

Feedback loops and the longer-term: towards feedback spirals

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ABSTRACT

A key challenge for feedback practice involves promoting student uptake through the closing of feedback loops. This paper investigates feedback loops by using the concepts of single and double-loop learning to interrogate student responses to feedback. Single-loop learning tackles an identified problem or task, whereas double-loop learning additionally re-evaluates how the problem or task is approached. Evidence from a five-year longitudinal enquiry into four undergraduate students' experiences of feedback is used to analyse feedback loops. Students reported a variety of experiences: failing to engage significantly with end-of-semester comments; short-term uptake within modules which had two assignments; and longer-term efforts at improving their learning strategies. A model of long-term student engagement with feedback is proposed, including single-loop feedback processes, double-loop feedback processes and unresolved learning puzzles. Whereas feedback loops are mainly focused on the shorter-term, it is suggested that feedback spirals represent an alternative way of analysing complex, iterative longer-term learning processes. Implications for practice focus on student self-regulation and the development of student feedback literacy.


KEYWORDS

feedback; feedback loops;
feedback spirals;
feedback literacy

Introduction

The importance of useful feedback for advancing student learning is well-established (e.g. Hattie and Timperley 2007) but feedback processes are difficult to carry out effectively in mass higher education (Evans 2013). A significant challenge emanates from generally limited student engagement with feedback (Winstone et al. 2017). A related barrier is modest student feedback literacy: the capacities and dispositions to make use of feedback productively (Carless and Boud 2018). For students to engage actively with feedback, they need agency in line with social constructivist approaches to learning (Rust, O'Donovan and Price 2005). Social constructivist feedback research and practice takes the perspective that shared and individual interpretations are developed through dialogue, sense-making and co-construction (Price, Handley and Millar 2011). Feedback predominantly in the form of teacher transmission of information to students is insufficient to promote complex learning (Sadler 2010).

Defining and conceptualising feedback is contested territory. The view of Hattie and Timperley (2007) is that feedback involves information about performance or understanding with

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the information coming from a range of sources: e.g. teachers, peers or self. In the recent feedback in higher education literature, researchers focus more on students' actions in response to information. Building on this line of thinking (Boud and Molloy 2013; Carless 2015; Carless and Boud 2018), feedback is conceptualised as a process in which learners make sense of comments about the quality of their work in order to inform the development of future performance or learning strategies. This perspective places emphasis on student engagement with feedback in terms of the shorter-term, e.g. improving performance on a piece of work, or longer-term, e.g. improving strategies for approaching assessment tasks. When information leads to actions, a feedback loop is said to be closed.

The main aim of the paper is to investigate feedback loops of short-term and longer-term duration as a means of informing theory and practice. The concepts of single-loop learning and double-loop learning (Argyris 1990) are used to illustrate feedback loops involving relatively straightforward short-term actions (single-loop feedback processes) and more complex longer-term adjustments to learning strategies (double-loop feedback processes). The data-set which is deployed to support the arguments involves interview data from longitudinal case studies of four Chinese students' experiences of feedback. Alicia, Candice, Eva and Philippa (pseudonyms) studied a five-year undergraduate double-degree programme in Arts and Education at an English-medium university in Hong Kong. Ethics approval for the study was granted by the university.

Taped and transcribed individual interviews were carried out eight times per person at regular intervals over the five-year period to probe how student informants were responding to feedback processes. They were repeatedly asked to provide examples of feedback that they had acted upon so as to enable them to report short-term and longer-term attempts at using comments as well as challenges for uptake of feedback messages. In what follows, I interweave literature with students' accounts of their feedback experiences and learning trajectories to illustrate different kinds of feedback loops and spirals.

