

## Maturational differences in undergraduate medical students' perceptions about feedback

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**CONTEXT** Although medical students receive varied feedback throughout their training programmes, research demonstrates that they frequently perceive it as insufficient. However, supervisors tend to perceive that it is adequate. Students' responses to, and use of, feedback are not clearly understood. The purposes of this study were to investigate how medical students recognise, respond to and utilise feedback, and to determine whether there are maturational differences in understandings of the role of feedback across academic years in medical school.

**METHODS** This was a mixed-methods study collecting qualitative (focus group and open-ended questionnaire items) and quantitative (questionnaire) data across the 5 years of an undergraduate programme.

**RESULTS** A total of 68 students participated in 10 focus groups. The questionnaire response rate was 46% (564/1233). Data analysis investi-

gated the students' perceptions of feedback and explored patterns of responses across the continuum of undergraduate medical school stages. Maturational differences among the year cohorts within the programme emerged in three general areas: (i) student perceptions of the purpose of feedback; (ii) student recognition of feedback, and (iii) student perceptions regarding the credibility of feedback providers.

**CONCLUSIONS** Junior students generally perceived the receiving of feedback as a passive activity and preferred positive feedback that confirmed their progress and provided reassurance. More senior students viewed feedback as informing their specific learning needs and personal development. They valued immediate informal verbal feedback and feedback from peers and others, as well as that from senior teachers. Exploring students' progressive degrees of engagement with feedback and its relationship with self-esteem are subjects for further study.

*Medical Education* 2012; **46**: 711–721

doi:10.1111/j.1365-2923.2012.04291.x

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## INTRODUCTION

Feedback is recognised as being of crucial importance in learning.<sup>1–3</sup> Feedback has been described as ‘information provided by an agent (e.g. teacher, peer, book, parent, self, experience) regarding aspects of one’s performance or understanding’.<sup>4</sup> Feedback differs from teaching in that it specifically provides information on the quality of the recipient’s learning and performance, and can give indications for improvement.

Feedback can have a notable impact upon learner development and progression.

This work is guided by a conceptual framework which positions feedback as formative (i.e. as necessary to inform and guide development, learning and improvement), and arises from theoretical perspectives within both medical education and general education literature.<sup>4,5</sup> Hattie and Timperley, in a large meta-analysis of feedback studies in the public education system, determined that of over 100 influences on learner achievement, individual feedback was in the top five.<sup>4</sup> Furthermore, the studies that showed the highest effect sizes involved students receiving information feedback on a task and ways to do it more effectively; lower effect sizes were related to praise and punishment. Effect sizes also varied substantially across studies. Multiple factors influenced the positive impact of feedback, and feedback, given its potentially high impact upon learner development, was generally under-used as a formal strategy for enhancing progression.<sup>3,4,6</sup>

Moreover, the response to feedback cannot be regarded as a simple behavioural response such as a measurable output produced in a linear fashion by an input. The learner first needs to recognise that feedback has been given and then to consider the feedback, recognise potential for change, and act on it. The learner can accept and use feedback, modify the advice or information given, or even reject it.<sup>4,7,8</sup> Feedback is more likely to be acted upon if the information contained within it is specific, credible, timely and relevant, and if the recipient is at an appropriate stage of learning, both emotionally and cognitively, to be able to act upon it.<sup>3</sup>

Feedback influences motivation and approaches to learning. Academic achievements and performance are affected by learning approaches, and indications of a positive relationship between deep processing learning styles and high attainment have been noted.<sup>9</sup>

Effort is consistently reported to influence performance. Narciss<sup>10</sup> demonstrated that motivation and achievement are dependent on both self-efficacy and type of feedback. Self-esteem and teachers’ expectations of the student similarly influence approaches to learning. This indicates the important influence teachers can have on students’ motivation; they should have high expectations of students, communicate these expectations often, and thus positively influence competence.<sup>9,11</sup> Conversely, low expectations of students can result in inconsistent feedback, including the delivery of inappropriate positive feedback that rewards poor performance and sometimes ignoring inadequate competence or attainment of learning outcomes.<sup>9,12</sup>

