What is feedback in clinical education?

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OBJECTIVE Feedback is important in clinical education. However, the medical education literature provides no consensual definition of feedback. The aim of this study is to propose a consensual, research-based, operational definition of feedback in clinical education. An operational definition is needed for educational practice and teacher training, and for research into the effectiveness of different types of feedback.

METHODS A literature search about definitions of feedback was performed in general sources, meta-analyses and literature reviews in the social sciences and other fields. Feedback definitions given from 1995 to 2006 in the medical education literature are also reviewed.

RESULTS Three underlying concepts were found, defining feedback as 'information'; as 'reaction', including information, and as a 'cycle', including both information and reaction. In most medical education and social science literature, feedback is usually conceptualised as information only. Comparison of feedback definitions in medical education reveals at least 9 different features. The following operational definition is proposed. Feedback is: 'Specific information about the comparison between a trainee's observed performance and a standard, given with the intent to improve the trainee's performance.'

CONCLUSIONS Different conceptual representations and the use of different key features might be a cause for inconsistent definitions of feedback. The characteristics, strengths and weaknesses of this research-based operational definition are discussed.

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INTRODUCTION

Feedback is crucial in clinical learning situations, judging from the number of publications about feedback and related topics in medical education.[1–3] Medical educators frequently believe they give feedback to medical trainees, whereas trainees report that feedback is rare.[4–8] To illustrate this, Sender-Liberman *et al.* found that, although 90% of attending surgeons reported they gave feedback successfully, only 17% of their residents agreed with this assertion.[4] This illustrates the notion that agreement about the meaning of feedback is not evident. Clinical education is weakened when teachers, supervisors, students and trainees do not agree about the definition and use of feedback as an educational tool. In addition, research on effective feedback cannot be performed without agreement about what it means. A clear, operational definition of feedback is needed.

The idea of feedback has a long history. Feedback as a feature of medical teaching is discussed in the writings of Hippocrates and other prominent ancient Greek physicians.[9] The concept of feedback is now used in many fields of science, including mathematics, engineering, social science, logic, biology and econometrics.[10] The contemporary use of 'feedback' dates from the beginning of the 20th century. It was introduced in electronics in 1920, defined as: 'The return of a fraction of the output signal from one stage of a circuit … to the input of the same or a preceding stage … tending to increase or decrease the amplification.'[11] Electronic feedback

Overview

What is already known on this subject

Although feedback is seen as important, there is little consensus on its definition.

Definitions are important for theory building and to distinguish concepts from each other. Poorly defined concepts lead to misinterpretations in daily practice and research.

What this study adds

An overview is provided of conceptual and operational features of feedback definitions in social science and medical education. A consensual, research-based, operational definition is proposed.

Suggestions for further research

Further research might focus on the influence of weak and strong feedback, according to the proposed definition, and influences on trainee perception and performance.

was later described in 1936 as: 'The effect whereby sound from a loudspeaker reaches a microphone feeding the speaker thereby distorting the sound and typically generating a screeching or humming noise.'[11]

A social science definition of feedback was proposed in 1943 stating: '… feedback [signifies] that the behaviour of an object is controlled by the margin of error at which the object stands at a given time with reference to a relatively specific goal.'[12] In this definition, feedback is viewed as a cycle that connects input and output. The cycle concept expanded over time and feedback in the social sciences also became 'information' and 'reaction'.[13] The term 'feedback' is now used and interpreted in many different ways. There seems to be little consensus about its definition.[10,11,13–17]

The aim of this report is to propose a research-based operational definition of feedback for learning situations in clinical education. To achieve this, we addressed 4 questions.

1   What is the most general conceptual formulation of feedback?

2   Which approaches to feedback are most commonly used in social sciences and medical education?
3   Which characteristics of feedback are commonly used in definitions about the learning process in medical education?
4   Which of these concepts and characteristics contribute most to an unambiguous description of feedback for clinical education?

METHODS

Questions 1 and 2 were investigated by 3 literature searches, performed in general literature sources, in the social science literature, and specifically in the area of medical education (available from the authors).

General literature

To determine general conceptual formulations of the term 'feedback', definitions were collected from dictionaries ($n = 18$), encyclopaedias ($n = 11$), lexicons ($n = 2$) and handbooks ($n = 5$) pertaining to different scientific fields available in the library collection of Utrecht University.

Social science literature

Literature searches in the ERIC and PsycINFO databases were performed focusing on meta-analyses and literature reviews on feedback. To keep our search manageable, we excluded all other types of publications.

Medical education literature

Further searches in the ERIC, PsycINFO and MED-LINE databases focused on the term 'feedback' in a supervisor−learner situation in medical education.

