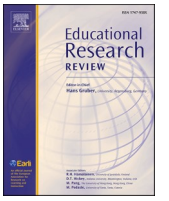
Educational Research Review 35 (2022) 100416

Contents lists available at ScienceDirect

Educational Research Review

journal homepage: www.elsevier.com/locate/edurev



A review of feedback models and typologies: Towards an integrative model of feedback elements

Ernesto Panadero [a,b,*], Anastasiya A. Lipnevich [c]

[a] Facultad de Educación y Deporte, Universidad de Deusto, Bilbao, Spain
[b] IKERBASQUE, Basque Foundation for Science, Bilbao, Spain
[c] Queens College and the Graduate Center, City University of New York, USA

ARTICLE INFO

Keywords:
Feedback
Feedback models
Feedback typologies
Review
Definition

ABSTRACT

A number of models has been proposed to describe various types of feedback along with mechanisms through which feedback may improve student performance and learning. We selected fourteen most prominent models, which we discussed in two complementary reviews. In the first part (Lipnevich & Panadero, 2021) we described the models, feedback definitions, and the empirical evidence supporting them, whereas in the present publication, we analyzed and compared the fourteen models with the goal to classify and integrate shared elements into a new comprehensive model. As a result of our synthesis, we offered an expanded typology of feedback and a classification of models into five thematic areas: descriptive, internal processing, interactional, pedagogical, and students characteristics. We concluded with an Integrative Model of Feedback Elements that includes five components: Message, Implementation, Student, Context, and Agents (MISCA). We described each element and relations among them, offering future directions for theory and practice.

1. Introduction

Feedback is one of the most important instructional interventions because of its strong effects and relative ease of implementation (Educational Endowment Foundation, 2018, 2021). Students of all levels of schooling receive feedback messages on a daily – if not hourly – basis. In a classroom context, sharing learning intentions, clarifying criteria for success, providing information that moves learners forward, and activating students as the owners of their learning are essential functions of feedback (Black & Wiliam, 2009). Inarguably, feedback is a key element of successful instructional practices – those that lead to improvements in student learning outcomes (e.g., Brown, 2018; Educational Endowment Foundation, 2021; Hattie & Timperley, 2007; Shute, 2008; Wiliam, 2018).

Although researchers agree that feedback is essential for improved performance and can contribute to enhanced achievement on the task, it is also known that (a) learners often dread it and dismiss it, (b) the effectiveness of feedback varies depending on specific characteristic of feedback messages that learners receive, and its implementation can be complicated for a number of reasons (see, e.g., Boud & Molloy, 2013; Hattie & Timperley, 2007; Jonsson & Panadero, 2018; Lipnevich & Smith, 2009; Shute, 2008). Many researchers have attempted to identify what constitutes good feedback, which characteristics are most critical for students' receptivity, and how to encourage students to effectively utilize it – often with inconsistent results (e.g., Lipnevich & Smith, 2018). Part of the reason for such inconsistency may be attributed to researchers coming from different methodological perspectives and using disparate terminology to

* Corresponding author. Facultad de Educación y Deporte, Universidad de Deusto, Bilbao, Spain.
E-mail addresses: ernesto.research@gmail.com (E. Panadero), a.lipnevich@gmail.com (A.A. Lipnevich).

https://doi.org/10.1016/j.edurev.2021.100416
Received 14 January 2021; Received in revised form 4 November 2021; Accepted 22 November 2021
Available online 1 December 2021

label relevant student-, feedback- or context-level factors that link feedback to improved performance (i.e., the "jingle–jangle fallacy", see Block, 1995). To bring more clarity into the field, scholars have attempted to propose models and taxonomies that describe feedback, student interaction with it, along with specific conditions that make feedback effective.

At this time, the models are proliferating and the field is missing clarity on which feedback models are available and how their information can be integrated. Hence, our aim with this systematic conceptual review was to propose a comprehensive analysis of the most prominent models and typologies. Our review is split in two parts. In the first part (Lipnevich & Panadero, 2021), we focused on the description of the fourteen selected models, integrating their definitions of feedback and analyzing the empirical evidence behind each model, whereas in the current manuscript, we synthesized the typologies, the areas each model addresses, and proposed a new integrative model.