The development of self-regulation skills in maturing medical students is embedded within contextualised learning experiences. Niemi investigated pre-clinical students’ reflective learning skills and demonstrated some limitation in development amongst a significant proportion of students, which was attributed to a lack of ‘personal feedback in pre-clinical years’.<sup>13</sup> Effective learners are self-regulating, and feedback is integral to develop and underpin the processes that constitute self-regulation, such as goal setting, strategies to progress learning, task selection and monitoring.<sup>14</sup> More recently, models of formative assessment and self-regulated learning have confirmed the critical contributions of feedback, and of guided reflection upon the feedback and one’s performance, to the development of capacity to self-regulate.<sup>15,16</sup> As learners progress, maturational changes in approaches to learning may be underpinned by more effective and strategic utilisation of feedback.

Although medical students receive detailed and varied feedback at different stages of their undergraduate education, research in medical education demonstrates that medical students frequently perceive the feedback they are given as insufficient, especially in clinical settings, whereas supervisors tend to perceive it as adequate.<sup>5,17–19</sup> A constructivist perspective of learning suggests that it is what students ‘do’ with the message (i.e. how they interpret the data and how they act on this information) that is important. Students’ responses to and use of feedback are not clearly understood and thus there is potential for valuable learning opportunities to be overlooked.<sup>4,19</sup>

Hence, the purpose of this current study was two-fold: (i) to investigate how undergraduate medical students recognise, respond to and utilise feedback, and

(ii) to determine if there are maturational differences in understandings of the role of feedback across different year cohorts in a medical school.

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## METHODS

A mixed methodological approach was utilised, using qualitative and quantitative data and integrating the findings of both strands to draw conclusions. The study was guided by the theoretical perspective that developmental changes might occur across the duration of a programme and, together with changes in cognitive or self-regulated learning, might impinge upon how feedback is recognised and utilised, and thus influence learning. In line with Morgan,<sup>20</sup> we have approached this inquiry from a stance of 'pragmatism', utilising methods and questions that seem most appropriate to answer the questions posed, in a manner that allows the different approaches to inform one another and to contribute to the shared conceptualisation that such a mixed approach will enhance validity and inform analysis and interpretation.

The study was conducted over a single academic year in a 5-year UK medical school programme. Ethics approval was granted by the appropriate education research committee. Although the programme has an integrated curricular approach and provides early clinical exposure, training in Years 1 and 2 takes place predominantly within the university campus, clinical placements commence in Year 3 and, by Years 4 and 5, students principally train off campus.

The conceptual notions guiding mixed-methods research emphasise the deliberate use of each method in order to answer the research questions. In this case, we used three methodological approaches: (i) a qualitative approach, using focus groups at the beginning of the year to explore students' perceptions of feedback; (ii) a quantitative approach, using a questionnaire designed using the focus group results and distributed to all students, and (iii) another set of focus groups conducted at the end of the year to further explore themes identified in the first focus groups and questionnaire responses.

As we knew little about the students' perceptions and use of feedback, we began by taking a qualitative approach involving a small number of students to explore their perceptions of feedback. Five focus groups were conducted early in the

academic year; one group was sourced from each year group. Students were recruited by open invitation and word of mouth by interested responders who recruited their peers. The intent was to recruit students who were perceived to have an interest in feedback. The focus groups were facilitated by an independent experienced educationalist because an independent educator was considered more likely to access the students' real views than a researcher from within their programme. A hierarchical questioning technique was used, in which initial open-ended questions explored students' views and experiences of feedback at their stage in the undergraduate course.<sup>21</sup> Follow-up questions elicited in more depth the experiences of the students to identify key areas of recognition, good practice and perceptions of the role of feedback in their learning (Table 1). Sample questions included: 'When would you have liked more feedback?' and 'Give examples of when you acted on feedback and why?'

