BMC Medical Education

RESEARCH

Open Access

A mixed-methods study on the course of professional identity formation in undergraduate medical students

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Abstract

Background This study explored the development of professional identity formation (PIF) in medical students during clinical rotations, focusing on the relationship between self-perceived development and actual development. It examined feedback and evaluations within the entrustable professional activities (EPA) framework, emphasizing the role of formative feedback in fostering professional growth. By analysing students' perceptions of their professional identity and feedback from online portfolios, this study aimed to enhance understanding of the trajectory of PIF.

Methods Conducted at the Radboud University, this study focused on medical students in the Master's programme. Sub-study 1 involved administering the extended Professional Self Identity Questionnaire (PSIQ) to 2,095 students from September 2020 to September 2022. Sub-study 2 analysed data from 240 students, integrating PSIQ responses with feedback from their online portfolios, including assessments and supervisor feedback. Data were analysed using SPSS (sub-study 1) and content analysis (sub-study 2) to explore the relationship between self-perceived PIF and actual performance.

Results A total of 1,519 students completed the extended PSIQ, with exploratory factor analysis confirming the questionnaire's unidimensional structure and improved reliability after adding three items. A one-way ANOVA showed a significant increase in PSIQ scores across different medical programme episodes. In sub-study 2, data of 240 students from three clerkships were analysed for the correlation between self-perceived PIF and actual performance, with no significant differences in their performance on national tests, assessments, or supervisor ratings. Portfolio analysis revealed that supervisors' feedback centred on collaboration, attitude, self-confidence, and growth toward becoming a physician, with students in later clerkships receiving more detailed feedback.

Conclusions The extended PSIQ, which includes questions about EPAs and clerkship transitions, maintains reliability and construct validity, making it suitable for studying PIF within an EPA-based curriculum. Although no significant differences in performance were found, assertiveness emerged as a key factor in the quality and quantity of feedback, with more assertive students receiving better feedback. Narrative feedback, especially process-oriented, is crucial for supporting professional identity formation in medical students.

Keywords Professional identity formation, Entrustable professional activities, Feedback, Clerkships

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Background

In life, personal identity evolves continuously as we grow and adapt to various experiences. Similarly, professional identity—the integration of personal values and professional roles—develops over time, particularly in professions like the medical [1]. For medical students, professional identity involves understanding what it means to be a good doctor and learning how to embody this role in their behaviour and decision-making [2]. What we perceive as a good doctor can vary from person to person as the different stakeholders (e.g. patients, colleagues) have different needs [3]. According to research of Steiner-Hofbauer and colleagues [3], 'good doctors' need several characteristics belonging into six categories: (1) general interpersonal qualities, (2) communication and patient involvement, (3) medical competence, (4) ethics, (5) medical management, (6) teaching, research, and continuous education. Patients mostly seem to focus on communication skills, while doctors highly value medical skills. This shows that medical students nowadays need to develop in many areas of the profession.

Professional identity formation (PIF) is essential to medical education [4]. PIF occurs through three interrelated domains: individual identity, encompassing self-beliefs and personality traits; relational identity, shaped by interactions with significant others; and collective identity, influenced by the social groups to which individuals belong [5]. These domains are all shaped by the context of medical education. Early engagement in the clinical workplace fosters students'accountability for their professional roles [6], supports the formation of a professional identity [7], and enhances sensitivity toward patients, ultimately contributing to improved healthcare outcomes [8]. PIF involves transitioning from a layperson to a skilled professional [9], a journey that is often challenging and stressful. Junior doctors frequently struggle to deal with their newly gained responsibilities and to manage uncertainty [10–12]. Various factors influence PIF [13], including prior clinical experiences, socialization, observations of others [14], and guidance from mentors and role models [15].

One approach to supporting PIF in medical education is through entrustable professional activities (EPAs) [16]. EPAs are specific clinical tasks entrusted to students once they demonstrate the necessary skills and readiness [17, 18]. Research suggests that EPA-based curricula can facilitate PIF by encouraging workplace participation and promoting feedback-seeking behaviour [19]. Receiving robust and clear feedback is essential for learning and professional development [20–23]. A study of Andreou and colleagues shows that EPAs possess great potential to encourage formative feedback leading to professional development of medical students [24]. Detailed, written feedback on performance is important for the development of medical students, as it provides them with specific insights that can guide their learning and professional growth [25–27]. The Radboud University Medical Center is among the institutions that have implemented an EPA-based undergraduate medical curriculum [16]. The frequent feedback reports used in this curriculum promote active learning and professional growth.

