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Feedback that works: a realist review of feedback interventions for written tasks

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ABSTRACT

Despite feedback being considered important to learning, its potential is rarely fully realised. Promoting learning through feedback in open-ended written tasks (e.g. essays and reports) is a complex endeavour that requires students who are motivated to identify and utilise appropriate information. We set out to understand the mechanisms that enable feedback interventions to work, for whom and in what contexts. Using a realist review research methodology, 19,065 papers mentioning feedback in undergraduate courses were screened, 375 full-text papers were assessed for rigour and relevance, resulting in 58 papers for analysis. Self-determination theory was identified as a good fit for understanding what is required of feedback interventions to mobilise students to engage with the process. Findings indicate that the design of feedback processes in open-ended tasks needs to afford opportunities for students to have a sense of relatedness to their teacher, and perceptions of competence and autonomy. In addition, the role of emotion in mediating perceptions of competence needs to be considered. This review supports the use of feedback designs which include scaffolded tasks, dialogue, action plans and sequenced tasks. These designs promote students' perceptions of relatedness, competence and autonomy, leading to motivation to engage in feedback, and thus improved performance.

KEYWORDS

Feedback; realist review; self-determination theory; higher education; motivation

Introduction

Feedback research in higher education is prolific. The number of reviews and meta-analyses of feedback would suggest the effects of feedback on students are well established (Evans 2013; Hattie and Timperley 2007; Jonsson 2013; Kluger and DeNisi 1996; Li and De Luca 2014; Shute 2008; Winstone et al. 2017; Hepplestone et al. 2011; Wisniewski, Zierer, and Hattie 2020). However, findings are conflicting, because effect sizes vary widely between studies and examples of negative and unintended effects abound (Wiliam 2018). A common critique of such diverse outcomes is feedback may not operate identically everywhere and thus it is not possible to synthesise a large number of studies

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without accounting for contextual variations such as feedback design, student engagement, or type of task (Evans 2013). This led Wiliam (2018) to note that little is known about the kinds of feedback that are helpful in particular situations. While previous meta-analyses have calculated a magnitude for the feedback effect, without further contextual information, it is not known how to harness this effect. The realist principle of understanding what types of feedback are effective, for whom and under what circumstances enables the development of such knowledge.

The value and challenge of feedback in higher education

Focused reviews in higher education have investigated written feedback (Parboteeah and Anwar 2009; Ball 2010; Agius and Wilkinson 2014) and assessment feedback (Evans 2013; Hattie and Clarke 2019; Li and De Luca 2014). These tend to conceptualise feedback as information given by the teacher to the student and therefore recommendations tend towards information quality and timeliness, and identifying misalignment between student and teacher expectations, perceptions and information utility. While these reviews have highlighted the role of student motivation and emotion in the uptake of feedback information, they are less able to identify the effects (i.e. outcomes) of specific feedback interventions for particular students. The relationship between student use of feedback information and changes in assessment performance remains poorly understood (Jonsson 2013).

Another grouping of reviews focus on feedback that uses technology-oriented delivery mechanisms, such as online feedback (Gikandi, Morrow, and Davis 2011; Hepplestone et al. 2011), audio-feedback (Dixon 2015), video-feedback (Mahoney, Macfarlane, and Ajjawi 2019), and the use of clickers in class (Han 2014). These identify student satisfaction with the use of technology, but are inconclusive regarding learning gains when compared with written feedback (Chalmers et al. 2014). Scholars posit that a lack of outcome gains is likely due to feedback designs which continue to privilege transmission rather than dialogue (Mahoney, Macfarlane, and Ajjawi 2019).

Increasingly, feedback reviews are honing in on the need to pay more attention to feedback design and its influence on what students do. Two reviews investigated how students engage with feedback interventions (Jonsson 2013; Winstone et al. 2017). The former identified barriers to students using feedback information and recommended that feedback designs should afford opportunities to use the information and that student preference and usefulness might not always align. Jonsson (2013) also found that feedback information did not need to be specific and individualised to improve learning if the process led to further engagement with the task. Winstone et al. (2017) found that students' motivation and their ability to self-regulate were key to their engagement with feedback. A third, rapid review highlighted three design features of impactful learner-centred feedback: that feedback processes are designed to promote learning, comments invite feedback dialogue, and comments provide actionable information for future performance (Ryan et al. 2020).

