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Feedforward practices: a systematic review of the literature

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ABSTRACT

The notion of 'feedforward' has emerged as popular with practitioners, and there has been an upsurge in publications which include this term. This interpretivist and conceptual systematic review sought to consider the different forms of educational practices that are framed in relation to feedforward. The initial search of four electronic databases found 1076 articles published between 2007 and 2019, which were reduced to 68 once duplicates had been removed and exclusion/inclusion criteria applied during screening and eligibility procedures. An iterative meta-ethnographic approach to analysis resulted in the identification of five main practices, framed as feedforward. These were: alignment and timing (41%); use (25%); comments (18%); self-review (9%); and teaching (7%). The vast majority involved a *process* where student improvement was a key goal, but the *design* of this process differed between practices. A large proportion supported improvement from one task to the next, almost exclusively within the 'future horizon' of the module/study unit, while only a small proportion of articles focuses on improving the amount, nature or quality of the information delivered to learners. Evidence of student sense-making and uptake was rarely sought, and few practices offered genuine opportunities for student agency, self-regulation and the development of evaluative judgment.

Introduction

During the last decade or so, feedback has received considerable attention in higher education, in practice developments as well as research (Nicol and Macfarlane-Dick 2006; Boud and Molloy 2013; Winstone et al. 2017; Dawson et al. 2019). There have been repeated calls to reconceptualise the transmission-focused feedback paradigm (Winstone and Carless 2020) in which feedback is regarded as a *product* delivered to students, i.e. information about performance, usually in the format of teacher comments on summatively assessed work. In contrast, in the socio-constructivist new paradigm, feedback is seen as a *process* during which students make sense of performance information and take action to improve. Instead of inputs, the focus is on outputs achieved by the students who proactively seek, generate, make sense of and use information in interaction with others.

When developing new feedback practices, the notion of 'feedforward' has emerged as particularly popular with practitioners. In institutional discourse academics increasingly use the term to denote novel ways of implementing feedback, and there has been an upsurge in

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publications which include this term. From a theoretical perspective, a range of conceptualisations of feedforward have been proposed, some of which have been contested. The term feedforward is often associated with Hattie and Timperley (2007) seminal article which reviews the evidence on the impact of feedback on learning and achievement. Based on this evidence, their conceptual model suggests that:

> Effective feedback must answer three major questions… Where am I going? (What are the goals?), How am I going? (What progress is being made toward the goal?), and Where to next? (What activities need to be undertaken to make better progress?) These questions correspond to notions of feed up, feed back, and feed forward. (Hattie and Timperley 2007, 86)

Hattie and Timperley define feedback as 'information provided by an agent (e.g. teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding' (81). This has been criticised as not taking into account that students need to make sense of this information and use it to improve (Winstone and Carless 2020). Hounsell et al. (2008) offer a different conceptualisation of feedforward, regarding it as one component in a complex cyclical assessment process, where subsequent assignments are underpinned and linked to each other by the ways of thinking and practising in the subject area. In contrast Sadler (2010) associates the term feedforward with transmission and teacher-focused practices such as pre-assessment guidance and future-oriented comments.

Meanwhile, the term feedforward continues to be used, not only in the practice arena, but also in publications. This is evident in an upsurge of journal articles since 2007 which feature the term. A recent interview-based study (Reimann, Sadler, and Sambell 2019), focusing upon the conceptualisations of feedforward by higher education practitioners, found that the term stimulated a range of practices, including those associated with new paradigm feedback. Feedforward made academics think about the point in the future at which students would use feedback information, and this point, or 'future horizon', was predominantly located within modules. That this was an in-depth study based on 12 UK practitioners highlighted the need to examine additional data sources and a wider range of practices internationally associated with the feedforward label, thus prompting this systematic review.

The resulting review took the term feedforward as a starting point, with a specific focus on practices. Initial searches demonstrated not only that the word is definitely widely used in publications, but also that the way in which it is used to frame practices merits closer attention. The remainder of this article will help to better understand the ubiquity of the term through examining what it means to practitioners and the forms of practice they associate with it, both in higher education and beyond.

Method

Research question and approach to review

This interpretivist systematic review focuses on one particular term, i.e. feedforward, and can be classified as a conceptual review (Kennedy 2007; Amundsen and Wilson 2012). It seeks to understand the ways in which the notion of feedforward has been applied to underpin and justify educational practices. The research question was: what different forms do educational practices take that are framed in relation to feedforward?