Furthermore, when scholars put forward a model, it represents their understanding of how feedback influences learning and/or how students process feedback. By comparing and integrating feedback models, we will attempt at presenting a roadmap – our integrative model - of how feedback is currently thought to operate. Importantly, our model has implications for all educational levels. Although it is known that most feedback research is conducted with higher education students (Ruiz-Primo & Li, 2013), several of the reviewed models were derived based on non-university samples. Hence, the main findings apply to students across educational levels.

2. Method[1]

2.1. Selection of relevant publications

To select models for review we searched PsycINFO, ERIC, and Google Scholar databases. Unfortunately, this approach was not fruitful as the combination of "feedback + model" and "feedback + model + education" in either title, abstract, or document offered a mix of results from different disciplines in the first combination and focus on variables other than feedback in the second (e.g. self-assessment, peer assessment). Therefore, we established a three-way search method. First, we used our own reference libraries to locate the feedback models we had previously identified. By exploring the specific feedback model folder each of us have developed over the years working in the field, and via conducting a search using "feedback model" in title, abstract, and keywords. This exercise resulted in ten models. Second, we consulted colleagues to get their opinion on models that had an impact in feedback literature. We sent emails to 38 colleagues asking the following questions: What were the feedback models they knew of, have they developed any model themselves, and would they be available for further consultation. Our instructions intentionally did not include a strict definition or operationalization of what constituted a feedback model; this was done purposefully to allow for individual interpretation. To select the 38 colleagues, we first contacted all the first authors of the models we had already identified, the authors of the two existing reviews, and internationally reputed feedback researchers. We obtained 29 responses, but two of them did not provide enough information and were rejected. Through this procedure we identified 65 models, including the ten models that were already selected from our reference libraries. Finally, we used two previous feedback model reviews (Mory, 2004; Shute, 2008) to identify models that might not have been included in the two previous steps, selecting two more. Importantly, one of the models included in Mory (2004) that had not been identified earlier, had a very limited impact in the field. Clariana (1999) had only been cited 39 times since 1999, thus this model was no longer considered for inclusion. The resulting number of feedback models was 67.

Acknowledging that these many models could not have been meaningfully represented in our review, we tasked ourselves with further reduction of the data base. We used a combination of two inclusion criteria. First, we selected all but one model that had been included in the two previous feedback model reviews (Mory, 2004; Shute, 2008). Application of this criterion produced the selection of six models. Second, in addition to the previous criterion, we established a minimum threshold of three votes by the consulted colleagues to incorporate new models, which resulted in ten models. In conclusion, a total of 14 models were included in this review, after two overlapping models were excluded (see Fig. 1). The final list is: Ramaprasad (1983); Kulhavy and Stock (1989); Sadler (1989); Bangert-Drowns et al. (1991); Butler and Winne (1995); Kluger and DeNisi (1996); Tunstall and Gipps (1996); Mason and Bruning (2001); Narciss (2004, 2008); Nicol and Macfarlane-Dick (2006); Hattie and Timperley (2007); Evans (2013); Lipnevich et al. (2016); and Carless and Boud (2018).

These fourteen selected publications are different in their nature, and include meta-analytic reviews, conceptual reviews, and empirical papers. Importantly, two of the included papers are purely theoretical with no empirical evidence (Ramaprasad and Sadler). We would like to alert the reader that some of the publications discussed in this review would not comply with the definition of a model. Traditionally, a model is intended to explain existing relations among variables and is typically graphically represented (Gall et al., 1996). Some of the manuscripts that we were bound to include neither describe relations nor offer pictorial representations of feedback-related phenomena. Our decision in favor of inclusion was based exclusively on the criteria that we described above. For the purposes of simplicity, we will refer to the fourteen scholarly contributions as models, but will explicate the type of each contribution in the upcoming sections.

2.2. Extracting, coding, analyzing data and consulting models' authors

The data were extracted from the included publications for the following categories: (1) Reference, (2) Definition of feedback, (3)

[1] The method section is shared with the first part of the review (Lipnevich & Panadero, 2021).