A preliminary thematic analysis of these initial focus groups identified key areas of potential interest.<sup>22,23</sup> The key areas were used to develop the questionnaire subsequently administered to all students within the school. The purpose of the questionnaire was to determine if the views expressed by students in the focus groups represented the views of a particularly interested and motivated minority, or whether they reflected more broadly held perspectives. The questionnaire was intended to generate both quantitative data derived from closed Likert-scale type items exploring specific aspects of the undergraduate programme, and additional qualitative data sourced through open-ended questions designed to explore in more depth areas of understanding of feedback principles and individual experiences (Table 2). Sample questions included: 'What do you think are the main reasons for giving you feedback on your work?' and 'What do you think might be the key reasons behind you not getting your feedback as quickly as you might like?' A common misunderstanding expressed by students within the focus groups concerned the nature of the 'feedback' being explored in this study. Thus, an opening statement was included in the questionnaire to clarify that this survey was intended to elicit students' views on feedback they had received, not feedback they had given on the teaching they had received (i.e. course evaluation). A further five focus groups were held, one in each academic year group, for which students other than those who had attended groups held earlier in the year were purposively recruited. These were conducted in the same manner as the first set of

Table 1 Focus group questions (qualitative data)

Beginning of academic year		Towards end of academic year (after questionnaire administration)	
Lead question	Follow-up questions	Lead question	Follow-up questions
Tell us your name and what you think the purpose of feedback is		Tell us your name and an experience you have had over the past year with getting feedback	
Tell us about an experience in the past when you received feedback (whether it was helpful or not)	On thinking about feedback, how do you prefer to receive feedback? In which way/form is it most useful? What other types of feedback have you received that you find helpful?	Do you think your views of the purpose of feedback have changed over the last year?	Why? What has influenced this? [Can explore whether this is to do with maturity in the course, type of feedback the recipient got, use of resource, etc.]
If you wanted feedback on some of your work, how would you go about getting it?	How could feedback information be more readily accessible, more easily used?	Do you think your understanding of feedback has changed over the year?	Do you think you have a clearer understanding of what feedback is and where to get it?
Give examples of when you have acted on feedback and why	Was this personal? [i.e. Was the feedback given at the right time for the recipient? Was he or she ready to hear it? Was it the type of feedback he or she was given?] What aspects of feedback you received were you able to transfer from one course into your other courses?	Has your response to receiving feedback changed?	If so, in what way?
Where would you have liked more feedback?	Why? What difference would it have made to you? What type of feedback?	Previously we asked if you considered negative feedback helpful or not. Are you able to use the feedback you receive in a more positive way?	
This question is about your views on receiving negative and positive feedback and its impact on you	What effect does this have on you, your motivation, value placed upon it, strategies for work?	How else do you think we could increase students' understanding of feedback and its role in their learning?	If you had just a few minutes to sum up what you wanted to change about the feedback you receive, what would you say?
Do you think there are any circumstances in which perhaps giving feedback might not be helpful or beneficial to students?	Do you think feedback might ever stop students developing an ability to self-evaluate or judge the quality of their work?	All things considered, what do you think is the most useful feedback you receive?	Is there anything we have missed?
If you had just a few minutes to sum up what you would want to change about the feedback you receive, what would you say?	Is there anything we have missed?		

Table 2 Open-ended questionnaire items, with space allowed for free text responses (qualitative data)

- 1 What do you think are the main reasons for giving you feedback on your work?
- 2 What do you think might be the key reasons behind you not getting your feedback as quickly as you might like?
- 3 Has the amount or type of feedback which you have received varied according to your stage at medical school or the individual course component? Can you describe or give an example?
- 4 Please give an example of what you have done with some feedback you have received and why
- 5 Have you any other comments to make about the website or other areas in relation to feedback to students we can improve on?

groups, later in the academic year and after the administration of the questionnaire (Table 1).