Since feedforward has neither been clearly defined nor consistently operationalised, the scope of the review is deliberately broad. In order to capture the diversity of the literature in which the term is used, it was initially important to identify as many relevant publications as possible, which were then narrowed down in an iterative process. Both higher education and non-higher education literature were included to allow for broad and alternative perspectives on feedforward from a range of communities to emerge. Gough and Thomas (2017) distinguish systematic

reviews that aggregate findings from empirical studies, from reviews that develop and generate concepts. The latter synthesise knowledge from different contexts in a mosaic-like pattern, characterised by open questions, inductive processes, emergent concepts and iteration. The present review used such a process, aiming, first, to identify the interpretations made in heterogenous publications and, then, bring them together as a coherent body of new knowledge (Campbell et al. 2011). It also involved systematic and repeated dialogue between the three authors, focused on developing, refining and testing a shared understanding of the criteria and analytic categories used.

Searches were conducted of five bibliographic databases, including: British Education Index, Education Resources Information Center (ERIC), Web of Science, PsychoInfo and Scopus. Search terms were developed around the following three main concepts:

1. Feedforward/assessment (feedforward OR feed* forward OR feed*forward AND assess* OR test* OR assess* OR feed* OR exam OR assignment OR feedback OR learn* OR teach*);
2. Education sector (higher education OR undergraduate OR universit* OR post*16 OR college OR school OR primary OR secondary OR tertiary OR junior);
3. Teachers/learners (teacher OR lecturer OR tutor OR professor OR faculty OR staff OR student OR learner OR pupil).

Following identification, articles were screened to ensure relevance to the research question. In the first phase of screening, the authors considered the titles and abstracts of a sample of 30 articles. Each article was discussed regarding the relevance to the research question and, in line with the iterative approach taken, criteria 4 and 5 (Table 1) were developed. These criteria were applied by the authors to a second new sample of 30 articles, judgements compared and ways of interpreting the criteria agreed. The remaining 383 articles were then screened by one of the authors using criteria 1-5 (Table 1). Following this, the judgements were checked by a second author on a random sample of 10% (53 articles). There was disagreement for only two articles, indicating high levels of agreement (96%); disagreements were resolved through consensus-seeking dialogue. The screening process resulted in the inclusion of 132 articles.

Eligibility was then considered based on review of the full text of each article. A key focus of this stage was the extent to which practices had been framed in relation to feedforward (i.e. criterion 6). A 10% sample ($n=13$) was reviewed by all three authors to identify the practices concerned and the ways in which the term feedforward was used. Discussions of these articles clarified judgements on criterion six by developing three sequential questions:

1. Is the article about learning, teaching, assessment practice?
2. Is feedforward (as a noun or verb) included in the main body of the text?
3. Is feedforward used as a basis for either the design or the analysis of a practice?

The questions were trialed by all three authors on 12 new articles. Following the calibration of judgements on this sample, the remaining 107 articles were distributed between the authors. Decisions were: include, exclude or unsure. Fifteen articles were identified as unsure and these

Table 1. Inclusion/exclusion criteria.

Criteria	Description	Main point of application
Criterion 1	Published between January 2007 and September 2019	Identification and Screening
Criterion 2	English Language	Identification and Screening
Criterion 3	Peer reviewed academic journal	Identification and Screening
Criterion 4	Feedforward is used as noun and/or verb in title and/or abstract	Screening
Criterion 5	There is a focus on educational and/or assessment practice	Screening
Criterion 6	There is sufficient focus on feedforward and practice in the article to contribute to the research question	Eligibility

were then judged by a second reviewer, discussed and a decision made. Following the individual judgements on all full texts, a 10% (*n* = 13) random moderation exercise was undertaken by two authors. There was disagreement on one article, which indicated a good level of consistency; again disagreements were resolved through seeking consensus. The process as a whole took the original search of 1076 articles to a final sample of 68 articles (Table 2).

Publications were not excluded on the basis of research quality since it was crucial to capture the widest possible range of practices and the aggregation of findings was not an aim. Several publications that met the inclusion criteria could be classified as scholarship of teaching and learning (Kreber and Cranton 2000), since practices were made public using different types of evidence such as practitioners' reflections and conversations with students in addition to, or instead of, empirical data collection. Empirical studies often drew on data available to practitioners such as grades or institutional course evaluations.