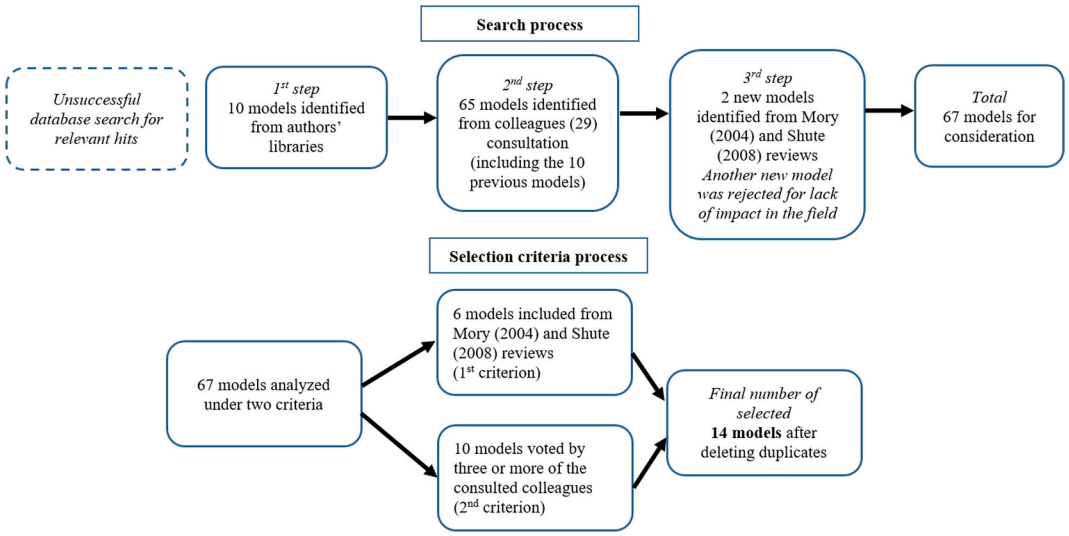


Fig. 1. Search and selection criteria process.

Theoretical framework, (4) Cites of previous models, (5) Areas of feedback covered, (6) Model description, (7) Empirical evidence supporting the model, (8) Pictorial representation, (9) Reference to formative assessment, (10) Notes first author, (11) Notes second author, and (12) Summaries of the model from other publications. The sources were coded in a descriptive manner for most categories except for the Definition, which was copied directly from the original source, and in some cases, for the Model description. Both authors coded the articles and there was a total agreement in the assignment of separate components to the aforementioned categories.

Finally, we contacted authors of all the included publications except for one (the two authors were in retirement and not accessible). Twelve authors replied (two from the same publication) but only seven agreed to an interview (Boud, Carless, Kluger, Narciss, Ramaprasad, Sadler, and Winne). The interviews were recorded and helped us to better understand the models. Also, to ensure adequate interpretation of the models we shared our descriptions with the authors, which they returned with their approval and, in some cases, suggestions for revisions.

2.3. Organization of results

After the analysis of the data extracted from the models, we decided to divide the review in two publications as one could not include all the relevant information. In the first publication (Lipnevich & Panadero, 2021) we described in detail the fourteen models, then compared the definitions of feedback presented in corresponding publications, and examined empirical evidence supporting each model. In the present publication we covered three main topics. First, we analyzed the main typologies or classifications of feedback included in nine of the fourteen reviewed publications. By comparing these typologies, we aimed at understanding how feedback was currently categorized and we also intended to propose an integrated typology. Second, we identified five thematic areas describing the models: descriptive, internal processing, interactional, pedagogical, and student characteristics. Third, we presented our comprehensive model, in which we integrated the typologies and thematic areas and explained how specific feedback processes interact. Finally, we presented some final conclusions.

3. Typologies of feedback: comparing, integrating, and proposing a new typology

In both research and practice, typologies are used to classify constructs or ideas into categories based on commonalities and differences which then build our understanding of a phenomenon. In feedback literature, one area of special interest specifically focuses on organizing, categorizing, and describing different aspects of feedback (Shute, 2008). This interest is shown by the fact that nine of the fourteen manuscripts included in this review discussed typologies.[2] Next we present an exhaustive and systematic overview of all existing approaches to categorizing feedback among the key models. Appendix A includes the original typologies and their categories, whereas Appendix B presents our classification. Finally, Table 1 shows our comprehensive typology that integrates prominent features across those included in the review.