These reviews suggest that future research should be sensitive to (1) students' motivation to engage with feedback, and (2) contextual factors, including feedback design, as these influence the effects of feedback. It is also likely that these are interrelated: contextual factors may impact motivation. At face value, these two foci might seem self-evident, and yet the bulk of feedback research has in the past focused on the content of the message and on what teachers do. In order to shift practice, a clearer exposition of the contextual factors that influence student motivation and outcomes is needed. Accordingly, our review seeks to understand the mechanisms that motivate students to engage with feedback and thus lead to learning.

An additional consideration is that mechanisms for feedback effectiveness are likely to differ depending on the task. The current review specifically focuses on investigating feedback in open-ended tasks. Open-ended tasks, encompassing essays, projects, reports, etc., are the mainstay of undergraduate assessment (Tomas and Jessop 2019). They are typically more complex requiring feedback information that is broader in scope than answers and corrections, and so there is more onus on students to make choices, interpret assessment requirements and self-regulate their learning (Bennett

et al. 2018). As a consequence, there are more opportunities within open-ended tasks to convey expectations and notions of quality than within short answer question or procedural tasks.

Method

Realist research methods are intended for the analysis of complex interventions, which are context-dependent (Pawson 2013). As mentioned, feedback is a complex intervention as it ' … includes many different forms with, at times, quite different effects on student learning' (Wisniewski, Zierer, and Hattie 2020, 13). The realist philosophy suggests that interventions may work in some *contexts* but not in others. Importantly, *mechanisms* are the mediators of *outcomes,* they are: ' … underlying entities, processes, or [social] structures which operate in particular contexts to generate outcomes of interest' (Astbury and Leeuw 2010, 368). Realist inquiry seeks to identify the patterns of context-mechanism-outcome configurations which might explain why particular interventions succeed or fail and how they influence outcomes; explanations which can contribute to theory development.

A realist review is a systematic theory-driven approach to literature synthesis, which aims to build upon existing theory. This review seeks to develop theories of feedback through (a) selecting a meaningful initial theoretical frame (b) interrogating the existing evidence to ascertain whether and when this theoretical frame is relevant and productive and (c) inductively identifying extensions to the theory in relation to feedback based on the evidence. We ask: How does feedback in open-ended tasks influence undergraduate student learning, for whom and under what circumstances?

The review followed the five key stages described by Pawson et al. (2005): (1) define the scope of the review; (2) search for evidence; (3) appraisal of the evidence; (4) data extraction; (5) data synthesis. We follow reporting protocols aligned to Realist and Meta-narrative Evidence Syntheses Standards (RAMESES; Wong et al. 2013).

Scoping the review

The introduction outlines the decision to focus on feedback for open-ended, written tasks. Initial search scoping was undertaken through an analysis of existing literature reviews on feedback identified via Google Scholar alongside exploratory searches to determine appropriate search parameters such as relevant databases and search terms. Given the large body of published literature on feedback we limited the review period to January 2008 - February 2019, to focus on the research conducted since the comprehensive Hattie and Timperley (2007) review which emphasised the power of feedback for learning.

During this stage, the initial program theory was chosen to guide our review. Since previous feedback research has highlighted the significance of motivation, we selected a key, well-researched, motivation theory. Self-determination theory (SDT) suggests that motivation spans a continuum from external to internal motivation (Ryan and Deci 2000). It proposes that self-determination is increased through events that lead to an internal locus of control, and is decreased through events that focus on a more external locus of control (Deci, Koestner, and Ryan 2001, 33). Individuals are more likely to be internally motivated to engage with feedback if their psychological needs for relatedness, competence and autonomy are met (Ryan and Deci 2000). Extrinsically motivated behaviours, on the other hand, are initially performed because the behaviours are prompted, modelled, or valued by significant others. Internal motivation is related to academic achievement and well-being (Ryan and Deci 2000). If feedback processes can be designed to promote internal motivation, students might choose to deeply engage with tasks and thus lead to improved performance.