Method of synthesis

Since configuration and translation between disparate publications (Gough and Thomas 2017) was essential for this review, a process of meta-ethnographic synthesis (Noblit and Hare 1988; Britten et al. 2002; Campbell et al. 2011) was used. This involved the development of a template to capture key content and characteristics of each publication, a spreadsheet to further condense and juxtapose them, and a line of argument derived through continuous comparative analysis between these sources of data. The three authors considered an initial sample of 15 articles to develop, complete and refine the template. The final version included, first, descriptive information about the sector of education, country, discipline, and frequency and location of the term feedforward. Second, the template summarised key information relevant to the research question. This included the way in which feedforward was conceptualised, details about the practice linked to the term feedforward, its future horizon (Reimann, Sadler, and Sambell 2019), whether it was akin to the old or new paradigm (Winstone and Carless 2020), and whether feedforward was regarded as part of, or separate from, feedback.

Where an article contained empirical data, details about research questions, design, data and results were recorded. Templates were then completed for the remaining 53 articles, divided between the three authors. Next, key information derived from the templates was collated in a spreadsheet in order to enable comparisons in one single space. In line with the meta-ethnographic approach, this information served as a basis for interpreting and synthesising the relationships between articles. The final step involved a thematic analysis in an iterative process of interpretation and comparison between and across templates, spreadsheet and articles, interspersed with discussions of emerging themes and sub-themes amongst the authors. The result of this process is presented below. It includes a brief overview of the descriptive information followed by the findings.

Descriptive information

The descriptive information provides insights into the contexts within which the practices framed as feedforward took place. To some extent this was relatively narrow in terms of setting and

Table 2. Stage of search strategy and number of articles included.

Stage	Number of Articles
Identification: original search	1076
Identification: application of date, language and article type (C1-3)	714
Identification: removal of duplicates	543
Screening (C1-5)	132
Eligibility (C6)	68

date of publication. The majority of articles were based in higher education (84%, $n = 57$). The remaining articles were either in a school (7%, $n = 5$) or medical education (6%, $n = 4$) context, plus one in sport coaching and one in organisational development. Publications came from 17 different countries but predominantly from the UK (31%), Australia (16%) and the USA (7%). Although the search period spanned 2007-2019, the vast majority (78%) were published in the second half (i.e. since 2013) of this range, indicating an increased interest in practices associated with feedforward (Figure 1). The subject disciplines were extremely varied and too many to report. However, subjects with multiple articles included education/teacher training ($n = 10$), biology/bioscience ($n = 8$), business/law ($n = 7$) and medicine/nursing ($n = 7$).

Interpretivist synthesis: forms of practice associated with feedforward

Introduction

Following analysis of the 68 articles five main practices were identified. These were labelled as: alignment and timing, comments, use, self-review and teaching. The *alignment and timing* practices tended to focus on providing students with pre-emptive information they could apply, often to the summative assessment. *Comments* practices were about improving the quality of the information given to students, targeted at helping them with future work. The *use* practices were orientated around getting the students to uptake information about their performance by encouraging or requiring them to apply it to a new or related task. *Self-review* comprised practices that focused on students themselves evaluating and generating information about the quality of their work that would help them to enhance future performance. Finally, the *teaching* associated practices were based on teachers' use of information obtained from students to shape future teaching episodes. As will become clear, aiming to improve students' future performance or learning strategies is the common feature in these practices. However, the types of practices associated with the term feedforward vary and these will be unpicked in more detail.