Our search criteria required that feedback be a defining theme in journal articles, Medical Subject Headings (MeSH), thesaurus terms and titles of articles – 'the shortest possible abstract'.[18]

In order to ensure focus on its definition and meaning, 'feedback' was the only term used in the second and third search strategies. Other terms, including 'knowledge of results', 'reinforcement', 'reward', 'formative assessment' and 'appraisal' were dropped. Clear inclusion and exclusion criteria were listed and described to decide on feedback definitions.

The content of different definitions in the medical education literature was compared with feedback characteristics to answer the third question. An answer to the fourth question required synthesis and evaluation of the different concepts and elements to formulate an operational definition of feedback.

RESULTS

General conceptual formulation of feedback

A comparison of feedback definitions from 36 dictionaries, encyclopaedias, lexicons and other general sources in medicine, biology, music, linguistics, communications and social sciences programmes leads to multiple definitions of feedback. Three concepts dominate: feedback as *information*; feedback as a *reaction* where information is included, and feedback as a *cycle*, involving information and reaction. Table 1 gives examples of the 3 approaches.

Feedback as *information* has message content as its focus. Central to feedback as a *reaction* is interaction, a process of information delivery and reception. Feedback as a *cycle* includes both information and reaction features but also includes a consequence or outcome of the message (e.g. response
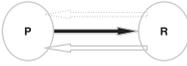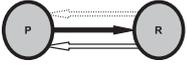
improvement). In addition, feedback as information is discrete, whereas both the reaction and cycle formulations are processes.[10]

Feedback definitions in social science

The social science literature search produced 133 reviews or meta-analyses. Articles on feedback within a 'learning' situation were found in the context of education ($n = 82$), clinical psychology or therapy ($n = 24$), and the workplace ($n = 10$). Most reviews describe written, oral, graphic or video forms of feedback to convey information about a performance. In addition, sensory feedback, bio[logical] feedback and auditory feedback were described in 2, 12 and 3 reports, respectively.

Authors used 4 different strategies to address defining feedback. Firstly, most do not define the term.[24] Instead, they describe 1 or more characteristics of feedback such as its purpose, target, content, dimensions, type and source. Secondly, other writers do not specifically define feedback but refer to definitions of feedback from the literature[15,17] and discuss their limitations.[13,25,26] Thirdly, some define a derivative of feedback, for example feedback *interventions*[27] and *360-degree* feedback. A fourth group defines feedback explicitly. An overview of definitions is provided in Table 2. Feedback is mostly represented by the information concept[28–38] ($n = 8$),

Table 1 Characteristics and examples of concepts underlying definitions of feedback

Concept	Characteristic	Example of feedback definitions
Information	Focus is message content P) feedback provider R) feedback recipient	'Feedback is information on progress of teaching and learning provided through various methods of assessment'[19] 'Feedback is information provided to the learner concerning the correctness, appropriateness or accuracy. In short feedback is information about a learner's performance'[20]
Reaction	Focus is interaction with information 	'The interchange of information on the part of human beings in a communication or problem-solving situation'[21] 'A direct response by an individual or group to another person's behaviour, such as the reactions of an audience to a speaker's remarks'[22]
Cycle	Focus is receiving information, responding to data, and improving response quality 	'In every instance, part of the output is fed back as new input to modify and improve the subsequent output of a system'[23] 'Error correcting information returned to the control center of a servomechanism (or to the nervous system and brain of a living organism) enabling it to offset deviations in its course toward a particular goal'[22]

followed by reaction[39–43] ($n = 5$), and cycle[44–48] ($n = 3$). One definition combines these 3 concepts.[49]

Feedback definitions in medical education

The focus in medical education literature is on feedback in a learning context, a situation in which 2 parties – a supervisor and trainee – aim to improve trainee knowledge and skills. We excluded articles that did not meet the criterion of a learning context based on titles and abstracts. Included were feedback interventions, guidelines about providing and receiving feedback, and perceptions of feedback.

Concepts

Feedback is mostly described as information ($n = 7$) and reaction ($n = 4$). Often ($n = 8$) authors cite or base their definition on an existing definition.[4,50–56] Ende is cited twice, but differently.[57] His article describes important elements in the feedback process but he does not explicitly define the term.

