing and providing space, content or affect in all clinical encounters. We used Mann Withney test to assess differences regarding SPs' expression of cues and concerns as well as students' responses to SPs' cues and concerns between low and high JSE-S scorers. Values under 0.05 were considered significant (for sub-categories of verbal empathy and non verbal communication, a Bonferroni correction was applied and data were considered significant for $p < 0.0125$). Finally, distribution of SPs and scenarios between low and high JSE-S students was analysed using Chi square tests.

3. Results

Fifteen medical students completed the JSE-S questionnaire and were videotaped while taking history with a simulated patient during their primary care clerkship. One videotape being not usable, 14 students had complete data. The videotaped clinical encounters (focused on history taking) lasted 10.22 (SD 5.0) minutes. The distribution of SPs and of scenarios did not differ between both groups ($p = 0.290$ and 0.627).

SPs gave more cues than concerns (Wilcoxon=91.00; $p = 0.001$) (Table 2). Three SPs did not express a concern during history taking (2 in group A and 1 in group B). In response to SPs' cues and concerns, students provided more space than they reduced it although not statistically relevant (Wilcoxon=65.50; $p = 0.162$), and more often explored the content than the affect (Wilcoxon=67.00; $p = 0.028$). Students expressed verbal empathy to 15% of SPs' cues and concerns and obtained high scores of all four non-verbal communication coded, especially for gazing.

SPs in interaction with high JSE-S scorers (group B) expressed more cues in reaction to their questions or statements than with low JSE-S scorers (Mann Whitney=40.50; $p = 0.029$). Though receiving more cues, high JSE-scorers did not display more verbal empathy (Mann Whitney=-25.00; $p = 1.00$) and did not provide more space to SPs (Mann Whitney=19.50; $p = 0.573$) (Table 3). Yet their non-verbal communication tended to be rated slightly higher than low JSE-S scorers with a notable higher use of facial expression (Mann Whitney=31.00; $p = 0.008$).

4. Discussion and conclusion

4.1. Discussion

The aim of the study was to compare 4th year medical students self-reported cognitive empathy with their behavioural empathy. Overall, students provided more space than reducing it in response to cues and concerns. They more frequently explored the content than the affect related to patients' cues and concerns. Fourteen percent of medical students' responses to patients' cues and concerns were related to verbal empathy. Compared to students with low JSE-S score, those with high global JSE-S scores did not provide more space to patients' emotions (cues and concerns) and did not express more verbal empathy, even though patients gave them more