An important aspect of the process of PIF is the development of professional self-identity, which is described as a state of mind where one identifies as a member of a professional group [28]. "Tools like the Professional Self Identity Questionnaire (PSIQ), developed by Crossley and Vivekananda-Schmid, provide insight into how medical students perceive their professional self-identity." When using this questionnaire, one should be aware of the fact that one's self-identity is intrinsically unstable, as it reflects an emotional realm rather that a structural one [28]. While the PSIQ offers a valid measure of this perception [29, 30], it does not directly assess the actual process of PIF. With very little research into how actual PIF correlates with the student's perception of his or her development, we do not know exactly how these two are related. As a result, the relationship between self-perceived professional identity and actual professional growth or performance remains unclear, making it challenging to design optimal medical curricula to foster PIF effectively.

This study investigated the self-perceived PIF of medical students during clinical rotations and examined the feedback and evaluations within the EPA framework, collected in their portfolios. By exploring the relationship between students' self-perception of their professional growth and their actual development in clinical settings, we aimed to better understand the trajectory of PIF.

Methods

Context

This study was conducted at the Radboud University in Nijmegen, the Netherlands, where the undergraduate medical school curriculum is structured into a 3-year Bachelor's programme followed by a 3-year Master's programme [19] (provided in Fig. 1). Postgraduate medical training is the same as residency in the United States. The Master's programme integrates clerkships with occasional classroom training, creating a dynamic interplay between practical and theoretical learning.

Participants

The target population for this study consisted of medical students enrolled in the undergraduate medical curriculum at Radboud University in Nijmegen, the Netherlands. Only students of the Master's programme were included

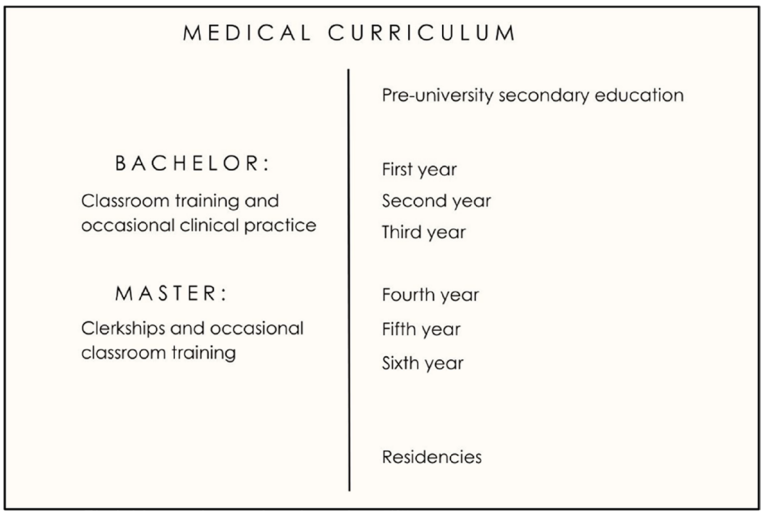

Fig. 1 Medical curriculum at Radboud University, Nijmegen

in this study. This programme follows a structured schedule divided into distinct"episodes,"alternating between classroom training and clinical training (clerkships). Figure 2 presents an overview of the Master's programme and its clerkship structure. Episodes 0–3 correspond with the first year of the Master's programme, episodes 4–6 with the second year and episodes 7–8 with the third and last year. Each month, a new cohort, referred to as a Clinical Rotation Group (CRG), comprising 26–30 medical students, starts their clinical rotations. Students

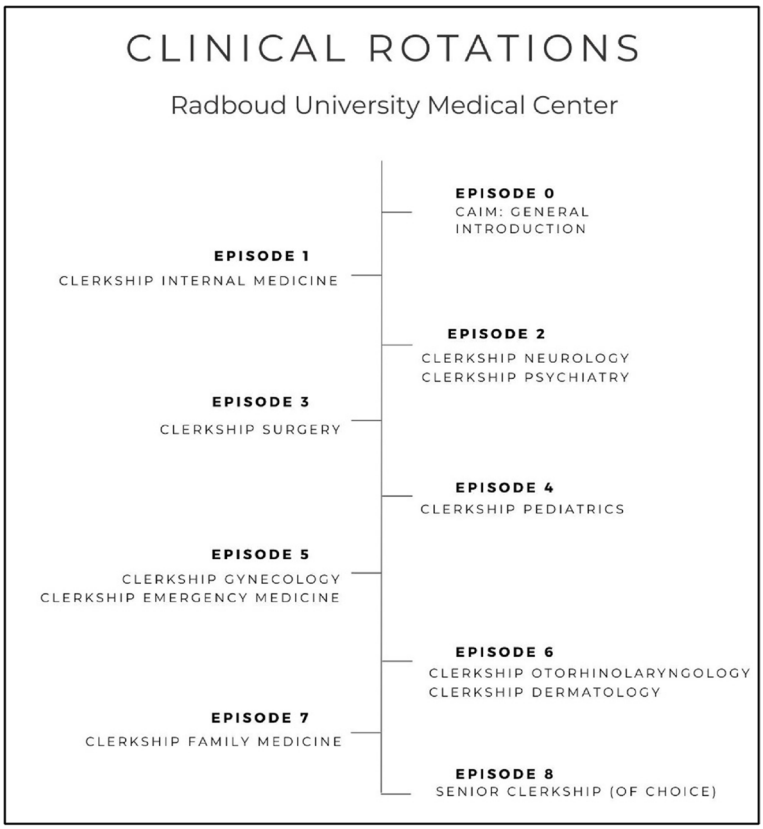

Fig. 2 Clinical rotations at the Radboud University Medical Center

remain within their assigned CRG throughout the 3-year Master's programme, fostering continuity and collaboration within their cohort.