Characteristics of feedback definitions

Nine characteristics are evident when the definitions in Table 2 are compared. All definitions state which *concept* is used – information or reaction. In addition, information is included about some of the following characteristics:

1 *content* of information that should be conveyed: cognitive; evaluative; or about a standard, results, effects, behaviour, or the feedback recipient;

Table 2 Conceptual categorisation of feedback definitions in medical education literature

Feedback definitions in the medical education learning context	Concept and characteristics
'Any information that is provided to the performer of any action about that performance'[51] (p 509)[60]	Information [1,3]
'Feedback is information about the result of a performance and this is often about a consultation and/or skill that has been performed by the learner and observed by the teacher'[52] (p 691) Based on: *Shorter Oxford English Dictionary*	Information [1,3,5,6]
'[…] information from instructor to learners about their past performance on the wards which serve to enhance or modify future actions of learners […]'[53] (p 332)[61]	Information [1,2,7]
'[…] information that gives learners knowledge of the results of their study and clinical work'[54] (p 632)[62]	Information [1,2]
Formative feedback: 'information about how successfully something has been or is being done'[63] and is provided to help individuals improve their performance'[55] (p 66)	Information [1,2]
'Feedback is defined as specific information presented to a learner to promote reflection on performance. It focuses on both what was done and what the consequences of the action might be. The ultimate goal is to help learners in establishing their own goals and critiquing their own performance'[4] (p 470)[64]	Information [1,2,3,4]
'[…] information describing students' or house officers' performance in a given activity that is intended to guide their future performance in that same or in a related activity. It is a key step in the acquisition of clinical skills'[56,57] (p 777)	Information [1,2,]
'[…] an informed, non-evaluative, and objective appraisal of performance that is aimed at improving clinical skills rather than estimating the student's personal worth'[50] (p 1)[57]	Reaction [1,4]
'Giving trainees feedback means letting them know, in a timely and ongoing way, how they are performing'[58] (p 267)	Reaction [1,3,8]
'Audit and feedback involves collecting information on performance measures for individual physicians and then providing this information to the physicians with comparisons with colleagues or other standards'[59] (p 738)	Reaction [1,5,6,9]

Characteristics: 1 = content; 2 = aim; 3 = recipient; 4 = form; 5 = preparation; 6 = source; 7 = provider; 8 = communication conditions; 9 = contextual factors

2 *aim* of the feedback: motivational, for improvement, or to promote reflection;
3 *feedback recipient*: the person to whom the information is sent;
4 *form* of the information to be communicated: oral, written, specific, non-evaluative;
5 *preparation* before the information can be conveyed: collecting results or observing the subject;
6 *source* of the information: from the person him/herself (internal feedback), task results, or from another source (external feedback);
7 *feedback provider*: the person who gives the information;
8 *communication conditions*: timeliness, directness, and
9 *contextual factors*, such as the place where feedback is given.

These different characteristics can be described even when definitions have the same conceptual meaning. Most definitions include information about the *type and content* of the information and describe its *aim.*

Definition of feedback in clinical education

Based on the review above, we propose to define feedback in clinical education as: 'Specific information about the comparison between a trainee's observed performance and a standard, given with the intent to improve the trainee's performance.'

How is this definition of feedback novel compared with earlier statements? Feedback in clinical education is seen as a form of communication. Dissection of the definition into 10 key elements provides clarity. The elements are: clinical education; performance and task; trainee; feedback provider; comparison between observed performance and a standard; observation; standard; specific information; intention, and improvement.

Clinical education

This refers to the 'on-the-job' context in general at a hospital or clinic, such as on the ward, in an outpatient clinic, operating room, general practice consultation room, or any other place where the trainee is involved in patient care.

Performance and task

In the clinical setting, many tasks are suitable for providing feedback, including: history taking; clinical examinations; reporting during patient handover, and working with colleagues on a team. The task must be observable. Even clinical reasoning, performed aloud, is subject to feedback.

Trainee

In clinical education the feedback recipient is the trainee. The trainee can be anyone in a clinical learning situation, be he or she a student, clerk, resident or other health care trainee. The trainee receives feedback to acquire the knowledge, skills and attitudes necessary to become a superb practitioner.

Feedback provider

The feedback provider is a clinical teacher conceived broadly. This may be a clinical staff member who is formally responsible for clinical teaching. The feedback provider may also be a resident acting as a clinical teacher for students, or an attending doctor for residents. Essentially, a feedback provider is someone who can envision a standard against which to compare the trainee's performance. Key to this is the expertise of the feedback provider. This broad concept of 'clinical teacher' may therefore extend to anyone in this position.

Comparison between performance and a standard

The difference between performance and a standard determines the content of the feedback. This gap may be large or small, and positive or negative. By contrast with the cybernetic feedback definition of a negative feedback loop, feedback in clinical education for trainees who outperform a standard or expected level does not aim at decreasing the difference but may stimulate further development.

Observation

We cannot address feedback in clinical education when the trainee's performance has not been observed. The way in which the feedback provider observes depends on the nature of the task. Direct observation occurs when the observer and the feedback provider are the same person. Observation can involve the watching of skill performance and the reading of written products. In both situations the feedback provider receives first-hand information about a task. Indirect observation occurs when the observer and feedback provider are different. An example is when a supervisor bases feedback on comments from other observers in a multi-source situation.