Designing for uptake of feedback

Promoting uptake of feedback has been an enduring concern in business, management and education. In classic early work from management theory, comments were only seen as becoming feedback when they were used to alter the gap between current and desired standards, thereby closing the control loop (Ramaprasad, 1983). In his seminal paper, Sadler (1989) builds on this thinking by identifying three conditions for effective feedback: learners need to possess a concept of the standard being aimed for; compare the current level of performance with the standard; and engage in appropriate action which leads to some closure of the gap between the two. When information is passed to a learner who lacks the opportunity or knowledge to act, the control loop cannot be closed and dangling data - i.e. unclosed loops - result (Sadler 1989).

Student response to feedback is influenced by the level at which the feedback operates (Hattie and Timperley 2007). Task level feedback denotes how well tasks are performed; process level feedback focuses on how to perform tasks; feedback at the self-regulation level focuses on learners' self-monitoring of their actions; and personal feedback at the self-level evaluates the learner and frequently involves praise. Hattie and Timperley conclude that feedback at the self-regulation level and feedback at the process level are generally most effective in raising achievement; feedback at the self-level is least effective; and the main limitation of feedback at the task level is the difficulty for students to generalise messages to other tasks.

When I repeatedly asked my student informants to provide examples of feedback they had acted on, they usually struggled to describe concrete instances of uptake. A significant barrier they identified related to the timing of teacher comments. Alicia, for example, spoke as follows:

The time when the feedback is received is a major barrier to our use of feedback. It generally comes back too late and by then I have often forgotten what I wrote, so it doesn't motivate me to do anything.

Candice talked about these kinds of issue as follows:

For mid-semester assignments, feedback is more useful. For end-of-semester assignments we don't come back to it because it is finished. Our mindset is that we are not going to take this course again so we don't need to concern about it anymore. I can't generalise the comments to other subjects because they are a different topic with a different teacher.

These self-reports reiterate the challenge of promoting student uptake of feedback found in relevant literature (e.g. Winstone et al. 2017). From the student perspective, information generally needs to be relevant to the next task but when commentary on assessed work comes after a module is completed, there is little prospect of learners engaging actively with the comments or using them. Feedback at the task level identifies issues in a specific assignment but may have limited impact on future assignments.

Promoting student uptake of feedback and the closing of feedback loops is facilitated by positioning assessment and feedback as fundamental elements of curriculum design (Boud and Molloy 2013). When assessment tasks are designed to build on earlier tasks, and the links in a sequence are made explicit, students are more likely to draw on information from preceding tasks (Zimbardi et al. 2017). Assessment sequences which involve feedback on draft submissions are an example of a design to promote uptake of comments, but they increase teacher workload and risk creating student dependency (Beaumont, O'Doherty and Shannon 2011).

My student informants often expressed a preference for staged assessment tasks in which they could use information from the first one to improve the second one. Their preferences resonate with the position of Boud and Molloy (2013) that feedback should be designed so that there are opportunities for feedback loops to be closed. One of the teacher strategies favoured by the student informants was providing timely feedback that they could promptly act on. Sequences of drafting and re-drafting of assignments were an example of this kind of approach. Eva reported an experience in one of her education modules when she had prepared a draft assignment of a lesson plan and received teacher comments. The teacher input included both positive and more critical feedback, and five bullet points of suggestions. Eva expressed appreciation of this feedback:

What was great about this feedback is that she gave constructive suggestions about how we can improve. It was clear and direct and we don't have to guess what it means like we sometimes do. She pointed out what we can do and we revised it.

There are some positive elements in this reported example. Eva perceives the teacher feedback to be clear and constructive, and she revises her assignment based on the teacher comments so a feedback loop has been closed. She also perceived the process favourably which is significant because students often express dissatisfaction with how feedback is managed (e.g. Carless 2006; Robinson, Pope and Holyoak 2013). To take a more critical perspective, however, it is questionable whether these kinds of sequences promote productive longer-term student learning processes. There is limited student agency when the teacher advises, the learner follows and the completion of the feedback loop appears relatively superficial. Boud and Molloy (2013) refer to these kinds of sequences as Feedback Mark 1: a task which demonstrates the current student performance level, teacher provision of information and a subsequent task in which a change of performance can be identified. A feedback loop is closed but there are risks of reinforcing dependency on the teacher rather than capacities in deploying internal feedback effectively.