### Qualitative analysis

The focus group (FG) discussions were recorded and transcribed for analysis, and open-ended responses from the questionnaire (Qn) (consisting mostly of short notes or single sentences) were collated and printed out for analysis. Thematic analysis was undertaken to identify, interpret and synthesise patterns within the data. Data were identified by source of data (FG or Qn) and year of study. The thematic analysis used a contextualist framework, in which responses are analysed to consider not only the experiences described by students, but also their contextual responses and interpretations of these experiences.<sup>21</sup> This was intended to elucidate students' understandings of the purpose of feedback in their learning, and their recognition of the different types of feedback they perceived they had received. DM-E and both research assistants met to discuss themes that emerged during the analysis of the initial focus group discussions, and to consider whether any alterations in methodology or questioning format were required. Questionnaire design was agreed upon and the decision not to alter the format planned for later focus groups was made. DM-E and one research assistant (CD) read the transcripts independently and identified emergent themes; these were discussed, clarified and categorised to form an initial coding frame. DM-E reanalysed all transcripts, and CD and JS validated and compared the analyses. The final stage of analysis involved refining the specifics of each theme to produce clearer descriptions.<sup>20,21,24</sup> During analysis, the researchers remained aware that the data provided cross-sectional perspectives for each year group in the programme in isolation. Hence, the emerging themes were inspected to explore the patterns in perceptions of feedback across the continuum and to highlight differences among the year groups spanning undergraduate training.

### Quantitative analysis

Quantitative data sourced from responses to five questions within the questionnaire (Table 2) were analysed using spss Version 17 (SPSS, Inc., Chicago, IL, USA), using descriptive statistics (means, frequencies). An analysis of variance (ANOVA) was carried out for each set of responses to a question to investigate the degree to which the year of training impacted upon responses.

## RESULTS

In the academic year during which this study was conducted, female students represented 64% of the medical school population. A total of 75% were UK school-leavers and 9% were international students (school-leavers); the remainder were graduates or had entered via a widening-access-to-medicine programme. Sixty-eight students participated in the 10 focus groups. Each academic year group was represented by two focus groups and group sizes ranged from three to eight participants. Overall, 64% of participants were female, which is representative of the gender profile of the medical school population. Other demographic data (e.g. age, ethnicity and specific educational characteristics) were not collected. The questionnaire response rate was 46% (564/1233).

Quantitative analysis of responses to the five items on the questionnaire (Table 3, Fig. 1) showed that students were most affirmative of the importance of receiving feedback, irrespective of year of study. A total of 97% of students rated the questionnaire item 'I consider it important to get feedback on my work' positively. They were less positive in their views around the other four items (Fig. 1). Year effects were observed, three of which achieved statistical significance at the 5% level, whereas the other was of borderline significance. Year 1 students were consistently more positive than students in other years;

however, the size of the effect in each case was small and in the order of 1–5%.

Three main themes relating to students' understanding and use of feedback emerged from views expressed by students in the focus groups and in responses to the closed and open-ended questionnaire items. As findings from the second set of focus groups confirmed the results of the questionnaire and first set of focus groups, overall findings are reported. These three themes were: (i) the purpose of feedback ('why'); (ii) misunderstandings about feedback ('what'), and, finally, (iii) views on the status of the person giving feedback ('who'). Representative quotes are provided to support the themes and are identified as arising from responses to the questionnaire (Qn) or focus group (FG) discussions and by the student's year (e.g. Year 1).

### The purpose of feedback: 'Why'

The majority of students, irrespective of their year group, stated that they believed the primary purpose of feedback was to enhance their academic performance. Examples of frequently written responses to the open question on the purpose of feedback included 'Learn from mistakes', 'Do better next time' and 'Advice on areas that need improving'.