Standards of comparison

The feedback provider needs to know the standard of comparison to describe the difference between a performance and its outcome. Examples of standards include a protocol where a performance is described, the performance of colleagues, a trainee's previous performance, and clinical teachers' opinions about the performance standard. Standards vary from objective to subjective and from absolute to relative.

Specific information

Feedback must contain a minimum amount of specification to serve its purpose. Utterances that cannot be understood by the feedback recipient in behavioural terms (i.e. in terms of *what* has been done well or *what* could be improved) should not be called feedback.

Intention

An intention to give feedback for trainee performance improvement characterises the learning situation. This might be seen in the amount of time taken, the tone and accuracy in which the information is conveyed, or readiness to observe the learner again.

Improvement

The aim of feedback is trainee performance improvement. As explained earlier, improvement is not limited to a fixed end-point. Continuous development of expertise makes feedback valuable in nearly all situations.

DISCUSSION

An operational definition should increase conceptual understanding. An operational definition provides insight into a concept's characteristics and explains concept specificity, precision and generalisability;[65] reveals tacit assumptions or presumptions; discloses premises,[13,17] and makes concept features plain.[66] An operational definition also specifies procedures to identify or to produce the defined concept reliably.[67] Does our definition meet these criteria?

Operational definition

Four procedures to produce or identify feedback are described in the definition. The procedures are:

1   *information gathering*: the definition states that a trainee's performance should be observed;
2   *content*: the content of the information is about the comparison between the trainee's observed performance and a standard;
3   *direction of the provided information*: the clinical teacher provides information for the trainee, and
4   *intention of providing information*: the clinical teacher's intent is to improve trainee performance. This is not always directly observable, but can be discerned by asking about the feedback provider's motives when feedback is given or from indirect observation.

An operational definition should be reliable. It should be clear, measurable, and reproducible.[67] Feedback data are collected by observation, the content of feedback is about a gap between trainee performance and a standard, and the direction of the feedback is from a clinical teacher toward a trainee. This is measured by asking participants or observing the feedback process. However, an intention is not directly observable. This must be probed or observed indirectly.

Conceptual representation

A conceptual definition refers to a general idea behind a definition. Feedback in medical education refers chiefly to information. Defining feedback as a cycle also has advantages. It is a rich definition because it includes information and reaction. The cycle analogy gives emphasis to outcomes compared with feedback as information or reaction. From a linguistic perspective, it better represents the meaning of the word 'feedback'. The word 'feedback' does itself suggest movement (process of feeding) and cycle ('back' refers to a return). So from this point of view, feedback as a cycle is most sufficient. Finally, it is the original definition.[10,11,16] Why do we not consistently use the original definition and define feedback as a cycle? Defined as a cycle, feedback includes the trainee's behaviour adjusted after observation and the exchange of information by the feedback provider.

Historically, the exact meaning of feedback in social science has evolved and expanded in scope over the past 30 years.[13] *Methodologically*, a clear operational definition improves scholarly understanding and exchange. Table 2 reminds us that a concept may have several operational definitions.

Weak versus strong feedback

Our definition is meant to improve communication about the feedback concept and to serve research

Table 3 Weak versus strong modalities of feedback, based on its definition

Weak feedback	Strong feedback
Competencies that are not observable	Well observable tasks and competencies
Uninformed or non-expert observer	Expert observer and feedback provider
Global information	Highly specific information
Implicit standard	Explicit standard
Second hand information	Personal observation
No aim of performance improvement	Explicit aim of performance improvement
No intention to re-observe	Plan to re-observe

purposes. Some of the procedures to produce or identify feedback and the 10 elements of our operational definition can be seen as variables that vary from weak to strong. Listing these elements allows us to distinguish 'weaker' and 'stronger' types of feedback. In Table 3 we show examples of these extremes.

Specifying the definition along a weak–strong dimension signifies a linguistic variability of the concept. We do not intend to equalise this with 'worse' or 'better' feedback. 'Weak' and 'strong' are only related to our definition.

Another question is: Which feedback is effective and which is not? This actually is a research question. Many variables have been mentioned in the literature as possibly influencing the effectiveness of feedback. To describe and validate these variables is a task for future research.

We believe that our definition of feedback in clinical education provides a clear point of departure for teacher training and research on the effectiveness of variables in feedback processes. The definition discriminates authentic feedback statements from those that do not qualify and contrasts weak and strong feedback.

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The following supplementary material is available from the authors: (1) a full description of the search strategies for identifying information about feedback in clinical education in the literature of social science, and medical education; (2) a table with 16 definitions of feedback in social sciences literature; (3) the references of general literature ($n = 36$) and reviews and meta-analyses in social science literature ($n = 133$).