The discussion above illustrates tensions between feedback as teacher-telling and more dialogic forms of feedback envisaged in key literature (Esterhazy and Damşa 2017; Nicol 2010; Yang and Carless 2013). Feedback that is less teacher-controlled and envisages greater student agency in closing feedback loops is described by Boud and Molloy (2013) as Feedback Mark 2. In this way of thinking, rather than just receiving inputs from teachers, students are involved in seeking information for improvement and self-monitoring their progress so that their evaluative judgment is developed (Tai et al. 2018).

Single-loop learning and double-loop learning

A useful lens to explore feedback loops arises from the work of the organisational theorist Argyris. He documented two types of learning by individuals in organisations: single-loop learning focused on tackling a specific problem or task, and double-loop learning which added a second loop re-evaluating the way the problem or task was tackled (Argyris 1990; Argyris and Schön 1978). Single-loop learning involves adjusting actions but is unable to induce changed ways of thinking and acting since modification of behaviours is limited to the solving of specific problems (Argyris 1991). Double-loop learning involves the re-examination of the principles for tackling a task and the subsequent adjustment of values and practices. One of the features of double-loop learning is that it can be stimulated by dialogue with others because without some kind of external stimulus, individuals may repeatedly use the same approach (Argyris and Schön 1978). Whereas double-loop learning is deemed preferable to single-loop learning, there are considerable challenges in achieving this because defensiveness occurs and individuals are reluctant to make fundamental changes to their ways of working (Argyris 1994). Similar defensiveness or protection of self-esteem also manifests itself in student reactions to feedback (Forsythe and Johnson 2017).

Argyris was not talking about feedback in higher education, he was referring to how individuals change. Adapting his ideas to feedback, one of the ways in which double-loop learning from feedback may arise lies in reflective thinking. Reflection involves a process through which inputs are, or are not, assimilated and this appears significant in decisions to use feedback (Sargeant et al. 2009). Reflections can be stimulated by social constructivist learning processes: interaction with peers or teachers and co-construction of ideas. Productive reflections often involve higher-order processes of self-regulation. These are consistent with the main purpose of feedback being to enable students to self-regulate their own learning (Butler and Winne 1995; Nicol and Macfarlane-Dick 2006).

In response to interview questions about key inferences from a body of feedback, the students talked about teacher comments helping them realise that for university work they generally needed to cover less ground but in more depth. This issue seems to carry features of both single and double-loop learning: the former when students are solving a challenge in a particular task and the latter when they are developing alternative longer-term ways of approaching academic work.

A significant piece of feedback that Candice recalled was 'try not to cover too many points, rather discuss a small number in detail'. She received this comment in year 2 on a draft that she submitted to the teacher and was able to close a single-loop by acting on this advice. She reported that this feedback was something she held in mind when working on future assignments so that instead of putting down all her ideas, she would select two or three of the most significant ones for elaboration. This seems to resemble double-loop learning in that it is suggestive of a changed approach to doing assignments derived from teacher comments and her own reflections.

When I asked Eva at the end of year 2 about how the totality of feedback she had received was informing her general understanding of quality academic writing, she identified that teachers wanted 'in-depth coverage rather than touching on the surface, with examples and theories to support your ideas'. Two years later she re-affirmed 'in-depth is better than bombarding teachers with a lot of shallow ideas'. So Eva seems to have internalised the idea of less can be more and used it to inform her assignment preparation. Similar to Candice's case, I interpret this as akin to double-loop learning in that it represents a modified approach to academic writing.

The issues of coverage and depth seemed to exemplify feedback at the process level and carried both short-term and longer-term implications for student academic writing. Over the short-term, in-depth analysis could be applied to a revised draft or the second assignment of a two-stage assessment design. Striving for greater depth could also reflect a different way of tackling

assignments with a focus on quality over quantity: a more detailed coverage of a smaller number of points. Tackling the balance between breadth and depth might involve a single-loop of immediate problem-solving; a double-loop of adjusting strategies for doing assignments; or an ongoing spiral that remains unresolved as a continuing challenge.