Despite the practices being allocated to one of these five themes, it is important to acknowledge that this was not always clear cut. Several articles contained practices that could be placed in multiple themes. Where this was the case, a dominant or primary theme was assigned. For
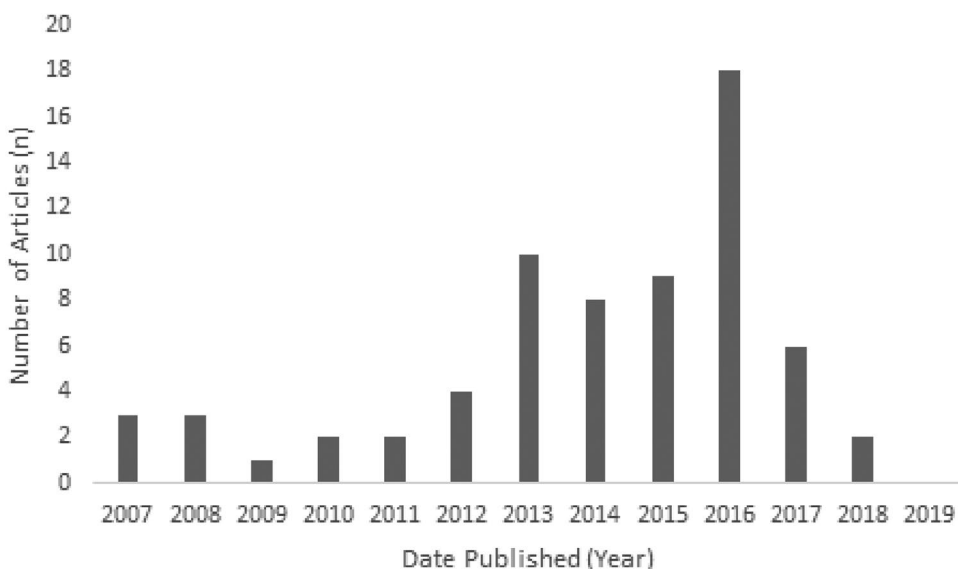

Figure 1. Distribution of articles based on year of publication.

example, in the Penn and Wells (2017) article on scientific report writing, there were elements of both *use* and *comments*. However, although tutor comments on formative work was part of the practice, it was the broader process by which students engaged with and used them that dominated.

Within each theme, the practices themselves differed slightly in terms of what they were trying to achieve. These variations have been drawn out in the development of sub-themes (Table 3). The main themes and sub-themes aim to provide a landscape of the different ways in which feedforward practices have been reported in the literature. Each theme and associated practices will be now be illustrated.

Feedforward through alignment and timing

This is by far the most dominant practice as 28 articles were allocated to this theme. It focused on *aligning and timing* activities, information or guidance in relation to specific summative

Table 3. Articles representing the main forms of practice associated with feedforward.

Main Theme: Forms of Practice	Sub-Theme	Articles
Alignment and timing (_n_ = 28)	Opportunities to gain feedback prior to summative assessment	Backstrom and Cooper (2013), Caquineau et al. (2017), Carless (2007), Chokwe (2015), Egelandsdal and Krumsvik (2017), García-Sanpedro (2012), Hunter and Elliott-Kingston (2016), Mason (2018), Morrell (2014), Nwabude (2012), Patel and Laud (2015), Sørensen and Levinsen (2015), Southall and Wason (2016), Thorpe (2008), Tong (2011), Webb and Moallem (2016), Withey (2013).
	Clarification of task expectations through illustration and discussion of requirements, criteria and exemplars	Baker and Zuvela (2013), Carter et al. (2018); Economou and James (2017), Hendry, White, and Herbert (2016), Parry and Bamber (2010), Scoles, Huxham, and McArthur (2013), Walker and Hobson (2014), Wimshurst and Manning (2013).
	Feedback aimed at supporting students beyond the module and/or programme	Crook et al. (2012), Murtagh and Baker (2009), Santandreu Calonge et al. (2013).
Use (_n_ = 17)	Satisfaction with teacher-designed activity/tool to support use (e.g. additional materials in feedback; use of technology)	Engerer et al. (2016), Gill and Greenhow (2007), Penn and Wells (2017), Sullivan et al. (2016), Turner and West (2013).
	Student improvement based on undertaking task requiring use (e.g. individual learning plan; subsequent task; reflection sheets; checklist)	Bird and Yucel (2015), Chen, Chou, and Cowan (2014), De Kleijn et al. (2013), Dulamă and Ilovan (2016), Duncan (2007), Ibarra-Sáiz, Rodríguez-Gómez, and Olmos-Migueláñez (2016), Jackson and Marks (2016), Mpotos et al. (2013), Parry, Larsen, and Walsh (2008), Quinton and Smallbone (2010), Todd and McIlroy (2014), Vardi (2013).
Comments (_n_ = 12)	Evaluating perceived quality of written comments and approaches to enhance their delivery	Agius and Wilkinson (2014), Arts, Jaspers, and Joosten-ten Brinke (2016), Debuse and Lawley (2016), Henderson and Phillips (2015), Hughes, Smith, and Creese (2015), Morris and Chikwa (2016).
	Comments on (draft) work as part of a formative process, innovations to encourage use	Brearley and Cullen (2012), Carter and Kumar (2017), Ion, Barrera-Corominas, and Tomàs-Folch (2016), Ion, Cano-García, and Fernández-Ferrer (2017), Kelly (2015), Wakefield et al. (2014).
Self-review (_n_ = 6)	Strengths-based, appreciative self-review (feedforward interview, feedforward video self-monitoring)	Görlitz, Schmidmaier, and Kiessling (2015), McDowall, Freemann, and Marshall (2014), Robson, Blampied, and Walker (2015), Ste-Marie et al. (2011).
	Self-assessment through analysing and monitoring own work	Huang (2016), Murphy and Barry (2016).
Teaching (_n_ = 5)	Information on student understanding of the subject to inform teaching	Cathcart, Greer, and Neale (2014), Daelmans et al. (2016), Falout et al. (2016), Payne, Flynn, and Whitfield (2008), Pedrosa-de-Jesus, Leite, and Watts (2016).