Searching process

A formal search was undertaken in CINAHL, PsycINFO, OVID Medline, ERIC, ProQuest, Scopus, Embase in February 2019. Search terms included: student OR learner AND undergraduate OR higher

education OR university OR college AND feedback OR debriefing OR assessment for learning. Findings were exported to bibliographic software and duplicates removed. One author (FK) screened all abstracts against the inclusion criteria (see Table S1 online only) for appropriateness to progress to full-text review. A second opinion was sought in cases of ambiguity (RA). One article was added through a snowball approach (where one reference leads to another).

Selection and appraisal

Papers selected for full-text review were judged on relevance (whether it can contribute to theory building) and rigour (whether the method used to generate that particular piece of data is credible and trustworthy) as recommended by Wong et al. (2013). The relevance of studies was rated between one and five; with studies rating below three discarded (see Table S2 for criteria). Rigour of studies was holistically assessed as low, medium or high, with low rating studies excluded from further analysis. A global rating of quality was used as this is typical of realist research (Wong et al. 2013) and previous research shows that global judgements of quality by experienced researchers are comparable to a more analytic tool (Dixon-Woods et al. 2007). An initial moderation exercise was conducted among the team, and papers deemed borderline for relevance or rigour were discussed by the research team to determine inclusion through consensus.

Data extraction

Data were extracted into a spreadsheet to identify contexts, interventions, mechanisms and outcomes. Initial coding for context focused on descriptors such as year of study, country of study and discipline, with later coding for context including student achievement level and self-efficacy. Feedback interventions were described and inductively categorised. Mechanisms were based on SDT: perceptions of relatedness, competence and autonomy. The initial coding involved identifying outcomes in each paper and highlighting the context and mechanisms (perceptions of relatedness, competence and autonomy) that lead to each outcome within a paper. The papers were also coded inductively for other potential mechanisms (emotions were identified here). Outcomes were coded inductively and categorised into engagement with feedback, evaluative judgement (appraising quality of own/others' work), self-efficacy and performance. Outcomes may be positive or negative.

Data synthesis

Data synthesis requires an iterative qualitative process to develop feedback theories derived from SDT based on recurrent, identified patterns of Context-Mechanisms-Outcome Configurations (CMOCs). These CMOCs form the basis for testing the feedback theories for fit, we identified four mechanisms (perceptions of relatedness, competence and autonomy as well as emotions) and one context (achievement) as relevant mediators of outcomes. The data coded to each feedback theory was read and double-checked against the original paper by one member of the research team (RA). Team meetings were held to discuss our developing interpretations and relevant supporting or opposing evidence for each of the identified 'theories'. Final theories were then proposed to explain how feedback interventions worked in different contexts, through mobilising particular mechanisms to generate outcomes.

Findings

Description of sample

The initial search yielded 19,065 records, 13,113 were screened for title and abstract, 375 were reviewed at full-text, 58 articles were included in the final analysis (see Figure S1 online). Table S3

(online only) contains the full list of included articles which we describe here briefly. The majority of articles were mixed methods studies ($n = 25$), from the UK, Australia and USA ($n = 40$), contained first-year ($n = 24$) students, from Psychology or Education courses ($n = 20$), who submitted assignments or essays for assessment ($n = 40$) and most often received written feedback ($n = 43$).

Building upon SDT, we propose four interrelated feedback theories (Table 1) that could illuminate how feedback interventions for open-ended tasks mobilise student motivation through perceptions of relatedness, competence and autonomy, and therefore affect student learning. We outline the theories here, providing evidence for each through reference to the papers. For brevity we do not mention every study that provides evidence, however, these are referenced in Table S4 (online only).