The notions of single and double-loop learning also resonate with the conceptualisation of feedback presented at the outset of the paper. When students are improving their work, they are mainly focused on single-loop learning; when they are developing their learning strategies, there is greater potential for double-loop learning. There would also be learning processes which might involve some form of combination of single and double-loops, or lie somewhere between the two. The active student role in re-evaluating learning strategies through double-loop learning also resonates with Feedback Mark 2. The difference is that Feedback Mark 2 places emphasis on the agent stimulating action, whereas double-loop feedback processes are more focused on the extent of the change.

Longer-term change and development

The most powerful feedback often has a critical longer-term dimension in that it provokes thinking, reflection and then considered action. Learning is a progressive, experiential process requiring repeated practice and so feedback should not be ephemeral but involve long-lasting and cumulative impacts on students' learning (Barker and Pinard 2014). An aim of feedback is to challenge students to adopt new perspectives but if they have a fixed mindset they often respond defensively to feedback and become trapped in ineffective study routines (Forsythe and Johnson 2017). Teachers and students could be working in partnership to develop longer-term approaches to the uptake of feedback messages. To what extent, however, is the curriculum in modularised higher education organised to promote this kind of iterative, spiral longer term development? Studies of programme-based assessment suggest instead that the student experience of feedback is often of an episodic, fragmented and disjointed nature (Jessop and Tomas 2017). Effective learner development is then largely dependent on students making sense of a wide range of assessment experiences; reflecting on those experiences; and taking action to improve performance or learning strategies. These gradual long-term impacts are often hard to discern.

Learner development and longer-term changes in learning strategies are illustrated by analysing some issues arising in Alicia's case. Alicia described herself as being a laid-back and not particularly hard-working student. In her first year at university, her grades were at the level of lower second honours. She did not seem to be engaging much with teacher comments and generally was unable to give examples of uptake of feedback:

I don't really feel that I have received much feedback that is particularly memorable or useful. Often I just got some feedback which told me what I was doing wrong and then provided me the correct answer: e.g. grammatical mistakes.

This seems to suggest that either the feedback is quite limited or she is not able to draw productive implications from teacher comments, perhaps because the feedback is directed mainly at the task level.

By the middle of her second year, her grades started improving. When I asked her about this, she mentioned something that she had learnt from some classmates when they were doing a group project together. The strategy was to make more use of teacher-designed rubrics to guide the preparation of assignments and she found this helpful in producing work that was better-focused on teachers' expectations. So this learner progress was not based on teacher feedback but a realisation from social interaction with peers. Learning from interaction with peers is one of the features of double-loop learning noted by Argyris and Schön (1978) as stimulating behavioural changes. In the feedback literature, socio-culturally based interaction with peers during

group assessment is also seen as an important element of meaning-making, improving the current assignment and developing broader understandings of the discipline (Esterhazy and Damşa 2017).

Alicia reported that she usually worked on her individual assignments immediately before the deadline and did them in a rush. Over time, she found that when there were multiple deadlines at the end of a semester it was difficult for her to produce quality work. When I asked her at the beginning of the final year whether she had made any changes to her learning strategies, she referred to this issue as follows:

I used to procrastinate a lot but now I leave myself more time to revise my assignments and do proofreading. The reason I do this is because I find the quality of my work is better if I do that. Before, I sometimes wanted to just escape from assignments but now I realise that doesn't help. I should try my best in all of the modules so that I can try to get Upper Second Class Honours.

I interpret this shift away from procrastination as resonating with double-loop learning in that it involves re-examination of ways of working based on her reflections, agency and decision-making. It does not arise directly from teacher feedback about procrastination, instead the origins for change seem to involve interplay between assessment results, teacher comments about careless work and her own internal feedback. More specifically, some of her grades were modest when assignments were put together hastily just before the deadline and teachers had stated that work needs polishing and proofreading prior to submission. The will to avoid procrastination is her construction from a range of assessment and feedback experiences. The educative process of assessment informs the practice of learners so that they make their own judgments about producing academic work (Boud and Molloy 2013).