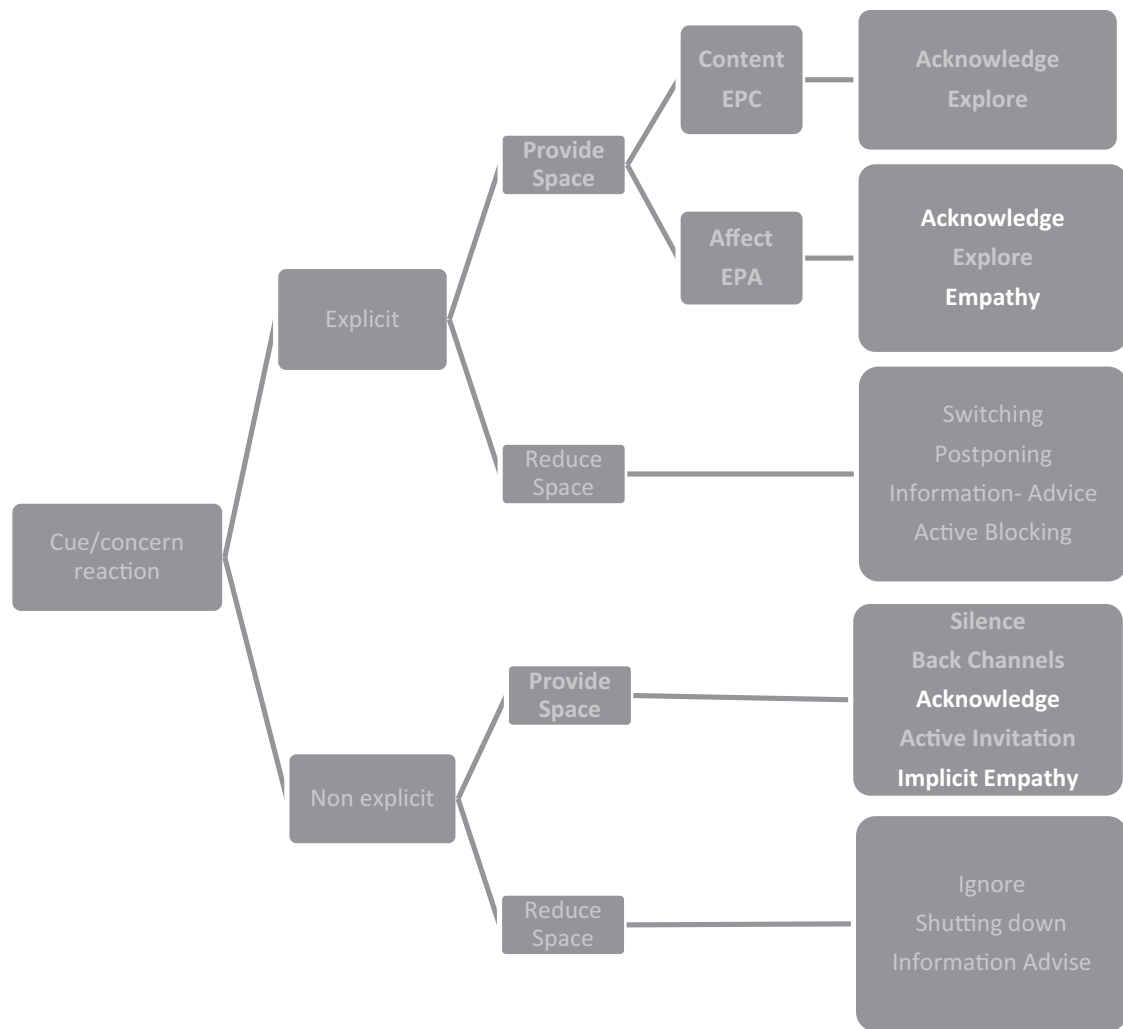


Fig. 1. Providers' answers to patients' cues and concerns adapted from the VR-CoDES-P coding manual [47] (in bold: space providing; in white: verbal empathy).

cues. Students scoring high on the global JSE-S tended to obtain higher scores for facial expression.

The results of our study are in line with a previous report exploring medical students' reactions to patients' cues and concerns during OSCE: patients' give more cues than concerns; students

provide space more frequently than reducing it in the beginning of a consultation [30]. It has also been shown that both physicians and medical students tend to explore more the content than the affect of a cue [40–42]. Clinicians often find it difficult to respond to patients' emotional distress [43,44] and the fact they focus on the content

Table 1

Examples for students' responses to cue/concerns (Verona-CoDES-P) extracted from the coding manual [52].

Code	Example
Acknowledge the content of patients' cues/concerns	Pt: I was in terrible pain HP: You had pain
Explore the content of patients' cues/concerns	Pt: I am so worried about the operation that is scheduled for Friday. HP: What operation are you having?
Acknowledge the affect of patients' cues/concerns	Pt: I am so worried about the operation that is scheduled for Friday. HP: Worried (pause)
Explore the affect of patients' cues/concerns	Pt: I am so worried about the operation that is scheduled for Friday. HP: What it is that worries you about the operation?
Empathetic response (explicit empathy?)	Pt: I am so worried about the operation that is scheduled for Friday. HP: I imagine that this must be really hard for you, especially as you are so scared about this operation. It must be difficult waiting...
Silence	A clear space or pause (3 s or more) allowing space for the patient to say more
Back Channel	Mmm, Yes, Right, OK (all followed by a pause)
Acknowledgement	P: I am so worried about the operation that is scheduled for Friday HP: I see
Active invitation	P: I am very worried about the operation HP: Tell me more about that...
Implicit Empathy	"That sounds hard" "I understand"

Table 2

Patients' cues and concerns and students' responses (ratio) to cues and concerns for all students ($N = 14$), Means (M), standard deviations (SD).