Feedback theory 1: perception of relatedness as mechanism

Student perception of relatedness was the most commonly identified mechanism that influenced engagement with feedback: if feedback interventions promoted students' sense of relatedness to their teachers, then subsequent motivation contributed to beneficial outcomes. Conversely, if feedback interventions reduced students' sense of relatedness to their teachers, then subsequent loss of motivation contributed to detrimental outcomes. We inferred relatedness through students' descriptions of being recognised or feeling personally known by their teachers or feeling that teachers cared about their learning.

Students' perceived sense of relatedness, through for example personalised feedback, influenced their self-efficacy and the amount of effort they put into the work (Price, Handley, and Millar 2011). One student in a study by Lipnevich and Smith (2009b, 354) reported: '[The professor] addressed me by my first name, so I thought like he really knew me and really thought I did great. I wanted to do even better.' Students' judgements of the teacher's intent were also reported by Steen-Utheim and Hopfenbeck (2019, 87) to influence effort regulation and self-efficacy. Perceived relatedness can also influence students' decision making about whether to consult a marker for clarification (Dowden et al. 2013). Perceptions of relatedness, therefore, can result in students' positive feedback-seeking behaviours, what Todd and McIlroy (2014) characterised as establishing a collaborative feedback relationship.

Table 1. Summary of context-mechanism-outcome configurations.

Theory 1: Perception of relatedness as mechanism	If feedback interventions facilitated students' perceptions of relatedness with teachers, then this increased their motivation to engage with feedback interventions contributing to improved self-efficacy, evaluative judgement and increased performance. If feedback interventions reduced students' perceptions of relatedness with teachers, then they avoided or disengaged from feedback interventions and experienced a loss of self-efficacy and feelings of hopelessness.
Theory 2: Perception of competence and autonomy as mechanism	If feedback interventions scaffolded students' perceptions of competence and/or perceptions of autonomous regulation, then this motivated students to engage with feedback interventions leading to improved self-efficacy, learning and evaluative judgement.
Theory 3: Emotions as mechanism	If feedback interventions evoked positive emotions and associated sense of competence, then this led to increased motivation to engage with feedback contributing to improved self-efficacy and learning. If feedback interventions and/or unexpectedly worse grades evoked negative emotions and associated perceptions of competence, then this led to decreased motivation to engage with feedback contributing to reduced self-efficacy and/or learning with potential longer-term effects.
Theory 4: Achievement as context	Students' prior level of achievement influences their engagement with feedback through perceptions of competence +/− emotions leading them to take up feedback opportunities differently. If low achieving students or those with low self-efficacy receive negative feedback, they have decreased perceptions of competence +/− negative emotions, leading to decreased motivation, less engagement with feedback and decreased learning.

Five studies demonstrated how a lack of relatedness resulted in students' loss of self-efficacy, feedback avoidance and inability to use feedback comments. There were two key aspects regarding lack of relatedness: it mediated feedback avoidance behaviours and lack of disclosure; and it led to loss of self-efficacy, helplessness and thus influenced interpretations of the comments.

How feedback interventions support student perception of relatedness

Dialogic feedback: Face-to-face dialogue was considered by first-year students as a means to improve perceptions of relatedness leading to better understanding of task expectations (Bloxham and Campbell 2010). It honed students' self-evaluative capacities and developed an evolving sense of quality (Carless 2015). Perceptions of relatedness through student-teacher feedback dialogue 'acted as a reinforcement of caring' which encouraged students to talk to their tutor (Crimmins et al. 2016, 146) and encouraged a 'sense of achievement and success at a time when students may feel most vulnerable to low self-esteem' (Cramp 2011, 113).

Feedback dialogue was disrupted when there was a new assessor for each assessment task or when students felt embarrassed or intimidated by their teachers (Bloxham and Campbell 2010) or the absence of dialogue left students feeling helpless and unable to improve their writing (Esambe, Mosito, and Pather 2016).

Comparison of human v computer-generated feedback: The mechanism of perception of relatedness was also apparent in studies that compared human-generated versus computer-generated feedback comments. There was less acceptance and efficacy when information was presumed to be coming from a software tool compared with a human source (Lipnevich and Smith 2009a, 2009b; Seifried, Lenhard, and Spinath 2016).