In the early years of the course, reassurance on meeting required standards was also a commonly expressed purpose of feedback:

'...to be reassured that I am meeting the standards required...' (FG, Year 1, B1b)

'...so I know if I understand the work...' (Qn, Year 1, ID 19)

'...show me if I am working hard enough...' (Qn, Year 2, ID 186)

'...feedback warned us people didn't revise... enough for the integrated exam, I didn't revise it enough and failed.' (Qn, Year 2, ID 431)

A maturational difference detected in the students' responses referred to a transition from 'passivity' (in which students expect their teachers to tell them if they are doing sufficiently well and are meeting the standards) in the early years of the course to 'activity' (in which students are guided by the feedback to consider how to adjust their learning styles) nearer to graduation. In both focus group discussions and questionnaire responses, more senior students began to identify the notion that feedback informed their personal development and could modify their approaches to learning. These quotations show this more active use of feedback:

'...enable you to improve your methods of learning so you can do better in the future...' (Qn, Year 5, ID 502)

'...to reflect ... and develop learning...' (Qn, Year 4, ID 704)

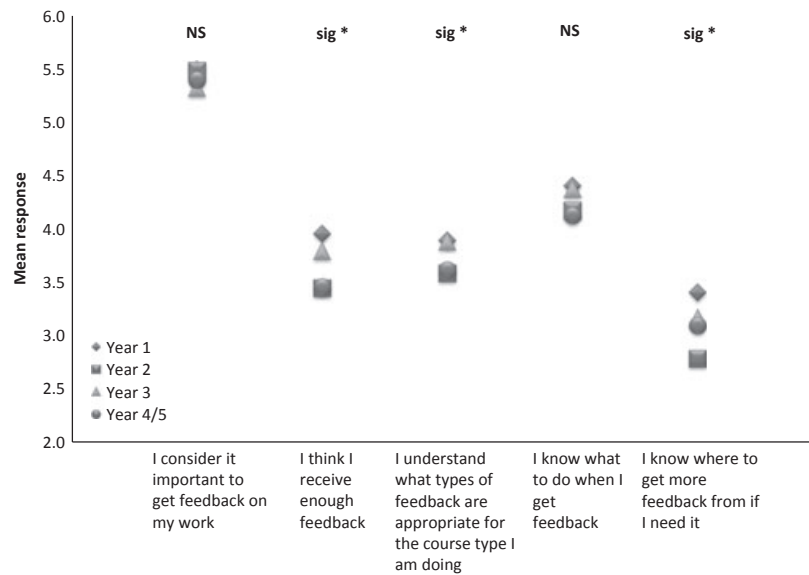
Table 3 Quantitative results from questionnaire: closed questions ( $n = 564/1233$ ; response rate: 45.7%)

Question	Responses*		ANOVA test of differences by year group	
	Positive responses <sup>†</sup>	Mean response	p-value	Effect size (adjusted $r^2$ ) <sup>‡</sup>
1 I consider it important to get feedback on my work	96.8%	5.44	0.417	0.0%
2 I think I receive enough feedback	58.8%	3.67	< 0.001	4.6%
3 I understand what types of feedback are appropriate for the type of course/project/core unit I am studying	59.1%	3.74	0.013	1.5%
4 I know what to do when I get feedback	78.8%	4.26	0.061	0.8%
5 I know where to get more feedback from if I need it	35.8%	3.13	< 0.001	3.0%

\*Responses were given on a scale of 1–6, where 1 = never, 2 = rarely, 3 = not often, 4 = quite often, 5 = mostly and 6 = always

<sup>†</sup>Responses of 6, 5 and 4 ('always', 'mostly' and 'quite often') were regarded as positive responses

<sup>‡</sup>The proportion of variation in outcome (i.e. response) accounted for by the predictors



**Figure 1** Means of student responses to five questionnaire items by year of training. Responses were given on a scale of 1–6, where 1 = never, 2 = rarely, 3 = not often, 4 = quite often, 5 = mostly and 6 = always. \*Significant year differences at the 5% level are indicated at the top of each item (ANOVA). NS = not significant

‘...improved participation and willingness to contribute...’ (Qn, Year 4, ID 611)

‘...got feedback from an observed consultation that I needed to work on certain areas of history taking, this focus has enabled me to improve skills...’ (Qn, Year 5, ID 840)