Unresolved learning puzzles

Teachers' end-of-semester comments on assignments often focus on future development beyond the immediate context, carrying a temporal dimension relating to slowly-learnt aspects of course outcomes, and requiring a process of student engagement over an extended period of time (Price et al. 2011). Existing feedback research rarely addresses these kinds of issue because of the short-term cross-sectional nature of most studies and the lack of visibility of students' responses to teacher comments. In the current study, the students' accounts contained a few instances of longer-term engagement with issues that were not, or possibly could not be, easily resolved. I refer to these as unresolved learning puzzles to denote ongoing issues that students were engaging with over the longer term, although they did not reach satisfying solutions or lead to the identifiable closure of a feedback loop. Two examples are discussed: Candice's strategy of storing and revisiting feedback and Philippa's long-term attempts to understand teachers' expectations regarding the assessment tasks they set.

When I asked Candice whether she reviewed or reflected on feedback from previous years, she talked about some strategies she used for building on previous assessment experiences:

I keep all my old assignments in a file and if it is a similar topic I take a look. In a course that required me to make a lesson plan I looked at a previous example. In year 2 and year 3, I kept a notebook of feedback that I could use for improvement. I tried to use feedback on my old assignments to recall what I did well and inform the assignment I was working on. I reminded myself how I blended literature with my own point of view; remembered to use headings or sub-headings; and copied the patterns of correct referencing format which I often forget. I partly did it to reduce my workload in that sometimes I could copy and paste ideas from one of my assignments to another similar one. I used this notebook for a few years but never looked at it in my final semester because by then I was satisfied with my likely final degree result.

This quotation provides an example of learner self-regulation and investment of effort in dealing with previous feedback. This seems positive because for feedback processes to reach their potential, there needs to be spiral engagement over the longer term. A characteristic of student

feedback literacy is to revisit feedback comments and apply them in pursuit of improvement (Carless and Boud 2018). In this case, the strategy did not seem to be fully realised so trying to use previous feedback ended up as an unresolved issue which was eventually abandoned. Motivational and self-efficacy factors may influence students' efforts in working hard with feedback. Learners sometimes need some kind of external recognition or stimulus to encourage them to persist so Candice might have been encouraged to continue the strategy through teacher scaffolding or peer dialogue along social constructivist lines.

A persistent theme in Philippa's case over the entire five-year period was striving to understand teachers' expectations for assignments. In relation to the first condition for effective feedback of Sadler (1989), she wishes to possess a concept of the standard being targeted. As part of seeking to understand teachers' conceptions of quality, Philippa engaged actively with the rubrics provided. In the first semester of her studies, she described a strategy of copying and pasting assignment guidelines and rubrics to the top of her essay drafts. She reported using this strategy throughout her studies so she could continuously self-evaluate work in progress against the stated requirements. This seems to be a promising strategy that makes use of teacher-designed guidelines and rubrics for self-monitoring purposes. It is consistent with Sadler's second condition for effective feedback in terms of comparing the current level of performance with the standard (Sadler 1989).

When there was an assessment design involving a mid-semester assignment followed by an end-of-semester task, Philippa reported eliciting feedback from teachers:

For many modules, I often didn't do particularly well in the mid-semester assessment. The feedback mechanism allows me to improve the second assignment. I discuss the first assignment with the teacher, find out which parts could be elaborated, what needs clarifying or where I could go deeper. I do this quite frequently; I can catch teachers around campus or make an appointment.

Philippa is an ambitious student and she is pro-active in seeking feedback from teachers. By clarifying what the teacher is looking for, she strives to improve performance in the second assignment of a module. Feedback seeking and active reflection are characteristics of feedback literate students (Carless and Boud 2018).