Audio and video feedback: All studies comparing written comments with audio or video noted how the latter two qualitatively improved students' perception of relatedness and therefore mediated greater engagement with feedback. West and Turner (2016, 406–407) wrote: 'it was apparent that many students perceived video feedback as a more personal approach than written feedback'. However, studies that compared actual performance between groups found minimal learning gains: a randomised study of annotated written feedback versus audio found no significant difference in knowledge elaboration despite students feeling supported and appreciating tutor's emotions through audio (Gleaves and Walker 2013). Another comparison of 'audio-visual and written' and 'written only' feedback identified significantly high scores on purpose and audience, however in practice this difference was marginal (Grigoryan 2017).

Feedback theory 2: perception of competence and autonomy as mechanism

Motivation to engage with feedback was influenced by students' perceptions of having both mastery of the subject and sufficient opportunity to direct their own work. According to Ryan and Deci (2000, 70), 'feelings of competence will not enhance intrinsic motivation unless accompanied by a sense of autonomy'. A key moderator here was the appropriate level of scaffolding, where the design of task and feedback supported the students through the task (i.e. cognitively supported tasks), thus maintaining perception of competence without the student feeling too constrained (loss of perception of autonomy).

How feedback interventions influence students' perceptions of competence and autonomy

Optional formative tasks: Three quasi-experimental studies explored optional formative feedback activities. They compared scores of students who submitted a formative or draft assignment (approximately 20–50% of students) with those who did not. In general, students who submitted a formative task, exhibiting autonomous regulation, consistently scored better in the final assessment compared with those who did not. However, these students may have scored better regardless of any feedback intervention. Fisher, Cavanagh, and Bowles (2011) examined this confounder by following students longitudinally, finding an additive effect of feedback to performance, for already

better self-regulated and higher achieving learners. Students who submitted a draft for review scored significantly better than those who did not.

Nested/sequenced tasks: Twelve studies explored the use of *compulsory* sequenced tasks with associated transmitted feedback as a way of scaffolding learning (thus overcoming the challenge of optional tasks favouring higher achieving students). Detailed feedback comments were strongly related to student improvement in subsequent essay scores and most effective when given without grades or praise (Lipnevich and Smith 2009a). Students reported using feedback when it could be readily applied in subsequent work (Price, Handley, and Millar 2011; Pitt and Norton 2017) and when it enabled them to continue their efforts (Arts, Jaspers, and Joosten-ten Brinke 2016). In particular, 'good' feedback was when things that can be improved are pointed out, improving feelings of competence, and so 'turning them into a sort of action plan' (Price, Handley, and Millar 2011, 889). Students were more likely to use feedback information when tasks were sequenced (Steen-Utheim and Hopfenbeck 2019).

Dialogic feedback: Beyond the relatedness effects of dialogue, as described above, feedback dialogue scaffolded learning through cognitive co-construction, reframing and clarification of feedback comments, leading to improved evaluative judgement and performance. We interpret dialogue as a way of cognitively scaffolding knowledge construction and the mechanism as one of increased perceptions of competence as students come to understand what is expected of them (Bloxham and Campbell 2010).

Face-to-face dialogue based on assessment feedback comments led to students' knowledge orientation and elaboration (Esterhazy and Damşa 2019), greater student motivation and development of evaluative judgement (Hawe and Dixon 2017). Written feedback without dialogue was deemed insufficient for students to understand the feedback information (Steen-Utheim and Hopfenbeck 2019; Pitt and Norton 2017).

Action plans: Seven studies encouraged action planning with many students reporting their value for the next assessment. Adcroft and Willis (2013) found that final examination scores significantly improved for those who completed action plans compared to those who did not. The findings suggest that action planners started from a lower point than non-action planners but managed to finish at a higher point (Adcroft and Willis 2013). Action planning also prompted students to develop evaluative judgement, for example, a student reported: 'it forced me to look at my errors instead of ignoring them so it was good' (Bird and Yucel 2015, 521).