This study was divided into two sub-studies. In Substudy 1, all registered students between Episode 1 and Episode 7 of the Master's programme were included, between September 2020 – September 2022. Participants were asked to complete an online questionnaire, the extended Professional Self Identity Questionnaire (extended PSIQ), which is detailed later in this paper. The data collected from sub-study 1 was anonymized, preventing direct linkage of the information to individual participants. As a result, we undertook sub-study 2, which was designed to address this limitation. In sub-Study 2, we aimed to correlate data from the extended PSIQ with the personal data stored in participants'online portfolios, for a more comprehensive analysis of the participants'progress and performance.

Sub-study 2 employed purposive sampling to select the participants. Out of the group of students mentioned above (sub-study 1), 12 CRGs (out of 36 in total) were invited to also complete the extended PSIQ. This approach enabled the connection of individual students' PSIQ scores to their e-portfolio data, which was not feasible in Sub-study 1 due to the anonymity of responses. Specifically, four CRGs were selected from Episode 1, four from Episode 4, and four from Episode 7, ensuring representation from different stages of the Master's curriculum, as these Episodes represent the beginning, mid- and end of the fixed components of the studies. We selected these specific clerkships as they comprehensively reflect the entirety of the master's curriculum. Each clerkship was carefully chosen to align with the core areas of study and practical experiences emphasized throughout the program. By integrating these diverse clerkships, we aim to ensure a well-rounded approach to the learning process, encompassing as many as possible essential facets of the curriculum.

Instrument

Sub-study 1

For Sub-study 1, we utilized the "extended PSIQ" questionnaire. The original PSIQ, developed by Crossley and Vivekananda-Schmidt [28], serves as a research instrument designed to investigate curricular elements that contribute to the development of professional self-identity. It is not intended to analyse the nature or content of professional self-identity or for individual assessment but may serve as a reflective tool for developmental purposes [28].

To adapt the PSIQ for this study, we added three questions to examine the relationship between entrustable professional activities (EPAs), transitioning between clerkships and PIF. The complete original PSIQ can be found in Appendix 1A, while the extended version is provided in Appendix 1C (Dutch) and Appendix 1D (English). The original PSIQ has been translated by Radboud In'to Languages, a Dutch expertise centre in language and communication and translation agency. The translation process included back translation, involving translating the questionnaire into Dutch and then having a separate translator convert it back into English, to identify and correct any discrepancies or loss of meaning.

Sub-study 2

In Sub-study 2, the extended PSIQ, as described earlier, was utilized alongside data from participants'online portfolios to obtain a more comprehensive understanding of their actual performance during clerkships. Within the Master's programme at the Radboud University Medical Center, students systematically collect feedback forms in their online portfolios. These forms include narrative feedback from supervisors on specific EPAs, individual learning goals, and overall evaluations. By integrating the extended PSIQ responses with this portfolio data, we aimed to establish a clearer connection between self-reported PIF and actual performance during clinical training.

Data collection

The data collection process was divided into two sub-studies, which are detailed below and illustrated in Fig. 3.

Sub-study 1

In Sub-study 1, all registered medical students between episode 1 and 7 were invited to complete the extended PSIQ between September 2020 and September 2022, employing a longitudinal research design. The extended PSIQ was administered during the regular online education evaluations, taking place after each episode, which occur on a quarterly basis. Thus, in the 2 years between September 2020 and September 2022, the extended PSIQ was administered eight times. Prior to participation, informed consent was obtained via an online consent form. To ensure anonymity, no personal identifying information was collected during this phase. The longitudinal data gathered in this sub-study provides insights into how PIF develops at the group level over time.

Sub-study 2

To address the research question at the individual level, Sub-study 2 was incorporated. For this sub-study, medical students who met the inclusion criteria were personally invited to participate by the lead researcher (AB) during a regular educational meeting. After obtaining