To analyze and integrate the proposed categories, we started from Narciss and Huth (2004) classification, which organized feedback according to its content, function, and presentation. This typology was the most comprehensive out of the nine included in

[2] Next, we clarify the meaning of the following terms. **Typology** refers to the classification as a whole, **category** refers to the general grouping of feedback types (e.g. in Bangert-Drowns typology the categories would be intentionality, target, and content), **subcategory** are the specific types of feedback within each category (e.g. in Bangert-Drowns typology in the intentionality category there are two subcategories: formal and informal).

Table 1
An integrative typology.

	Content	Function	Presentation	Source
New typology categories	Verification Valence Load Type of information (containing additional subcategories) *Lead by Where am I going? How am I going?* *Where to next?*	Learning/performance Motivation/Affect Self-regulated learning	Characteristics such as (1) immediate vs. delayed timing, (2) single vs. multiple try, (3) adaptive vs. nonadaptive, and (4) unimodal vs multimodal (–e. g. written, audio) (Taken from Narciss)	**Teacher** **Peer** **Self** Computer Task Parents …
Conclusions from the analysis of the previous typologies	- Key rule for number of subcategories: independent categories, comprehensiveness and parsimony - The number of subcategories seems related to the educational and/or research purposes, showing lack of agreement. - Content can be represented as a continuum from low number of subcategories (e.g. Bangert-Drowns et al.) to high (e.g. Narciss). - Typologies with fewer categories present broader variables such as load and form, whereas the ones with more categories focus on specific types of information.	- There is significant agreement among previous typologies. We identified three shared areas: (a) **learning/performance,** (b) **motivation/affective**, (c) and **self-regulated learning** - Though **personal** feedback, it is only included directly in Hattie and Timperley, it is still a usual function for feedback even if already known it can have negative effects - Two different typologies from Ramaprasad (+vs -) and Tunstall & Gipps (socialization, etc.)	- The least studied: only two typologies Bangert-Drowns et al. (formal vs. informal) and Narciss (four categories) - This area of research is growing with the exploration on how different delivery modes and contexts can increase the agentic use of feedback of students (e.g. Jonsson & Panadero, 2018; Winstone et al., 2017)	- Feedback literature tends to assume that feedback mainly comes from the teacher - The inception of formative assessment emphasized the role of students' involvement in assessment (self and peer assessment) - Depending on who is the source there are distinct effects and features - Three main active agents in the classroom: teacher, peers and the self - Other sources of feedback are computers, the task itself, and parents - Computers hold promise for the future as an area that might develop tremendously in coming years (Bimba et al., 2017)

the selected publications. Hence, we integrated the nine typologies into those three categories, extended existing ones (e.g., we included *reception* in the *presentation* category), and added a new category of *feedback source* that we felt was missing. The content category represents the substance of the feedback message; the function category is the expected area of the impact of the feedback; the presentation and category describes how feedback is delivered and how this might influence how it is received; and the source represents the agent providing the feedback.

3.1. Content: wide range of subcategories

Regarding the *content* category, the typologies ranged from more simple classifications, such as Kulhavy and Stock (1989) with verification, type, and load, to more extensive ones that specified various categories of content. Among the more complex ones were Mason and Bruning (2001) and Narciss and Huth (2004) that focused on different types of feedback content with great level of specificity (see Appendix A). Interestingly, these two typologies were developed for instructional contexts utilizing computer assisted delivery of feedback. Hence, their categories might be representing the need to have a more structured manner of feedback delivery to accommodate more systematic and better defined requirements of the computer-assisted instruction. Therefore, we propose that the typologies can be arranged along a continuum, bounded by the three content subcategories of Kulhavy and Stock or Bangert-Drowns et al. on the left and eight subcategories of Narciss or Mason and Bruning on the right.