‘...it’s up to you to seek out more feedback if you don’t think you are getting it, or feel you have an area of weakness.’ (FG, Year 4, A4d)

*Misunderstandings: ‘What’*

Findings from both focus groups and the questionnaire illustrated students’ perceptions of what feedback was, whether they were receiving feedback, and its value. Although 97% of students believed it was important to obtain feedback on their work, fewer than 60% agreed with the statement that they were receiving enough feedback (Table 3). Their comments supported these views:

‘I’ve not received much formal feedback at all.’ (FG, Year 4, B4g)

Questionnaire responses identified that 41% of students considered they were not clear about ‘understanding the types of feedback that were appropriate for the type of course they were doing’, and 64% acknowledged that they did not ‘know where to get more feedback from if they needed it’ (Table 3).

Early in the course, students described valuing written feedback and appeared either not to recognise verbal feedback or to place little value on it:

‘...very little feedback [is] given; most of it is oral and general...’ (Qn, Year 11, ID 62)

‘I’ve not received much formal feedback at all.’ (FG, Year 2, B2b)

When asked for examples of feedback sources, more junior students primarily cited examples for written feedback, such as formative written feedback on essay drafts and standardised assessment forms received after project work. These students neither cited nor appeared to recognise verbal feedback that was given immediately after presentations or within group work or interactive tutorials:

‘...peer discussion is not feedback...’ (FG, Year 2, B3d)

‘...we never got verbal feedback in previous years...’ (FG, Year 3, B3e)

This contrasted with the views of more senior students, who were more likely to acknowledge verbal feedback such as that given during a clinical situation:

‘...got feedback from an observed consultation that I needed to work on certain areas of history taking, this

focus has enabled me to improve skills.’ (FG, Year 4, A4a)

Junior and senior students also tended to express contrasting views of the value of ‘positive’ and ‘negative’ feedback. Junior students saw positive feedback as affirmation of their meeting of standards and as providing reassurance, and, alternatively, described feeling demoralised by negative feedback:

‘...if I’m doing something and if someone gives me positive feedback that makes me try harder and motivates me more, if someone gives me negative feedback I sort of get downhearted.’ (FG, Year 1, A1c)

By contrast, more senior students perceived negative feedback as constructive ‘so long as it gave specific ways to improve’ (FG, Year 4, B4d) and discounted the value of generally positive feedback:

‘...positive feedback can make you complacent.’ (FG, Year 3, A3a)

More senior students appeared to be almost impatient with and to devalue positive feedback:

‘... [the best teachers are the ones who] just get on with telling you what you did wrong...’ (FG, Year 4, B4c)

‘...need to be told how to get better, not waste time sugar-coating the pill...’ (Qn, Year 5, ID 864)

However, the affective impact of negative feedback that is not given with a view to improvement was also evident:

‘It’s easy to get hurt by feedback and ignore [it], I don’t always act on negative feedback...’ (FG, Year 4, B4a)

Different types of feedback were recognised. Comments illustrated students’ awareness of the pertinence of different types of feedback to their years of study:

‘Feedback varies by course component, and it often varies by year of course.’ (Qn, Year 3, ID 700)

However, modification of the type of feedback to match the purpose and alignment of feedback with course objectives was sometimes not recognised:

‘Feedback is more focused now, it’s better i.e. towards clinical things and being a doctor rather than in previous years where it was more general and theoretical.’ (Qn, Year 4, ID 852)

*Status of the person giving feedback: ‘Who’*

Another maturational difference pertained to the source of the feedback in terms of who provided it. Senior students acknowledged the validity and value of feedback from sources other than senior members of academic staff, such as in peer feedback and self-evaluation. Students in the earlier year groups showed a tendency to discount feedback given by anyone other than senior academics:

‘...[a peer would be]...probably not as reliable ...especially if I didn’t know them well, because you don’t want to be harsh and you don’t want to upset them...’ (FG, Year 1, A1h)

‘...work sessions where you go through in a group... is not feedback – it is only valid if a tutor is present...’ (FG, Year 2, A2d)