assessment tasks students were eventually undertaking. The early timing of interventions was crucial, to allow students to improve their performance on the assessed tasks. Almost all articles reported practices within a module or unit of study, often in a targeted way and within a relatively short, specific timeframe. Three sub-themes or variants of this practice were evident.

The first sub-theme ($n = 17$) contained feedforward practices that provided the conditions for feedback information on students' work to be taken up, in time for students to close the feedback loop within the timeframe. Such (re-)design of curricula and assessment sequences was often fairly complex and embedded in curriculum material or scaffolded assessment tasks. For example, Morrell (2014) described a sophisticated design whereby students received individualised comments on brief reports; in subsequent tasks teachers only offered comments on a subset which students compared with their own report; finally students selected the best two reports to submit for summative assessment. Other designs focused on interventions intended to enable uptake of feedback from one summative assessment to the next. For example, Tong (2011) introduced an 'electronic package' to offer generic feedback on mid-module coursework and feedforward guidance on skills for the end-of-module examination.

In the second sub-theme, which comprised eight articles, the focus was on timely guidance through opportunities to develop insight into task expectations, task-related goals, criteria, quality and standards in advance of a summative task, often by actively making evaluative judgements and in dialogue with others. For instance, Wimshurst and Manning (2013) devised an activity in which students graded exemplars and justified their judgements in a text, aiming to develop students' understanding of standards. Walker and Hobson (2014) investigated a staged approach where a workshop on assessment criteria was followed by a workshop with an exemplar grading activity, both framed as feeding forward into the module summative assignment. Timely guidance also featured in articles associated with the previous sub-theme and student activity was important in both, but in the second sub-theme the emphasis was on guiding students *before* they had produced any work.

A small number ($n = 3$) of practices involved a timeframe beyond the immediate summative assessment of a module/unit, combined with a programme or professional practice focus. The tool developed by Santandreu Calonge et al. (2013) was aimed at trainee graduate teaching assistants and involved instantaneously using feedback information generated during classroom observations as well as producing a long-term effect on practice. Feedback from tutors and peers was complemented by a self-reflective component after watching a video of their teaching session. While the future focus of this practice was clearly longer term, there were synergies with the other sub-themes, through the way in which the cycle enabled insight into task expectations and the feedback loop to be closed.

Feedforward to enhance student use of feedback information

There were 17 articles where the practices focused on enhancing student *use* and uptake of information about a prior performance in order to improve completion of a future task. The practices tended to feature the design of a process, through which the students were required to use information provided. For example, Penn and Wells (2017) reported embedding links to additional learning and study skills materials within written feedback on an essay. Using the assessment criteria the students considered if the examples within these materials were good or bad. Within these practices, there was variation that created the sub-themes. For some, the focus was on levels of satisfaction with the teacher-designed tool to support use, for others, the emphasis was on student improvement.

Five of the 17 articles reported student evaluation of and satisfaction with the feedforward activity or tool. These tools collated or helped students make sense of performance information, for example, an application which communicates feedback and reviews student use (Sullivan et al. 2016) through text message notifications. The practices in the other twelve articles tended

to be more protracted, formative processes that required students to use feedback information about prior work to improve subsequent performance. In some instances, the subsequent task involved another similar piece of work that they received feedback on (e.g. Parry, Larsen, and Walsh 2008), in others it involved a formal reflection on the feedback information (e.g. Quinton and Smallbone 2010). A key feature in these practices was the evaluation of how effectively the use of feedback improved student performance. For example, in an article on feedforward in online tutoring, it was the quantity and quality of students' online posts that was analysed (Chen, Chou, and Cowan 2014). Similarly, in their investigation of a feedforward checklist to support a seminar-based task, Dulamă and Ilovan (2016) considered post-intervention behavioural data and student geography sketch-maps.