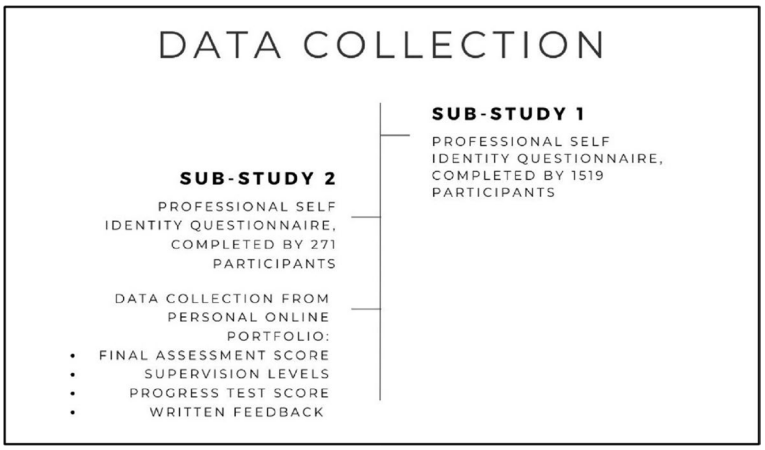

Fig. 3 Data collection

written informed consent, students were asked to complete the extended PSIQ. The data collected were pseudonymized to protect participants'identities.

Additionally, data were gathered from the personal online portfolios of the abovementioned selected medical students to review their actual performance, including:

a. Final clerkship assessment: at the conclusion of each clerkship, students receive an assessment from their supervisor, which is based on both the collected feedback and the supervisor's professional evaluation of the student. This assessment is classified into one of four categories: OVN (below the expected level), VN (at the expected level), BVN (above the expected level), or GU (no assessment possible).
b. Supervision levels from the previous clerkships**:** students receive daily feedback reports from their supervisor, which include written feedback and a supervision level. The supervision level, indicated on a scale, reflects the degree of trust the supervisor places in the student to perform specific EPAs independently. An overview of the supervision levels is provided in Appendix E.
c. The mean score on the Dutch national medicine progress test: this test, administered four times a year, measures the overall level of medical knowledge. The results contribute to a yearly summative assessment of the student's academic progress.
d. The written feedback collected in the students' evaluations: this includes the narrative feedback collected during both intermediate and final evaluations of the student's performance.

In sub-study 2, we received responses from 240 medical students in 12 different CRGs. All attending students agreed to participate. We missed the students who were absent from the class at the time the questionnaire was handed out. This group consisted of students from 3 different clerkships. In order to gain more knowledge about how the highest- and the lowest scoring students score on the extended PSIQ, we selected 60 students by purposive sampling: the 10 students with the lowest mean score and the 10 students with the highest mean score on the extended PSIQ in all three clerkships. This produced a total of 30 students with the lowest scores (hereafter called the LS group) and 30 students with the highest scores (hereafter called the HS group).

Data analysis

To address our research question, we employed a mixed-methods design that integrated both statistical and qualitative analyses.

Sub-study 1: statistical analysis of the PSIQ

The data were analysed using SPSS (version 29). Initially, descriptive statistics were applied to examine the data. Subsequently, reliability and factor analyses were conducted, followed by a one-way ANOVA to assess group differences.

Sub-study 2: statistical analysis of the PSIQ & qualitative analysis of the portfolio

An independent samples t-test was conducted to compare scores between the two groups (LS and HS). Moreover, a chi-square test of independence was used to analyse the relationship between gender and group assignment (LS vs. HS). The written feedback collected from the intermediate and final evaluations was subjected to qualitative content analysis. This analysis was conducted by AB (lead author, educationalist, and researcher), SS

(student assistant), CF (professor of workplace learning with expertise in both medicine and education), and MP (professor of student wellbeing and lifelong learning, and general practitioner).

A content analysis can be 'any technique for making inferences by systematically and objectively identifying special characteristics of messages' [31]. In this study, a deductive approach to content analysis was chosen due to its focus on testing pre-existing theories by organizing and coding data into predefined categories. This deductive approach also requires attention to the organization of categories to avoid overlooking potentially relevant themes in the data. In this study, an extensive review of the literature and relevant theories guided the creation of the coding scheme, ensuring that it was comprehensive and aligned with the research objectives.

The initial categorization process was informed by defining the research objectives and established concepts within the field, which helped ensure that all key themes related to the research focus were considered in the coding structure. Thereafter, we became more familiar with the data by reading through the data (the online portfolio) to get an initial sense of the content. During this stage, we started noting recurring themes and concepts. Based on the research objectives and the initial review of the data, AB and SS identified categories that might be relevant for the analysis, and preliminary codes based on these categories were created. These codes were also informed by the subjects of the PSIQ (e.g. professional identity formation, entrustment, collaboration, communication and reflection). All intermediate and final evaluations were then coded by AB and SS with this coding scheme. AB and SS then discussed the codes developed and formulated new codes. The coding scheme was updated until a consensus had been achieved, and a definitive coding scheme was then agreed by all researchers. All the data were coded again in the final analysis based on this coding scheme. The feedback, provided by supervisors at the end of specific clerkships, offered detailed insights into students'actual performance during the corresponding clinical rotations.