Philippa frequently expressed a goal of 'being synchronised with the teachers' but reported finding this difficult. In her final year, I asked her about her progress towards this goal and she responded as follows:

I still don't think I really know what each teacher is looking for and there may be some key elements not stated in the criteria. Every teacher seems to have their own preferences for what they think is important. There could be conventions in that field or research area and teachers may favour different theories. Sometimes I go to their webpages or the Internet to see what kind of work they have published. I find out what they are interested in and try to provide it ... and in at least one module that seemed to be successful.

The long-term nature of Philippa's engagement with teacher views of quality seems to evidence spiral forms of sense-making. There are, however, tensions between trying to identify or guess the preferences of individual teachers and developing a more general conception of quality work. Although she is a talented student who achieved high grades, spending considerable time and effort trying to identify teacher preferences may not be entirely productive. Orsmond and Merry (2013), for example, equate this approach of 'chasing what the tutor wants' (p. 748) with over-dependency on the teacher and link it to the strategies of lower-achieving students.

This section reports on two issues which did not reach clear or identifiable conclusions. Candice showed agency in devising a promising strategy of recording and using feedback but eventually abandoned it. Philippa strived throughout her studies to identify what teachers were looking for in assignments. In both cases, the issues remained largely unresolved: Candice did not find a satisfying long-term way of using previous feedback and Philippa did not feel she was able to synchronise herself with markers. Feedback loops were not closed but the students

seemed to be actively engaged in tackling long-term learning puzzles resembling more of a spiral than a loop. The spiral nature of engagement involved gathering and reflecting on evidence over a period of several years.

Implications

I have framed feedback loops in relation to research on the uptake of feedback and from the angle of Argyris' single and double-loop learning. Building on these theoretical starting-points, I have illustrated various kinds of loop-based feedback outcomes that may arise. Often these are unclosed loops when students fail to act on feedback for various reasons, such as the comments are received after the conclusion of the module or students lack the impetus to strive for improvement. Single-loop feedback processes arise in terms of short-term problem-solving or troubleshooting. Double-loop feedback processes result from learners re-examining the bases of actions and modifying learning strategies over the medium or longer term. Unresolved learning puzzles involve lengthy gestation and spiral forms of engagement. Given the complexity of student learning trajectories, there are also learning experiences that do not fit into these categories or involve some combination of them.

In [Figure 1](#) I propose a model of long-term student engagement with feedback. Inputs from teachers, peers or learners themselves and processes of student sense-making on the left-hand side of the figure are factors influencing different forms of outcomes represented in the central core of the figure. The arrow from single to double-loop feedback processes is suggestive of possible interplay between the two. Unresolved learning puzzles are represented as a separate element at the bottom of the figure.

Feedback spirals are depicted on the right of the central core of the model to represent students' long-term learning trajectories as they work on assignments, involve themselves in single-loop or double-loop feedback processes and tackle unresolved learning puzzles. A loop implies an end-point, whereas a spiral implies something more ongoing and developmental. Feedback spirals involve students making sense of inputs from a range of sources over an extended period of time in order to improve work and enhance learning strategies. This conceptualisation of feedback spirals resonates with the view of feedback presented at the outset of the paper and extends its operationalisation by highlighting the value of longer-term engagement with feedback. The focus remains on students' sense-making and potential action, whilst