Is there an ideal number of subcategories in a typology, the reader may ask? Empirical research provides support for typologies with a very low number of subcategories (e.g. two categories in Harris et al., 2014); intermediate (e.g. four categories in Irving et al., 2011, Harris et al., 2015) and high (e.g. eight categories in Knight, 2003, p. 4 main categories, 23 subcategories, 1 non-codable category in Strijbos et al., 2012). Therefore, there is evidence that can back up different proposals determined by such characteristics as the complexity of the provided feedback, students' developmental stage, expertise in the task at hand, the source delivering the feedback (e.g. peers vs. teacher), etc. As with any other classification, the key rule would be to include a sufficient number of relatively independent subcategories to ensure differentiation.

We also propose that the required number of subcategories depends on the purpose of categorization. Some studies may have a more limited range of feedback content types if the agents delivering the feedback are not experts and have not received training to produce feedback (e.g. natural occurrence of self-assessment). At the same time, a computer-based intervention may need more categories because a very precise categorization is needed for the software to take decisions on what to do next. Generally, the typologies with fewer subcategories present broader variables such as load and form, whereas the ones with more categories focus on specific types of information (e.g. mistakes, concepts, task constrains). Ultimately, the typologies that future researchers and

practitioners select to inform their studies would depend greatly on their goals and tasks at hand. If the goal is to carry out an intervention, including a typology with fewer categories and subcategories may be more prudent. If the goal is to inform educators about all possible types of feedback they could deliver, a more comprehensive typology will be of a greater use.

With all this in mind, and although it might be difficult to reach a universal categorization, we propose a comprehensive typology that comes from the analysis of the nine publications. This comprehensive typology includes the following subcategories: verification, valence, load, and type of information, with the latter containing additional subcategories. Verification refers to a dichotomous judgment that the response is right or wrong (Kulhavy & Stock, 1989). Valence can be interpreted as positive or negative in different areas such as its content (whether it is positive or negative in its formulation), expected outcome (reinforcement by Skinner) or emotions triggered (+for emotions as happy, - for sadness). Load refers to the amount of information in the feedback message (Bangert-Drowns et al., 1991; Kulhavy & Stock, 1989). Finally, the type of information is the category with the most subcategories. Examples are Butler and Winne (1995), Tunstall and Gipps (1996), Mason and Bruning (2001) or Narciss (2004, 2008), see Appendix A for more information. We would like to note that there are many other papers reporting typologies of feedback (Murray et al., 2018; Shute, 2008), but it was out of scope to review all of them here.

Finally, we want to emphasize that the content of the feedback is crucial. Lately, there have been some proposals reducing the importance of the substance of feedback and assuming that, unless used, feedback is just mere information (e.g. Boud & Molloy, 2013). Although the intention of such views is to emphasize the active role of the feedback recipients and the implementation of the feedback, in our view the content of the feedback should remain central. We are concerned that deemphasizing the importance of feedback content might demotivate teachers to aim for constructing strong comments and, importantly, we have strong knowledge on how to deliver feedback content of quality (e.g. Brookhart, 2017; Ruiz-Primo & Brookhart, 2018).

3.2. *Function: three positive purposes*

Regarding the *function* category, it refers to the purpose and meaning intended by the feedback provider (e.g. teacher, peer). Interestingly, most models that included function present a similar set of subcategories. Our review shows (see Appendix B) that it is possible to integrate the subcategories from the models into three types: learning/performance, motivation/affect, and self-regulated learning. In the first subcategory the function of feedback is to enhance students' learning and performance (e.g. correction, cognitive, task learning processes) (see Table 1). In this subcategory we included the task and process subcategories from Hattie and Timperley's (2007), as both are content specific and relate to the cognitive aspect of the performance. We name the second subcategory motivation/affect as this feedback aims to increase motivation and positive emotions and decrease negative learning goals (e.g. avoidance) and emotions. The third subcategory is self-regulated learning, which is represented by feedback with the purpose of enhancing students' regulation of (meta)cognition, behavior, emotions, and motivation. This subcategory might seem to overlap with the previous one, but in the former case the feedback is construed as directed to produce direct effects on students' motivation and affect (e.g. "It seems like you were nervous at the exam and that might have affected your results"), whereas here the feedback aims to develop students' own capacity to self-regulate (e.g. "These are some strategies that you may try to reduce your anxiety during exams").