To mitigate potential researcher biases during data collection and analysis, several strategies were implemented throughout the research process. First, multiple researchers were involved in the data collection and analysis phases, allowing for a collaborative approach that promoted a diversity of perspectives and minimized individual biases. Inter-coder reliability checks were conducted during the data analysis to ensure consistency and to validate the findings across different analysts. Furthermore, we documented decisions made at each stage of the research process to demonstrate the objectivity of our approach. Also, where possible, we applied reflexivity by encouraging our research team to reflect on their own potential biases and preconceptions throughout the study. This self-awareness helped identify and control for any inadvertent influences that could have shaped the research process or outcomes.

Results

Sub-study 1: extended professional self identity questionnaire analysis

We received responses from 2,095 medical students. After excluding 576 responses due to missing data in the PSIQ questionnaire, a total of 1,519 responses were included in the analysis. To adapt the original PSIQ for the context of this study, three additional items concerning EPAs and transitions were incorporated (items 10, 11, and 12). An exploratory factor analysis of all 12 items revealed a single factor, indicating that the set of items was unidimensional.

Additionally, a reliability analysis was conducted. The inclusion of the three additional items (items 10, 11, and 12) improved the reliability, with Cronbach's alpha increasing from 0.93 for the original PSIQ to 0.94 for the extended PSIQ. This increase in reliability is attributed to the higher number of items, rather than an improvement in the mean correlation between items. Specifically, the mean correlation decreased from 0.55 (for the original PSIQ) to 0.52 (for the extended PSIQ).

A one-way ANOVA was conducted using the extended PSIQ to compare the mean scores across the different episodes (1–7). The analysis revealed a statistically significant difference between groups ($F(5, 1505) = 301.539$, $p < 0.001$). Post hoc comparisons using the Bonferroni correction indicated that the mean PSIQ score increased significantly at each subsequent episode (all p values < 0.001). See Fig. 4.

Sub-study 2: self-perceived PIF versus actual performance

We now present the analysis of the actual performance scores on the Dutch medical progress test, the final clerkship assessment, and the supervision levels received during the preceding clerkships for the participants in Sub-study 2. An independent samples t-test was conducted to compare these scores between the two groups (LS and HS). The results showed no significant differences between the groups for the Dutch medical progress test, the final clerkship assessment, or the supervision level score (see Table 1).

Additionally, we analysed the relationship between gender and group assignment (LS vs. HS). A chi-square test of independence revealed a significant association ($X^2(1) = 13.017$, $p < 0.001$), with a higher proportion of men than women in the HS group.

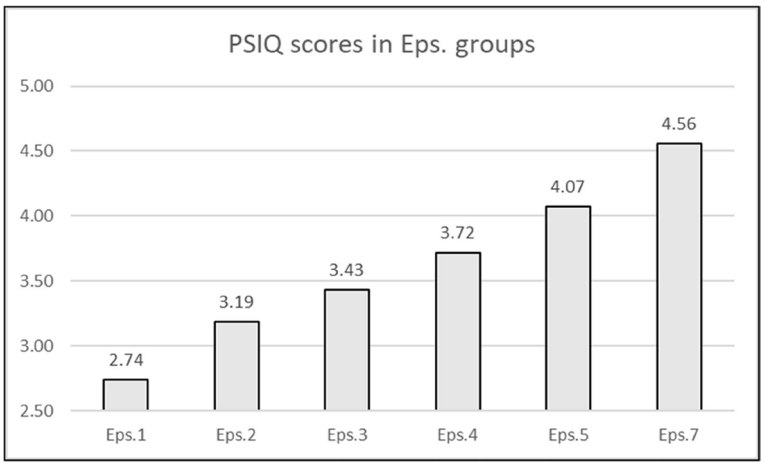

Fig. 4 Progression of PSIQ in episodes

Table 1 Scores of medical students for three different tests

Test	Group	M	SD	Sign
Dutch medical progress test	LS	2.32	0.39	t (57) = – 0.65; p = 0.52
	HS	2.24	0.48	
Final assessment clerkship	LS	2.07	0.22	t (57) = 1,22; p = 0.23
	HS	2.16	0.33	
Supervision level score	LS	33.31	18.03	t (58) = 1,38; p = 0.17
	HS	39.87	18.73	

Portfolio analysis

The portfolio analysis involved evaluating the portfolios of students in both the LS and HS groups. By examining the intermediate and final evaluations of students with the lowest and highest average extended PSIQ scores, we aimed to identify any differences in the written evaluations provided by supervisors, particularly regarding actual performance during the clerkship. Overall, we found that supervisors were generally attentive to aspects of collaboration and participation in the workplace, including interactions with supervisors, other medical staff, and peers. Additionally, feedback in episode 7 was of higher quality and significantly more detailed than feedback from episodes 1 and 4. The feedback in episode 7 focused more on a student's professional development and skills, whereas feedback in episodes 1 and 4 was primarily centred on medical knowledge and skills. Based on our content analysis of the narrative feedback, we identified five key themes, each with corresponding sub-themes:

1. Collaboration in the workplace
    a. Teamwork
    b. Communication
2. Presentation and eagerness to learn
    a. Attitude
    b. Self-reflection
    c. Pro-activity
3. Self-confidence
    a. Uncertainty
4. Growth towards becoming a physician
5. Trust and entrustment

Taken together, these themes provide deeper insights into the student's actual development and its relationship with their self-perceived development.