Cues and Concerns	M (SD)	Test value	p^a
Concerns	1.71 (1.38)		
Cues	6.57 (3.61)	91.00	0.001
Concerns			
– elicited by students	1.21 (1.05)		0.047
– elicited by standardized patients (SPs)	0.50 (0.76)	2.50	
Cues			
– elicited by students	5.57 (3.81)		
– elicited by SPs	1.00 (1.11)	6.50	0.006
Students' responses to SPs' cues and concerns	Ratio ^b (SD)		p^a
Reducing Space	0.40 (0.27)		
Providing Space	0.60 (0.27)	65.50	0.162
Explicit Providing space	0.46 (0.20)		
– Explicit Providing Space Content	0.36 (0.21)		
– Explicit Providing Space Affect	0.10 (1.77)	67.00	0.028
Verbal Empathy	0.15 (0.21)		
– Explicit acknowledging	0.03 (0.07)		
– Explicit empathy	0.02 (0.06)		
– Non explicit acknowledging	0.05 (0.10)		
– Non explicit empathy	0.07 (0.14)		
Non verbal behaviour	Mean (SD)		
	Likert scale 1–5		
Mean global non verbal behaviour	3.66 (0.66)		
– Eye gazing	4.29 (0.99)		
– Facial expression	3.21 (1.03)		
– Head movement	3.50 (1.16)		
– Tone of voice	3.64 (0.60)		

^a Wilcoxon rank sum test to analyse potential differences in cues/concerns and students' responses distribution

^b Ratio: number of specific responses (related to a code)/total number of students' responses

(e.g. what is the operation that you fear) more than on the affect related to a concern (e.g. why do you fear the operation) may reflect such discomfort.

Our study showed no difference in providing space and verbal empathy among students scoring high or low on self-reported cognitive empathy. These results contrast with other studies showing some degree of correlation between behavioural empathy and self-reported empathy [24–27]. Several elements may explain such differences. The few studies which found a correlation between cognitive and behavioural empathy relied on a single global rating of empathy, produced by either simulated patients, examiners or program directors [24, 26, 45]. Regarding behavioural empathy, global ratings of empathy might be more influenced by nonverbal communication than by verbal empathy. Indeed, non-verbal behaviour seems more important than verbal communication in conveying empathy [46–48]. In our study non-verbal communication of medical students with high JSE-S scores tended to be rated higher (especially the use of more facial expression) while they did not change their verbal behavioural empathy. This may indicate a stronger relationship between medical students' non-verbal behaviour and perceived empathy since patients tend to give more cues when they perceive their physician to be empathetic [49]. It may also reflect the affective/vicarious component of empathy since affective empathy involves not only experiencing another's feelings and emotions but also having an appropriate affective response to the other person's situation [50]. However, adding a more specific instrument assessing affective empathy would be helpful to further explore the link between affective empathy and non-verbal behaviour.

Finally, an intriguing result was that patients tended to give more cues to the medical students scoring high on JSE-S. This could be

Table 3

Students' JSE-S scores, patients' cues and concerns and students' responses (ratio) to cues and concerns for low and high scoring JSE students separately: Means (M), standard deviations (SD).

	Group A Low JSE-S Mean (SD) $N = 8$	Group B High JSE-S Mean (SD) $N = 6$	Test value	p^a
JSE-S (global score)	96.75 (10.29)	121.33 (2.94)		
Concerns	1.75 (1.28)	1.67 (1.63)	22.50	0.852
– elicited by students	1.13 (0.99)	1.33 (1.21)	26.50	0.755
– elicited by standardized patients (SPs)	0.63 (0.74)	0.33 (0.83)	17.50	0.414
Cues	4.75 (2.49)	9.00 (3.58)	40.50	0.029
– elicited by students	3.88 (3.18)	7.83 (3.60)	39.50	0.043
– elicited by SPs	0.87 (1.36)	1.17 (0.75)	32.50	0.282
Students' responses to SPs' cues and concerns	Ratio ^b (SD)	Ratio ^b (SD)		p^a
– Reducing Space	0.37 (0.30)	0.45 (0.24)	28.50	0.573
– Providing Space	0.63 (0.30)	0.55 (0.24)	19.50	0.573
Explicit Providing space	0.46 (0.22)	0.46 (0.19)	24.50	1.00
– Explicit Providing Space Content	0.39 (0.19)	0.32 (0.25)	22.00	0.852
– Explicit Providing Space Affect	0.07 (0.15)	0.14 (0.22)	29.00	0.573
Verbal Empathy	0.15 (0.22)	0.16 (0.21)	25.00	1.00
– Explicit acknowledging	0.02 (0.06)	0.04 (0.09)	25.50	0.852
– Explicit empathy	0.01 (0.03)	0.04 (0.09)	25.50	0.852
– Non explicit acknowledging	0.04 (0.11)	0.05 (0.08)	28.00	0.662
– Non explicit empathy	0.09 (0.17)	0.03 (0.05)	20.00	0.662
Non verbal behaviour	Mean (SD)	Mean (SD)		p^a
	Likert scale 1–5	Likert scale 1–5		
Global non verbal behaviour	3.36 (0.48)	4.07 (0.77)	38.00	0.081
– Eye gazing	4.13 (1.13)	4.5 (0.39)	28.50	0.573
– Facial expression	2.69 (0.84)	4.25 (0.29)	31.00	0.008
– Head movement	3.13 (0.99)	4.00 (1.26)	34.50	0.181
– Tone of voice	3.50 (0.53)	3.83 (0.68)	32.00	0.345