Feedback proformas and/or reflective tasks: Six studies asked students to actively self-assess or reflect on/process their feedback comments using proformas. For Todd and McIlroy (2014) the most effective element of the feedback intervention appeared to be the requirement to submit past feedback with the new work. In another study, students who had to explain how formative feedback information was addressed showed significant improvements in their essay scores compared to those who did not (Daniel, Gaze, and Braasch 2015). The authors hypothesised that 'articulat[ing] how feedback is being incorporated may help students more efficiently organize and respond to instructor feedback' (64). Similarly, students who had to complete an essay checklist prior to submission and then received feedback comments on areas of large discrepancy showed a significant improvement in marks on the end knowledge exam compared with students receiving feedback comments only (Wakefield et al. 2014). Students most valued where they could request feedback on specific aspects of their work, hence promoting perceptions of competence and autonomy related to personal goals, and guiding their future work.

Feedback theory 3: emotion as mechanism

The studies indicated that, unsurprisingly, feedback was emotional business. Emotions were both an outcome of feedback and a mediator of other outcomes. We interpret the emotions evoked by

feedback as influencing perceptions of competence and relatedness and therefore motivation to engage with feedback interventions.

For this feedback theory, we cannot separate the influence of feedback comments from the influence of grades (particularly poor ones) on students' perceptions of competence, motivation and performance. The motivational effects of feedback may be undermined through grades (Duijnhouwer, Prins, and Stokking 2010). We also caution against a simplistic positive–negative interpretation of valence, negative comments did not always lead to negative emotions and equally so with the positive comments, merely that the feedback intervention (confounded by the grade) evoked certain emotions which can affect perceptions of competence and relatedness and therefore motivation and effort. Generally, studies in this section did not set out to explore emotions as a primary outcome so only exceptional outcomes might be reported.

Six studies reported that positive emotions surrounding feedback, mediated through the mechanism of improving students' perceptions of competence and relatedness, led to feeling confident, supported, and motivated. The literature was more extensive regarding students' negative emotional responses. Seven studies reported that negative emotions surrounding feedback, were mediated through lowered perceptions of competence, leading to students feeling demotivated, loss of confidence and self-efficacy; and feelings of helplessness and worry about their future performance.

Strategies to modulate the effects of emotions

Five studies highlighted the importance of actively helping students to manage their emotions related to feedback processes in order to disrupt the negative de-motivational spiral. Active strategies included building students' perceptions of relatedness through peer and/or tutor dialogue in a trusting environment; for example, using group podcasts of shared stressors (McSwiggan and Campbell 2017) or a mobile phone application to log group emotions and to address these (Feidakis et al. 2013, 1656). Students in Cramp (2011, 121) appreciated being able to discuss their emotional responses to feedback.

Feedback theory 4: achievement as context

In this section, we focus on nine studies that look at differences in engagement with feedback interventions between high and low achievers. The high achieving students tended to autonomously regulate, take up optional formative feedback interventions, report more positive experiences and do better than their peers who do not take up optional feedback – unless the students had met their own personal goals (Bird and Yucel 2015; Covic and Jones 2008). However, when high achieving students' autonomous regulation was too constrained, they disengage from feedback (Roelle, Berthold, and Fries 2011).

Martens et al. (2010) found that both positive and negative feedback comments mobilised motivation through feelings of competence in highly achieving students. Jones and Gorra (2013) note that high achieving students sought feedback information from their teachers more often than those who scored 50–60%. Similarly, high achieving students showed more engagement with feedback comments than low achieving students (Wingate 2010). Therefore, the same intervention led relatively high achieving students to engage more with the feedback through mobilising their autonomous regulation; whereas for low achieving students, their sense of competence was dented, leading to less engagement with feedback and less improvement.

Eight studies reported that negative feedback comments activated students' pre-existing perception of low competence leading to demotivation and negative feedback behaviours, such as avoiding seeking clarification or additional feedback from lecturers, knowing what was expected and less action on feedback comments. They also did not know what questions to ask, as exemplified by a student's comment: 'There is something here that I don't understand but I don't understand enough to ask questions about it' (Bloxham and Campbell 2010, 297).