However, in the final years, verbal peer feedback was valued for its immediacy and its provision of opportunities to talk things through:

‘...if you didn’t know it you could ask your partner and maybe learn it together ...I think it reinforces self-reflection or like peer reflection and then if you both are in touch with your tutor... it reinforces... if you have a problem and talk about it aloud then it seems to make more sense just to get somebody receptive to it and they give you a way to think it through...’ (FG, Year 5, A5a)

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## DISCUSSION

The conceptual framework underpinning this study hinges around the provision of formative feedback and the instrumental role it can play in learner development, matched with the well-reported lack of recognition of given feedback, and the negative impact this may have upon effective learning. Self-esteem may be defined as ‘the positivity of the person’s evaluation of self’.<sup>25</sup> It is a perception rather than a reality, but it is an influential perception. Román *et al.*<sup>9</sup> described the effect of self-esteem on approaches to study in higher education and found that self-esteem had the strongest indirect positive effect on academic



achievement. Self-esteem is important in students' development, and the influence of feedback on self-esteem and in facilitating students' taking control of or self-regulating their own learning is not to be underestimated.<sup>16</sup> Self-esteem affects individuals' ability to receive and act on both positive and negative feedback.<sup>26,27</sup>

This mixed-methods study provides some insight into students' differing perceptions of feedback across a 5-year undergraduate medical school programme. Maturation differences across the programme emerged in three general areas: (i) students' perceptions of the purpose of feedback; (ii) students' recognition of feedback, and (iii) students' perceptions regarding the credibility of feedback providers.

More junior students viewed the purpose of feedback as being to report achievement of a standard and confirm their learning or performance (i.e. generally to be summative in nature). They more readily acknowledged and valued written feedback, were less likely to attend to verbal feedback, and recognised and valued feedback from senior teachers. They generally perceived the receiving of feedback as a passive activity, and preferred positive feedback, which confirmed their progress and provided reassurance, rather than negative feedback, which might 'demoralise' them and undermine their confidence.

By contrast, more senior students viewed the purpose of feedback as being to inform their specific learning needs and personal development (i.e. as being generally formative). They valued immediate informal verbal feedback and feedback from peers and others, as well as that from senior teachers. They reported the most useful feedback as being constructively critical and providing specific information on ways to improve, and viewed feedback as a process that would ideally lead to action on their part. They spoke of finding generally positive feedback less helpful, and appeared to be more discerning users of feedback than their junior colleagues. Notably, however, over 40% of both junior and senior students believed they were not receiving enough feedback; this finding is similar to results of other studies.<sup>4</sup>

Although there is always room for improvement in the quality of feedback given to students, the discrepancies between learners and teachers, and between junior and senior students, in expectations of feedback reflect differing perceptions of the educational purpose of assignments and experiences. Achievement of a grade sufficient to pass onto the

next stage, which appeared to be the need perceived by more junior students, is the simplest level of feedback utilisation. A more sophisticated use of feedback involves incorporating it into a longer-term change in learning approach, including an ability to generate transferability, progression and development for future learning, and to use higher-order learning skills to build on lessons learned from past experiences.<sup>28</sup> There are implications for programme design for all stages of learning, and challenges for the improved utilisation of peer-derived feedback and for the early introduction of feedback from patients or clients.

The maturation of approaches to learning also appeared to be characterised by progressive degrees of engagement with, and action resulting from, feedback. Enhanced self-awareness and recognition of an active reflection upon steps in a task to integrate both current and past experience contribute to greater engagement. The mature engagement of students with feedback is demonstrated not only by their acting on the diversity of feedback that is given, but also by their active generation of their own feedback.<sup>16</sup>