Feedforward comments

This feedforward practice focused on teacher-produced *comments* about student work to support the completion of (often undefined) future work. Half of these articles (*n* = 6) focused on the quality of tutors' written comments in response to student work. Some articles simply considered the extent to which feedforward information featured in the written comments, with students' perception of the quality of comments being important (e.g. Agius and Wilkinson 2014; Arts, Jaspers, and Joosten-ten Brinke 2016). Other articles reported adjustments to the delivery mode of comments (e.g. Debuse and Lawley 2016; Henderson and Phillips 2015; Morris and Chikwa 2016).

The other six articles were related to teacher commenting practices embedded within a formative process. A key aspect was that comments were provided prior to the submission of the same or a similar piece of work, e.g. audio feedback on drafts provided 2-weeks prior to the summative submission (Brearley and Cullen 2012) or a rubric to prompt comments on a staged laboratory report (Kelly 2015). The practices reported in Kelly (2015) and Ion, Barrera-Corominas, and Tomàs-Folch (2016) were the only examples where comments came from peers rather than teachers.

Across both sub-themes, practices tended to utilise innovative approaches for more effective delivery of comments to students. Examples include video (Henderson and Phillips 2015), audio (Brearley and Cullen 2012; Morris and Chikwa 2016), computer-assisted (Debuse and Lawley 2016) and checklists (Wakefield et al. 2014).

Feedforward as self-review

Six articles reported practices encouraging learners to actively appraise their own work and consider ways forward. These practices attributed considerable agency and ownership to learners who analysed, reviewed and, in some cases, took steps to improve their own work. The sub-themes arose due to the variation in the nature of such self-review and the degree to which student agency was evident.

A 'strength-based' approach featured in four of the articles in the first sub-theme. The *feedforward interview* (McDowall, Freemann, and Marshall 2014; Görlitz, Schmidmaier, and Kiessling 2015) provides a protocol to identify and analyse conditions that have already generated effective behaviours. This is framed as feeding forward into future performance by enabling goal-setting and enhancing self-efficacy, as an alternative to attending to behaviours that need improving. In a similar vein, the *feedforward self-modelling video*, referenced in the article to Dowick's work, captures or simulates good performance, played to the individual as a positive model which demonstrates that they can enact the desired performance and have done so already (Ste-Marie et al. 2011; Robson, Blampied, and Walker 2015).

Practices reported in the second sub-theme required learners to evaluate the quality of their own performance through tasks which involved considerable depth of analysis and self-regulation.

In Huang (2016), foreign language students reviewed an audio recording from oral examinations undertaken previously, and transcribed and analysed their performance in considerable detail according to criteria. They identified what they had done well and could do to improve, going well beyond what teachers could have fed back. Huang regards feedforward as a particularly important component of feedback which helps students know for themselves what they need to do in order to improve.

Feedforward for teaching and instruction

There were a handful of articles ($n = 5$) that considered feedforward as informing teaching practice. This was about ways in which teachers used information from students to shape or adapt future teaching episodes. Often evaluation was a term used in these articles, however the evaluation was focused on the student understanding of the subject rather than their satisfaction or experience of being taught. Based on the information arising from the evaluation (feedforward), the focus was on how future teaching episodes could be designed in order to address any gaps. Although similar in principle, the practices used slightly different strategies for evaluating students' understanding or skills. Cathcart, Greer, and Neale (2014) used 1-minute papers or clickers at the start of a module or class to inform delivery, and Pedrosa-de-Jesus, Leite, and Watts (2016) planned 'question moments' in sessions to gather information on student understanding to inform design.

Discussion and conclusion

The review findings indicate that the literature which employs the term feedforward to frame educational practice is sizable, with 68 articles published over a twelve-year period. Analysis has provided a snapshot of the different forms of practice associated with feedforward. These have been described as alignment and timing, use, comments, self-review and teaching, and offer insight into ways in which feedforward is currently conceptualised and used by practitioners. It is notable, however, that the distribution of articles across these forms of practice varied considerably. Alignment and timing was by far the practice most widely framed as feedforward (41%), while self-review (8%) and teaching (7%) featured least.