Discussion

We have identified the key contextual features of feedback design, and student achievement level as influential in engaging students with feedback. Self-determination theory was a useful explanatory theory for understanding the conditions that motivate students to utilise feedback processes in open-ended tasks in higher education. Feedback interventions that met student needs for relatedness, autonomy and/or competence motivated students to engage with feedback processes and therefore mobilised outcomes including improved performance, developing evaluative judgement, self-efficacy and learning. Beyond SDT, emotions also seemed to mediate students' perception of competence and relatedness, whilst achievement influenced how feedback was engaged with and therefore its effects. We start by discussing the ways in which feedback interventions created conditions for each of the needs, recognising that they are interrelated. This is followed by a global synthesis of the findings including implications for future research and practice.

Relatedness as mechanism

This review provides empirical evidence that the perception of an interpersonal relationship is a key part of feedback processes. This sense of individualised attention through the learner–teacher relationship goes beyond common notions that the feedback message should be personalised and specific. Students' perceptions of care, positive regard and trust matter; they lead to engagement with feedback and a range of positive outcomes. These findings also offer an explanation to the conundrum of why technology-enhanced feedback might lead to increased perceptions of relatedness and students reporting more effort, and yet limited influence on learning outcomes when written comments are simply substituted with audio or video feedback. We suggest that the lack of influence on learning outcomes of a simple media switch, might indicate that relatedness, in the absence of influence on perceptions of competence and autonomy and actual cognitive scaffolding, is not sufficient.

Perception of competence and autonomy as mechanism

Scaffolded feedback designs have the ability to prompt perceptions of competence and autonomy by helping students identify and control what must happen next. However, too much scaffolding might reduce some students' perceptions of autonomy while raising perceptions of competence, and conversely, too little scaffolding might lead to some students feeling confused about what to do next and reduced perceptions of competence. Feedback design that matches student capabilities and needs becomes critical.

Although student performance improved, we caution against optional tasks whether in the form of formative feedback (e.g. Brearley and Rod Cullen 2012), action planning (e.g. Adcroft and Willis 2013) or dialogue (e.g. Skinner 2014), as it would appear that preferentially higher achieving students take these opportunities up. A suitable compromise seems to be to make the activities count (i.e. not optional but with less weight) through sequenced task design. This equalises opportunities for feedback across students of varying levels of competence and motivation. Iterative feedback designs also signal to students that educators are invested in their learning progress, hence bolstering relatedness.

Emotion as mechanism

Although emotions were regularly mentioned in the studies in our sample, they were not foregrounded in the papers we reviewed and so were often reported in extremis. This may be because of the dominant cognitive view of feedback as information, which, when delivered well, will be automatically and neutrally absorbed by the learner (Molloy et al. 2020). Contrary to this,

emotions are inherent to learning (Värlander 2008), they influence sense-making and can have lasting effects on students' openness to feedback (Pitt and Norton 2017).

Our study shows that the impact of emotions upon feelings of competence and/or motivation counts, rather than the valence of the feedback comments. For example, 'negative' comments remained encouraging for highly achieving students (Martens et al. 2010). The studies suggest that students' emotions mediate their perceptions of competence. Therefore, simple recommendations to balance positive and negative information are unlikely to be helpful, especially when we consider student achievement as context. This raises its own challenge in supporting students to recognise their emotional responses throughout their studies and for educators to gain knowledge of students' emotional state prior to and independent of assessing students' work. Acknowledgement of emotions is considered to support student autonomy and reduce control (Reeve 2012).

Achievement as context

Our study suggests that students with different levels of achievement engage with feedback processes and information differently. Not only is the influence of feedback variable depending on students' proficiency (Stobart 2018), students also engage with feedback differentially. These two issues are likely interdependent. High levels of competence facilitate engagement with feedback opportunities. The preferential uptake of feedback opportunities by high-achieving students may simply assist better students to perform even better. Improving perceptions of relatedness for low achieving students (with low self-efficacy) could act as a circuit-breaker to the negative spiral of despair associated with feedback in this population.