Collaboration in the workplace

Teamwork is frequently highlighted by supervisors as essential activities for students in the workplace. Being an active member of the team, as well as maintaining clear and empathetic communication with patients and colleagues, is highly valued. Feedback on collaboration with other professionals and peers was provided to students in both the LS and HS groups:

'... (student) is a part of the team, is visible and collaborates whenever possible' (HS group, episode 1).

'She acts as a professional towards colleagues and other staff' (LS group, episode 1).

Additionally, aspects of communication, particularly with patients, were mentioned in the evaluations of students from both groups.

'Good and friendly contact with patients. Relaxed communication.' (HS group, episode 1).

'Communication comes naturally to you with patients and other healthcare professionals' (LS group, episode 7).

Presentation and eagerness to learn

Students in both groups received substantial feedback on their assertiveness and attitude across all episodes. However, feedback for the HS students regarding their attitude was slightly more negative compared to that for the LS students:

- *'Pay attention to your appearance. You are likable, easy-going and jovial. But this sometimes extends to nonchalance. You may adopt a more formal attitude over the course of your career.' (HS group, episode 4)*
- *'Professional attitude and pleasant personality were regularly mentioned by colleagues. Makes a calm but thoughtful impression.' (LS group, episode 4)*

With regard to a student's presentation and attitude, the willingness to improve and ability for self-reflection was frequently indicated by supervisors of students of both groups:

- *'For your next clerkship, I would like to advise you to continue to pay attention to your self-learning attitude. You should primarily ask for feedback to develop yourself and not to check off mandatory items.' (HS group, episode 1)*
- *'You deal with feedback very well and we clearly see that you try to take it into account and improve it in your next consultation.' (LS group, episode 7)*

However, a difference appears in terms of proactivity. Supervisors in the HS group particularly valued students'initiative in seeking learning opportunities and their courage to engage in new and challenging activities:

'You are an independent student who can be trusted and clearly indicates her boundaries. You like to tackle things and do not shy away from new challenges.' (HS group, episode 7)

'... (student) stands out in a positive way with participation, takes responsibility.' (HS group, episode 4).

In the LS group, unlike the HS group, the evaluations described the students' lack of courage and pro-activity to actively put themselves forward in the workplace:

- *'You are not yet a qualified doctor, but you know much more than the patient in front of you. So express yourself that way.' (LS group, episode 4)*
- *'We talked about a certain reluctance towards unknown things. Take this consciously, be curious about others, and also try to take the step to participate in unknown situations.' (LS group, episode 7)*

Self-confidence

Regarding self-confidence, students from both groups received feedback on their (lack of) self-confidence in episode 1. However, as the internships progressed, students in the LS group appeared to feel more uncertain than those in the HS group. In episode 4, feedback on a lack of self-confidence or uncertainty was more frequently noted for the LS group compared to the HS group:

- *'You could develop more and present yourself more as a medical doctor. Stop being so modest." (HS group, episode 4)*

In episode 7, feedback regarding uncertainty was rarely noted for the HS group. Instead, students in the HS group received feedback on their confidence and awareness of their own limits. In contrast, for students in the LS group, a lack of confidence was still mentioned.

- *'You are an independent student who can be trusted and clearly indicates her boundaries. You like to work hard and do not shy away from new challenges. Great!' (HS group, episode 7)*
- *'You should show yourself more and trust in your own abilities and insights. Don't be too modest!' (LS group, episode 7)*
- *'What could be improved: Be more confident by trusting your own judgment, but that will come naturally, a matter of experience.' (LS group, episode 7)*

Growth towards becoming a physician

In their clerkships, students are expected to grow from a student who has just started working in the field to an (almost) qualified medical doctor. Information regarding this growth features in the supervisors' evaluations in both groups:

- *'... who gradually became more confident and grew more and more into her role as a medical doctor' (HS group, episode 7)*
- *'I've seen an acceptable growth in the past weeks' (LS group, episode 7)*

However, in the LS group, the student's professional development and growth towards becoming a medical doctor were described cautiously in more modest terms, often mentioning a period of adjustment:

- *'In the first weeks you had a somewhat wait-and-see attitude, but after a good learning conversation there is clearly visible growth, both in terms of medical content (consultation, DD, policy) and professionalism (daring to ask questions, presenting yourself a little more in the spotlight, putting yourself out there, daring to discuss your doubts)' (LS group, Episode 7)*
- *'The degree of independence has grown.' (LS group, episode 7)*

In the HS group, on the other hand, professional growth was frequently described in more exuberant terms:

- *'... already functions at senior clerk level in the department' (HS group, episode 7)*
- *'Remarkably good and above standard: very assertive and his work absolutely contributes to our own work.' (HS group, episode 7)*
- *'The development as a medical doctor is appropriate to the phase of the training. And ... is increasingly growing in the role of a novice primary care physician. You are very suitable for working in primary care!' (HS group, episode 7)*

In general, feedback on transitioning into an (almost) qualified medical doctor was particularly prominent in the evaluations of clerkship 7. This is understandable, as students at this stage of their studies have more experience compared to those in clerkships 1 and 4.