If Bonferroni correction is applied, p is significant under a value of 0.0125 (0.05/4) for verbal empathy and non-verbal behaviour sub-categories

^a Mann Whitney non parametric test to analyse differences of means between low and high JSE-S scorers.

^b Ratio: number of specific responses (related to a code)/total number of students' responses.

linked to the fact that some standardized patients generally tended to express more cues despite the standardization efforts during training. However, patient distribution between participants was not statistically different. It is also possible that standardized patients were so keen to obtain verbal empathy from medical students that they produced more cues to receive more response. However, this should have also happened with low JSE-S scorers. Finally, another hypothesis is that patients may unconsciously react to medical students' –empathetic nonverbal behaviour by giving more cues. This needs to be confirmed by including standardized patients' rating of medical students' empathy.

This study has some limitations. Due to the constraints of putting up a study in an authentic setting, and of the analysis methodology, this study was more exploratory in nature. The small resulting sample and the fact that we limited our analysis to the beginning and history taking phases may not have allowed to show clear connections between the different dimensions of empathy and limit the generalisability of our results. However, an a posteriori power analysis with our results showed that even with several hundreds of students, the differences in behavioural empathy between the two groups would still be non-significant. Inclusion of external ratings of students' empathy by either supervisors or standardized patients might enrich the analysis. It would facilitate the understanding of empathetic processes by mixing scalar and non-scalar measures of behavioural empathy and allow further exploration of the

relationship between medical students' non-verbal behaviour and perceived empathy.

4.2. Conclusion

The use of the VR-CoDES-P contributes to the evidence regarding the links between cognitive and behavioural empathy by providing valuable additional information concerning students' reactions to patients' cues and concerns that go beyond global empathy ratings. The potential link between cognitive empathy and students' non-verbal communication needs further investigation with a larger number of students.

4.3. Practice Implications

The VR-CoDES is a recognized useful tool to assess medical students and physicians verbal and nonverbal empathic behaviour, also allowing to disentangle the components of behavioural empathy. Identifying specific behaviours related to cognitive empathy is essential for teaching empathic communication to trainees and may support more specific interventions aiming at enhancing empathy among medical students [51].

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Appendix A. Clinical scenarios

Complaint	Key elements	Worries
Headache	25–30 year old patient suffering from intermittent headache for the last 10 days	Student at the University, stressed because of low marks
Abdominal pain	Numbness of the right leg twice, not related to the headache episodes 30–35 year old patient complaining on intermittent abdominal pain for the last 2 months	Broken hearted due to a recent breakup Just started a new job and cannot miss work Has had a colonoscopy which was considered as normal but not sure that the results are reliable
Dizziness	30–35 year old patient complaining about intermittent dizziness for the last 3 months	Afraid that it might be serious An acquaintance of her sister was recently diagnosed with multiple sclerosis

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CRedit authorship contribution statement

Christina Klöckner Cronauer: Methodology, Formal analysis, Writing - original draft. **Margaret W Gerbase:** Conceptualization, Methodology, Formal analysis, Writing - review & editing. **Mathieu Nendaz:** Conceptualization, Methodology, Writing - review & editing. **Anne Baroffio:** Conceptualization, Methodology, Formal analysis, Writing - review & editing. **Noelle Junod Perron:** Conceptualization, Methodology, Formal analysis, Writing - original draft.

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