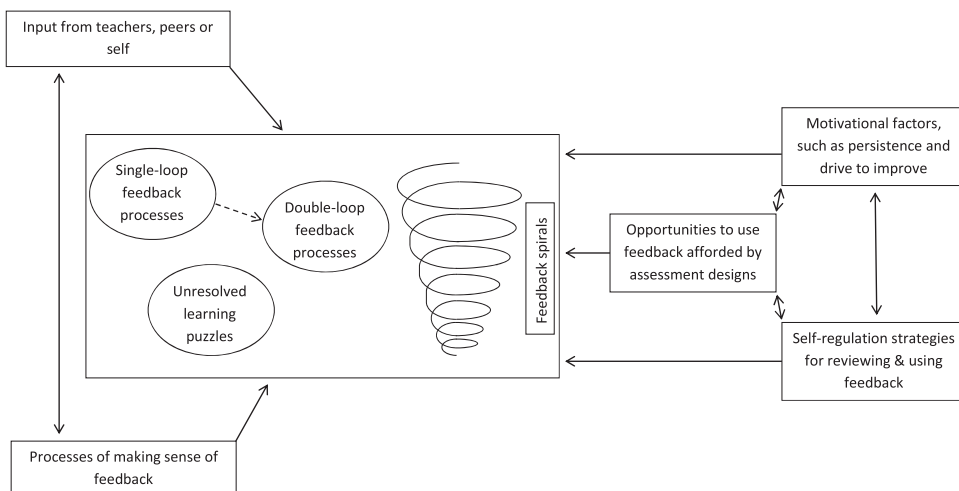


Figure 1. Model of long-term student engagement with feedback.

extending the temporal dimension to different forms of short-term, medium-term and long-term learning processes. This temporal and iterative nature of feedback spirals is one of its distinctive features. The process is spiral because learning is conceived as a series of cycles building on student engagement with previous feedback experiences and facilitating continuously more sophisticated starting-points. Viewing feedback as a series of spirals prepares the ground for double-loop learning and tackling unresolved learning puzzles in that insightful feedback frequently has a gradual, cumulative impact.

The right hand side of the model comprises three key enablers for student action in relation to feedback. An important teacher facilitating role is to provide opportunities for student uptake of feedback through curriculum and assessment design (cf. Boud and Molloy 2013). The other two factors on the right are student-related. Motivational aspects include drive, determination, persistence and volition of students to improve. Learners' self-regulation strategies for uptake of feedback include recording, accessing, retrieving and making use of inputs. The arrows linking the factors suggest possible interactions between them; e.g. motivation may prompt strategies for reviewing feedback, and increased opportunities for using feedback may enhance student impetus for improvement.

The main implications for practice follow from Figure 1. A key teacher role is to design curriculum and assessment in spiral sequences which enable students to use feedback and develop their own capacities in making academic judgments. For feedback processes to be productive, students need to be involved actively in making sense of information and engaging with it for the purposes of ongoing improvement. The enhancement of learning strategies implicit in double-loop feedback processes may be even more useful than shorter-term focus on improving a specific piece of work because effective learning strategies are essential for productive long-term learning. Longer-term approaches to feedback imply a need for teachers to coach students in the development of more sophisticated learning strategies. Teaching teams can embed the development of student feedback literacy within programme-wide approaches to feedback. Teachers play important facilitating roles in seeding student feedback literacy but it is students who are at the heart of developing their capacities in engaging with feedback. Students take an active role through self-regulation, including the development of enhanced goal-setting, self-monitoring, reflection and action on feedback. Feedback literate students possess motivation and strategies to make productive use of feedback (cf. Carless and Boud 2018).

Conclusion

The paper is based on interview data from just four students in a single setting but the novel longitudinal approach provides evidence of longer-term student learning trajectories. A starting point for the analysis was students' difficulties in using teacher comments because of lack of opportunities for action in response to feedback. Prior literature has thereby considered the closing of feedback loops to be a key goal of feedback processes. In this paper, it has been argued that feedback loops are more complex than this goal might imply in that the closing of a feedback loop may not always be indicative of fruitful independent student learning. Feedback loops have been theorised in terms of single and double-loop processes relating to the conceptualisation of feedback presented at the outset of the paper. Single-loop feedback processes are focused mainly on improving short-term performance, whereas double-loop feedback processes are predominantly oriented to improving students' learning strategies over the medium or longer-term. The concept of feedback loops may not be able to capture the slow iterative nature of complex learning, and so the potential of feedback spirals has been raised. Spiral forms of learning involve iterative cycles of tackling assignments, engaging with feedback, reflecting and making ongoing adjustments. Future research and development could investigate the embedding of feedback spirals with programme-based assessment and feedback strategies.

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