Trust and entrustment

All of the aforementioned themes were addressed in the feedback provided to students. However, feedback on the themes of trust and entrustment was notably absent, despite their importance in an EPA-based curriculum. Although these themes were not frequently mentioned in the evaluations, they were more prominent in episode 7 than in episodes 1 and 4. Supervisors in both groups referenced the trust they had in the students only occasionally:

- *'You can be trusted with working in the medical department.'* (HS group, episode 7)
- *'Also reliable in asking for help or discussing case studies.'* (LS group, episode 7)

Discussion

The extended PSIQ

The primary finding of sub-study 1 is that extending the PSIQ with three additional questions related to EPAs and the transition between clerkships does not compromise the reliability of the original questionnaire. The construct validity of the PSIQ is maintained after the addition of these extra items, indicating that the extended PSIQ remains an appropriate tool for studying PIF within an EPA-based curriculum. This is particularly significant given the widespread use of EPAs in contemporary undergraduate curricula.

Another key finding from sub-study 1 is the observed progression in PIF throughout the clerkships. This progression may be partially attributed to the design of the PSIQ's response scale, which is structured to naturally increase over time, reflecting a typical trajectory of PIF development. This result highlighted the need for a more in-depth examination of the underlying factors driving these differences, which was addressed in sub-study 2.

In sub-study 2, we compared two groups of students: those with the highest average scores (HS) and those with the lowest average scores (LS) on the extended PSIQ. Our analysis did not reveal significant differences between the two groups in terms of their EPA assessment scores, which could be due to several factors. The PSIQ scales are designed to assess overall levels and trends in development, rather than to detect small individual differences. Additionally, it is important to note that not all aspects of PIF are captured by the PSIQ. Data from the portfolios also did not provide sufficient context to explain the final assessment scores of clerkships. For instance, a student's failure to pass a clerkship may have been due to factors such as absenteeism rather than poor performance. Furthermore, the assessment tools or criteria used to evaluate performance may not have been sensitive enough to capture nuanced differences between high- and low-performing students. And we believe external factors, such as the learning environment, teaching quality, or assessment conditions, could have played a role in this as well.

Gender differences

Although gender differences were not the primary focus of this study, we observed a significant difference between male and female students in their average PSIQ scores, with men being more represented in the highest score group. This suggests that male students tend to perceive themselves as more as a medical professional during their clerkships, whereas female students appear more cautious. This is a new finding related to self-perception of performance in medical education, but it is

consistent with earlier research regarding gender differences in academia [32–35].

The fortunes of written feedback

Although overall performance assessments showed little difference between the HS and LS groups, a deeper analysis of the written feedback in sub-study 2 revealed both similarities and differences. Key similarities included the emphasis on communication and collaboration with staff, peers, and patients, as well as the students'willingness to improve and seek feedback. We believe that these components are not only central to the development of clinical skills and medical knowledge but also critical to the formation of professional identity and the cultivation of key competencies such as teamwork and professionalism. Communication and collaboration with staff, peers, and patients are pivotal in the practice of medicine, as healthcare is inherently a team-based effort. Medical students must learn to communicate effectively with a diverse array of individuals, including patients, families, and multidisciplinary healthcare teams. In addition to communication and collaboration, a student's willingness to improve and seek feedback is a key aspect of their professional development. Feedback in medical education serves as a mechanism for students to identify areas for growth, gain insights into their strengths and weaknesses, and refine their clinical practice. And written, or narrative, feedback seems to be even more beneficial for the PIF of medical students, which is supported by previous studies [25–27].

The power of assertiveness

Surprisingly, a student's attitude, particularly assertiveness, emerged as a key factor. Assertive students, who take initiative and seek new challenges, collected more specific and more frequent feedback. This increased visibility likely makes it easier for supervisors to provide feedback. Assertiveness is an essential skill for medical professionals [36], and plays an important role in the development of medical students and professionals. Assertiveness refers to the ability to express one's thoughts, feelings, and needs in an open, honest, and respectful manner, while also considering the perspectives of others [37]. In medical education, we believe that assertiveness is particularly important for fostering communication and professionalism. In various healthcare scenarios [38], such as when issues of professionalism or safety arise, or when patients make requests that challenge physicians'boundaries, assertiveness may be more effective than other communication styles.