Importantly, there are two included manuscripts that are exceptions and do not follow the same logic in their categorization. First, Ramaprasad (1983) dichotomized feedback into positive vs. negative. From Ramaprasad's perspective: "if the action triggered by feedback widens the gap between the reference and the actual levels of the system parameter … is called positive feedback ….if the action reduces the gap between the two levels … is negative" (p. 9). In the context of educational feedback is usually described as being positive or negative in valence depending on the emotions it elicits or intends to convey. Second, Tunstall and Gipps (1996) organized their typology around feedback for socialization and for assessment of elementary school children. These researchers described functions in terms of direct influences of feedback and discussed feedback as being rewarding, punishing, disapproving, etc. This categorization, however, is intended for a specific age group, whereas the other three typologies are intended for all ages and focus on feedback's impact on student characteristics.

Additionally, Hattie and Timperley's (2007) typology deserves a special consideration. First, they present two types of function: (1) the pedagogical point of view including three categories of feeding up, feeding back, and feeding forward that vary from informing students about past errors to providing them with recommendations on what to improve next on a task; (2) from a more psychological point of view, differentiating among four subcategories of task, process, self-regulation, and self. Importantly, the second set may also be categorized as both the content and the function of feedback they serve: for example, the content of self-regulation feedback actually aims to increase students' self-regulatory processes. In this sense, Hattie and Timperley's approach is an example of the dynamic interrelation between content and function. The function could be considered the main purpose of the feedback, whereas the content is the manifestation of that purpose.

The second area of special consideration in the model is the *self* category. Hattie and Timperley defined it as messages "directed to the 'self.' We propose that the *self* category can be subsumed in the three that we proposed –i.e. learning/performance, motivation/affect, and self-regulated learning. If we analyze the examples that those authors offered in their model: "You are a great student" and "That's an intelligent response, well done" (Hattie & Timperley, 2007, p. 90), we conclude that the latter example does relate to the task, and the former may serve a motivational function and ultimately contribute to, for example, students' positive academic identity. Furthermore, Brummelman and Sedikides (2020) synthesize a complex interplay of praise, noncognitive characteristics, and outcomes. They show that praise is not inherently detrimental, but it is certainly not inherently reinforcing or motivating. Hence, just like any other feedback, self-level or person-level feedback may serve motivational/affective; performance/learning, or self-regulatory function.

3.3. Presentation: the importance of the students' agentic use of feedback

Regarding *presentation*, only Bangert-Drowns et al. (1991) and Narciss and Huth (2004) included this category in their typologies, making it the least explored. Bangert-Drowns and colleagues did not use the term presentation, but some of their categories are connected to it such as form which is a term they used. Narciss and Huth (2004) used the term presentation and proposed four different subcategories: (1) immediate vs. delayed feedback, (2) single vs. multiple tries, (3) adaptive vs. nonadaptive, and (4) unimodal vs multimodal (e.g. written, audio, etc.) (see Appendix A for a detailed description). We adhere to Narciss' categorization when discussing our integrative typology.

Importantly, there has been a large number of empirical studies examining optimal ways of feedback presentation (e.g. Bangert-Drowns et al., 1991; Broadbent et al., 2018; Kulik & Kulik, 1988; Mahoney et al., 2019). An area that has received substantial attention out of the four categories proposed by Narciss is timing, showing variable results. One of the recent rather optimistic findings is that there was no difference between delayed and immediate feedback, with some evidence indicating that delayed feedback may be preferable for more complex tasks (e.g., Fyfe et al., 2019; Hattie, 2009). However, variables such as instructional context or the nature of the task would affect the effects of timing. For example, in music instruction, immediate feedback is expected and is most conducive to improvement (Parkes, 2018). Therefore, more research on the presentation of feedback is needed.