From a learning-oriented perspective, there were several positive aspects associated with the term feedforward. A common feature of the vast majority of practices in the review (91%) is that they involved a *process* where student improvement was a key goal. It was the *design* of this process that differentiated the forms of practice from each other. For example, in the practices categorised as use, it was the design of activities to engage students with feedback information about their performance. In self-review, activities were designed to guide students towards generating information about their performance themselves. This placed the teacher in the role of an instructional designer who, in the name of feedforward, designed a process for engaging students with information relating to a forthcoming performance, albeit in different ways.

Many of the feedforward interventions that involved a process were designed to support improvement from one task to another. This defined the articles ($n = 28$) categorised as alignment and timing, where sequential ordering of information that connected one task to the next was at the heart of the designs. Linkages in terms of how information would feed forward to improve the next piece of work was also prominent in the comments, use and self-review forms of practice. Interestingly, in their study on staff and student perspectives of effective feedback, Dawson et al. (2019) found that few educators or students considered this linkage from one task to the next as a feature of effective feedback and that such designs were relatively scarce, despite being a key feature in conceptualisations of effective feedback (Boud and Molloy 2013).

Only a small proportion of articles, the remaining 9%, were primarily about fine-tuning the amount, nature or quality of the information passed on to learners, i.e. in Sadler's (1989) words, about better 'dangling data'. Although this was with a view to supporting student improvement, these practices were clearly situated in the old paradigm, with a focus on feedback as a product rather than a process. It is encouraging that in the name of feedforward only so few practices focused on the input message, while the majority were process and design orientated. This implies that feedforward may be an important term symbolically to move thinking towards understandings of feedback that are in line with the new paradigm and, in particular, the teacher as a designer. Winstone and Boud (2022) have argued that assessment and feedback have become too entangled and often inappropriately conflated. Our review found that feedforward practices were not always closely associated with assessment and therefore may have the potential to shift thinking away from such entanglement. For example, while the practices focused on student improvement and were often aligned to summative assessment, grades and their justification did not feature prominently. Indeed, many of the feedforward practices displayed features that Winstone and Boud suggest feedback should: focus on timing and the intention for use; be central to course design; and be informal and undocumented. Hence feedforward may have the potential to move thinking forward.

Despite the potentially fruitful nature of feedforward for enhancing practice, there are some caveats. The first is that a process and design orientation on its own does not guarantee genuinely learning-oriented and learner-centred practices (Winstone et al. 2022), particularly when existing practices are considered against the 'lofty concepts' (Boud and Dawson 2021, p2) of what feedback practice should be. This is particularly the case when it comes to the extent to which they offer genuine opportunities for student agency, self-regulation, the development of evaluative judgment (Tai et al. 2018), and thus students' abilities to review their own work and improve it. Our review found evidence of a gap for all but a handful of practices which provide examples designed to develop students' own appreciation of their progress. Therefore, although feedforward may have potential for moving practitioners away from old paradigm feedback, we also found a paucity of examples of practices that align to a genuinely student-agentic, self-evaluative approach.

Despite the student improvement focus of feedforward, the practices were generally reported from the perspective of the teacher providing information or activities for the students. In a meta-review of the research on student roles in feedback, Van der Kleij, Adie, and Cumming (2019) identified four student role categories. Broadly, the role of the student in the feedforward practices from the current review was more akin to their third category of feedback as a communication model. Within this category students choose how they act on feedback with some degree of agency, but this is framed within the teacher's boundaries. This falls short of category 4 where students have a substantial role and greater agency. The self-review theme brought together a small number of heterogenous practices from different sectors of education (clinical education, coaching, primary school and extracurricular education) which offered a glimpse of approaches akin to Category 4. These included strength-based, appreciative approaches such as the feedforward interview (McDowall, Freemann, and Marshall 2014; Görlitz, Schmidmaier, and Kiessling 2015) and positive video modelling (Ste-Marie et al. 2011; Robson, Blampied, and Walker 2015), as well as analytical tasks which stimulated students to reflect deeply on their own performance and consider ways they could improve (Huang 2016; Murphy and Barry 2016). While this systematic review has not unearthed a very wide range of such divergent student-focused practices, these outliers may be fruitful in providing practitioners with concrete examples of alternative approaches, pointing towards new directions for the higher education sector.