However, this raises concerns about less assertive students potentially receiving insufficient or lower-quality feedback. Our findings showed that students with higher PSIQ scores, who view themselves as more developed, receive more positive feedback on assertiveness and confidence. However, no clear correlation was found between PSIQ scores and actual performance. Future research should explore whether assertiveness correlates with better development and learning outcomes.

Developing as a medical doctor

The feedback for both groups (HS and LS) reflects their development towards becoming a medical doctor, but the tone and content differ. Feedback for the LS group tends to focus on outcomes, such as"degree of independence has grown"or"has shown growth and development."In contrast, feedback for the HS group emphasizes the developmental process, with phrases like"increasingly growing in the role of a novice primary care physician. Research by Paulson and colleagues suggests that process-oriented feedback has a more positive impact on students'learning and self-perception than outcome-oriented feedback, [39] supporting the need for more process-focused feedback in medical clerkships to support PIF in medical students.

Feedback quality varied across episodes, with episode 7 providing more detailed and development-focused feedback compared to episodes 1 and 4. This may be due to the nature of the family medicine clerkship, where students are supervised by the same mentor for an extended period. This continuity fosters a deeper understanding of the student, both personally and professionally, potentially enhancing the student-supervisor relationship and the quality of feedback. Such longitudinal integrated clerkships, where students remain in the same practice [12], could improve feedback quality, and thus the PIF of medical students. Additionally, episodes 1 and 4 highlight the need for supervisor training to enhance feedback, which could potentially boost PIF early in the curriculum.

Strengths and limitations

This study has four key strengths. First, our mixed-methods design offers valuable insights into the relationship between students'self-perceived development and their actual development, as reflected in feedback. Second, the large sample size and long duration of the study enhance its robustness. Third, the interdisciplinary and multi-generational composition of the research team enriched discussions and provided diverse perspectives. Finally, the extended PSIQ's applicability to other curricula increases its transferability.

However, the study also has limitations. Conducted at a single institution with a unique curriculum and culture, the findings may not be fully generalizable. Additionally, the inability to link participants'identities in sub-study 1 may limit the depth of analysis. Moreover, the PSIQ is

a validated tool designed for research purposes. In this study, we employed the PSIQ to quantitatively measure the development of PIF, which is not what the instrument naturally is intended for. However, to enhance the robustness of our findings, we compared the PSIQ results with additional feedback data, incorporating both qualitative and quantitative perspectives. This comparative analysis enabled us to draw evidence-based conclusions regarding the progression of PIF, ensuring a more comprehensive and reliable interpretation of the data.

Implications for future research

Further investigation into the nature of feedback would be valuable, particularly through research that includes a detailed analysis of language use. Notably, we found limited feedback on trust and entrustment, areas for which the relationship to PIF remains underexplored. Additional research is needed to better understand how trust, particularly as conveyed through narrative feedback, influences student development and how it can be leveraged to promote PIF.

Conclusions

The extended PSIQ has demonstrated reliability and validity in examining the relationship between EPAs, PIF and transitions between clerkships. PIF among medical students increases over the course of their clerkships; however, clear and comprehensive feedback is crucial for fostering their growth and supporting their transition from medical student to junior doctor. Narrative feedback has proven to be a critical component in this developmental process. However, the manner and quality of feedback vary significantly across supervisors. Notably, students who demonstrate more substantial development receive more detailed feedback, suggesting that a focus on high-quality narrative feedback is essential for effective PIF.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-07162-2.

Supplementary Material 1

Acknowledgements
We wish to thank Geert Bouwmans and Myrthe Verhees for their contributions to this research. Furthermore, we want to thank all medical students who took the time to participate in the questionnaire.

Clinical trial number
Not applicable.

Authors' contributions
All authors contributed equally to this manuscript.

Funding
No funding was received for conducting this study.

Data availability
One out of two of the datasets supporting the conclusions of this article is available in the Radboud Data Repository, https://doi.org/10.34973/mc42-3y98, https://data.ru.nl/login/reviewer-17859981/UUR7MIH4OHKTF6NMBXQVY7ICEJQ2YLJCZWZJNDA. The other dataset supporting the conclusions of this article is archived in the Radboud Data Repository, doi: https://doi.org/10.34973/0fw3-4m22.

Declarations

Ethics approval and consent to participate
Ethical approval for conducting the PSIQ (for sub-studies 1 and 2) was granted by the ethics committee of the Netherlands Association for Medical Education (NVMO), reference number 2019.5.12. For the use of the portfolio data (sub-study 2), the ethics committee of the NVMO decided that no further review was necessary and approved the study (reference number 2024.3.8).
I hereby affirm that my research adheres to the ethical principles outlined in the Declaration of Helsinki. This study has been conducted with the utmost respect for the rights, safety, and well-being of all research participants.

Consent for publication
Informed consent was obtained from all individual participants included in the study.

Competing interests
The authors declare no competing interests.

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Received: 15 December 2024 Accepted: 10 April 2025
Published online: 17 April 2025

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