Multiple factors influence the effectiveness of feedback. Shute<sup>29</sup> summarised the complex nature of feedback and current understandings of the impact of student variables upon the effectiveness of different types of feedback. The timing of feedback is also important. Learning outcomes related to the acquisition of verbal, procedural or motor skills are enhanced by immediate feedback, whereas delayed feedback may be more effective for the transfer of learning or conceptual formation tasks. During skill acquisition, longer delays between feedback episodes affect immediate performance during the task acquisition phase, but facilitate better retention in the longer term compared with feedback delivered at shorter intervals.<sup>30</sup> Clarina<sup>31</sup> identified the impact of feedback timing in relation to the difficulty of the task and found that students for whom the task was easier benefited from delayed feedback. The stage of the student, as well as his or her abilities, is also relevant. Of interest is the impact of timing on longer-term acquisition, performance and higher-order cognitive tasks, such as problem solving and complex reasoning, and the potential influence on students' abilities to recognise different types of feedback. Our finding that senior students' preferred specific, constructive feedback on which they could act may be explained by their developmental stage in that this preference may be commensurate with their increasing skills, knowledge and problem-solving capacity, increasing clarity of personal learning goals,

and increasing ability to self-direct their learning to meet these goals. Shute postulated that early feedback may have positive effects on motivation and facilitating persistence, but detrimental longer-term effects by encouraging reliance on short-term, non-transferable information or promotion of 'less mindful behaviour'.<sup>29</sup> Similarly, the positive benefits of delayed feedback indicate the development of higher-order problem solving and metacognitive behaviours, although in some learners delayed feedback may be demotivating and detrimental to skills acquisition.<sup>29</sup>

The limitations of this study refer to variations in interpretations of feedback, its purpose and type, which may have contributed to how students responded to the questionnaire, particularly to the closed (quantitative) items. The richness of qualitative data collected in focus groups was supplemented by responses to the open-ended questions within the questionnaire; however, the differences in the nature of responses given in a written rather than a verbal format may have restricted the expression of views. The questionnaire response rate was 46% and hence responders to the questionnaire represented under half of students. Additionally, participants were volunteers and we do not know if and how their responses might have varied from those of the entire population. However, the use of a mixed-methods approach to study the research questions in more detail and to confirm findings adds strength to the study. The main limitation of this study concerns its restriction to one medical school. We do not know whether the responses are a product of the specific medical school and its clinical culture, or whether they represent students' perceptions and experiences of feedback more broadly. Conducting the study in additional sites will provide answers to this question.

In summary, this study suggests that learners perceive and use feedback differently depending upon their seniority in the programme: there is a maturational influence. Given that students come to medical school with diverse learning skills, learn at different paces and use varying approaches, it may not be surprising to find diversity in their responses to feedback. These findings imply that research that explores students' transition from viewing feedback as summative in junior years, to more formative in more senior years, may be fruitful in understanding this developmental process. The influence of the identity of the feedback provider as a key variable in shaping the impact of feedback is an additional potential line of inquiry.<sup>32</sup>

For medical educators, this study suggests a need to attend to the type and timing of feedback they provide, and students' responses to it, again with an eye to fostering their interest in formative feedback and self-directed learning earlier in the course. This poses important challenges in facilitating learners to recognise the roles they play in receiving and using feedback and in engaging in the process.<sup>15</sup>

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*Contributors:* the study was conceived and designed by DME. DME analysed the data and wrote the paper. JS contributed to data analysis and interpretation and to the drafting and critical revision of the article. Both authors approved the final manuscript for publication.

*Acknowledgements:* we thank Francina Cunningham London, UK, for focus group facilitation, Claire Davis and Vanessa Gray, University of Leeds, for assistance with data collection and collation, and Matt Homer, University of Leeds, for statistical analysis and advice.

*Funding:* the project was partly funded by an internal Teaching Quality Enhancement Fund grant from the Faculty of Medicine and Health, University of Leeds.

*Conflicts of interest:* none.

*Ethical approval:* this study was approved by the Educational Research Ethics Committee, School of Medicine and Dentistry, University of Leeds.

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*Received 8 May 2011; editorial comments to authors 4 July 2011, 12 October 2011, 17 January 2012; accepted for publication 11 March 2012*