Another caveat to the potential benefit of feedforward practices for enhancing student learning is the extent to which evidence of student sense-making and uptake was sought, if at all, in the articles reviewed. From both a practice and research point of view, monitoring

and assessing improvement in student learning and performance is complex, multifaceted and time consuming. In contrast, simple or proxy measures were commonplace, not necessarily evidencing actual student uptake and improvement from one performance to the next. Although this was not always explicitly stated, many authors appeared to be practitioners reporting their own enhancement initiatives, to whom marks and end-of-course evaluation would have been readily available without additional data collection. Many articles only reported student satisfaction scores and perceived usefulness of the interventions undertaken (e.g. Backstrom and Cooper 2013; Henderson and Phillips 2015; Ion, Cano-García, and Fernández-Ferrer 2017). Others focused on improved marks, between tasks or between cohorts, as proxies for learning and improvement (e.g. Duncan 2007; Parry, Larsen, and Walsh 2008; Morris and Chikwa 2016).

It is striking how significant the 'future horizon' of the module/study unit has been, with the majority of feedforward practices being confined to this level. This has synergies with Reimann, Sadler, and Sambell (2019) study and is especially evident in the most dominant form of practice, where all but three (Murtagh and Baker 2009; Crook et al. 2012; Santandreu Calonge et al. 2013) of the 28 articles specifically focus on aligning and timing activities, information or guidance with summatively assessed tasks as part of module design. Although this provides positive evidence of a process and design orientation, the very short time frame and the lack of attention on programmes and the development of students' ways of thinking and practicing in the discipline (McCune and Hounsell 2005) more broadly is also a concern. Henderson et al. (2019) have pointed towards policy and academic cultures as potential blockers to more sophisticated approaches. The sheer pragmatics, both from a learning and teaching and a research point of view are likely to substantially influence the nature of the practices that are developed and the evidence sought to demonstrate impact.

Despite existing theorisations of feedforward which suggest that it can make a contribution to the achievement of high-quality learning outcomes (Hounsell et al. 2008), up to now little has been known about how feedforward has manifested in practice. The current review provides an insight into the nature of these practices and also indicates the proliferation of the term. It can be assumed that these 68 published articles are just the 'tip of the iceberg' and therefore likely to be representative of relatively large-scale everyday practices in the name of feedforward. The centrality of the role of the teacher as *a designer of a process* appears to be a key feature of feedforward practices. This idea seems potentially helpful to take practitioners some way towards improving the connections between teaching, assessment and feedback related activities within course design. In particular, focusing attention on alignment and timing of activities, student use of information about their performance and developing skills of self-review are important considerations. However, we would argue that some of these practices are more developed than others in terms of putting the recent (re)conceptualisations of feedback into action, and when viewed through the lens of improving learning. Again, this demonstrates the challenges that practitioners face and the continued gap between the idealistic conceptions in the literature and the realities of practice. Future work needs to focus on this disconnect and strategies for closing *this* gap.

The significance of this systematic review lies in the way in which it categorises and illuminates the diversity of practices framed as feedforward and contributes to an understanding of feedforward that is grounded in practice. It is also of practical utility to those who support development in this area, as a springboard for academic development conversations that take the language, conceptualisations and concerns of practitioners as a starting point. Additionally, as it is the first systematic review in this area and charts new territory, it was important to capture the widest possible range of conceptualisations and practices. This necessitated a deliberately broad approach to what had been characterised as a conceptual review which generated a hugely divergent set of articles for synthesis. However, the lack of unanimity that surfaced limited our ability to identify and synthesise specific evidence about, for instance, the impact of the feedforward practices on student perspectives and student outcomes.

Any screening for research quality, as commonly done in the context of systematic reviews, was deliberately avoided as this would have also reduced the range and richness of aspects and practices that have emerged but again is a limitation in terms of the strength of evidence. A further limitation of the review was that while it considered peer reviewed publications only, the inclusion of grey literature, such as the many policy and strategy documents that feature the term feedforward and permeate the practice arena, would have made this work even more comprehensive and got even closer to grassroot perspectives and practices. Finally, given the dates of this review the dramatic changes that occurred in higher education learning, teaching and assessment as a result of the pandemic have not been captured and might influence the findings of future research. These are therefore areas which future research needs to examine, through more targeted investigations or more selective systematic reviews. Research and practice development should also focus on those practices that, according to this review, are rare but particularly promising: those that foster self-review and develop students' ways of thinking and practising in the discipline beyond the future horizon of the module/study unit.

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