Students' personal goals contribute to the decision to engage with feedback interventions, irrespective of the education design strategies implemented. It is unsurprising that students might cease to engage in feedback once their personal goals are satisfied, such as passing a unit at an acceptable level. Feedback processes typically do not take into account students' goals.

Implications for future research and practice

We encourage researchers and educators to discontinue viewing feedback as combinations of positive and negative information with pre-determined effects. Educators need to create conditions that promote students' perceptions of autonomy, competence and relatedness, particularly for low achieving students to be internally motivated to engage with feedback. Our review highlights that scaffolded feedback designs such as dialogue, iterative tasks, action planning and reflective tasks can lead to internal motivation and improvements in performance and self-efficacy. Their focus on learning offers students clarity with regards to the purpose of feedback and promotes relatedness, whilst the cognitive scaffolding and iteration over time prompts perceptions of competence

Relatedness	Competence	Autonomy
+ Dialogue	+ Scaffolded, sequenced tasks	+ Optional Tasks
+ Personalised	+ Dialogue / opportunity to elaborate	+ Action plans
+ Audio/video	+ Emotion	+ Reflective proformas
+ purpose of feedback for learning		+ Active management of emotions
- Changing assessors	- Strong negative emotion	- Over scaffolding of high achievers
- Embarrassed or intimidated by teacher	- Existing low self-efficacy	- Absence of dialogue
- Computer generated	- Absence of scaffolding	
- Absence of dialogue	- Feedback as grade justification	

Figure 1. Summary of conditions that support or constrain motivation to engage with feedback.

and autonomy. Helping students to acknowledge (rather than suppress) their emotional responses as natural components of feedback and learning processes is also supported. Figure 1 highlights feedback interventions and context factors that promote or inhibit perceptions of relatedness, competence and autonomy.

Future research could examine the applicability of these feedback theories in other assessment task designs and contexts such as workplace settings or doctoral supervision. Research may also seek to explore ambiguities identified in our research such as the interplay of actual competence and perceived competence on feedback uptake, and the role of personal goals on student engagement with feedback. Other questions raised by our review include: what is sufficient to give the students a sense of relatedness and with whom does the relatedness need to be? Furthermore, the role of emotion and goal setting in feedback warrants scrutiny beyond simplistic notions of valence of feedback information.

Strengths and limitations

A strength of realist reviews is the theory-driven synthesis that takes account of the context of the research studies. In keeping with realist methods, to avoid repetition and to offer a clearer narrative we have identified four separate but interrelated feedback theories.

Any review is limited by the quality of the research included. For this research, we excluded papers judged as low quality and those of student satisfaction alone. Despite this, there are limitations to many of the studies included. A common outcome measure for performance following a feedback intervention was the subject grade. Such an outcome lacks sensitivity on two fronts. First, it aggregates improvements on a number of domains or learning outcomes. Second, it is often an aggregate of multiple tasks. Alongside a lack of sensitivity as an outcome measure, grades and feedback conflate the source of the effects. Furthermore, the majority of papers included in this review were naturalistic rather than experimental and whilst this improves transferability, it is not possible to control for the effect of variables such as grades since they are ever-present in university assessment practices. Unfortunately, external rewards can undermine intrinsic motivation (Deci, Koestner, and Ryan 2001): without decoupling feedback and grades it is not clear how we might completely overcome this limitation.

Conclusion

This is the first realist synthesis exploring the effect of feedback interventions in open-ended tasks on learning. The articles pointed to the importance of student motivation as central to explaining the effects of feedback intervention. Ultimately, the context of assessment in higher education is one that is often controlled and driven by teaching personnel and therefore by definition one where student autonomy and therefore external motivation can be readily activated. Despite this, our findings highlight that under certain conditions students may be supported to be more internally motivated. Given the positive value of internal motivation to effort, learning and well-being it behooves us to take account of these conditions and to foster them within the contexts of our own feedback practices.

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