Interestingly, the feedback literature is turning its attention towards the exploration of how different delivery modes and contexts can increase the agentic use of feedback of students (Educational Endowment Foundation, 2021; Jonsson, 2013; Jonsson & Panadero, 2018; Winstone et al., 2017). What students do with the feedback they receive is influenced by the way the feedback message is presented to them. In recent years, the way in which delivery variables affected feedback processes has become a central topic in research (Jonsson, 2013; Jonsson & Panadero, 2018; Winstone et al., 2017; Van der Kleij & Lipnevich, 2020). Hattie, for example, has recently moved from examining characteristics of feedback as proposed by his model with Timperley, to exploring conditions of feedback presentation that aid students' use of feedback (Hattie & Clarke, 2019). Crucial for this development of the field has been the work of Black and Wiliam (1998, 2009, 2018), Wiliam (2011, 2013, 2017), David Boud (1995; Boud & Dawson, 2021; Boud & Molloy, 2013; Boud & Soler, 2016), David Carless (Carless & Boud, 2018; Carless & Winstone, 2020), or Mandouit (2018, 2020) among others.

This shift was necessary as historically, researchers' attention was placed on the feedback from the teacher without focusing on features of feedback that make students' reception of it more effective. So, for example, Winstone et al. (2017) reviewed feedback intervention components to recipience and identified four clusters: (1) manner of feedback delivery –clearly connected to the presentation of feedback-, (2) collective provision of training, (3) sustainable monitoring, and (4) internalizing and applying standards. These influenced what they called the SAGE model as in (1) Self-appraisal, (2) Assessment literacy, (3) Goal-setting, and (4) Engagement and motivation. The first characteristic is feedback presentation and, according to researchers, is the prime contributor to feedback recipience.

Clearly, presentation is an important feature of any feedback message and it affects students' receptivity. We contend that an equally important characteristic is feedback source, which is frequently overlooked in feedback research. Hence, we review it in the next section.

3.4. Source: emphasizing a "new" category to situate students in the center of feedback

The models and typologies analyzed in the current review seem to assume that feedback comes from a source without an explicit discussion of how different sources might affect the uptake of feedback. This is, in our opinion, a major omission. Only a few models include different feedback agents or sources (i.e. Evans, Narciss, Lipnevich et al.) but not with enough detail attesting to their differential effects.

The importance of the source of feedback is far from new (e.g. Narciss, 2013). To start, for decades, the self and peer assessment literature has claimed the importance of having students as their own sources of feedback (e.g. Andrade, 2018; Boud, 1995; Dochy et al., 1999; Topping, 2003). The interest in this area is also demonstrated by recent models that are explicitly exploring links between feedback characteristics and different sources, for example, in corrective feedback (Aben et al., 2019) or performance feedback (Lechermeier & Fassnacht, 2018). Similarly, Lipnevich and Smith (2009) showed differential responses to computer and instructor provided feedback, and Janelli and Lipnevich (2020, 2021) revealed that computer provided feedback in MOOCs had no effect on participant's persistence or final exam scores, a finding that is different from those reported in traditional instructional settings.

Importantly, as we will explain in the next section, the peer assessment literature has concentrated on exploring the role of receiving and giving feedback to peers, that is, on the source of feedback (van Gennip et al., 2009; Panadero, 2016). In other fields, such as organizational psychology, the importance of different sources of feedback has been consistently emphasized, referring to the multi-source feedback as 360° feedback or assessment (e.g. DeNisi & Kluger, 2000; Athota & Malik, 2018). A crucial benefit of source triangulation is in its evaluation of the credibility of the feedback received (Facteau et al., 1998). Although this aspect has been explored in peer assessment literature (van Gennip et al., 2009; Panadero, 2016), it still needs attention in the general feedback literature.

We join the above-cited along with many other authors (e.g. Allal, 2020; Black & Wiliam, 2018; Strijbos & Sluijsmans, 2010) to claim that the source is crucial for the study of the feedback process: the three main active agents -i.e. teachers, peers, and self-along with the feedback created by the task and computers, create different learning environments and responses from the students. A crucial aspect, as shown in Fig. 2, is that all sources ultimately contribute to the self-feedback generation of the student (Nicol, 2020; Panadero et al., 2019; Butler and Winne, 1995). It is important to disentangle the explicit active role of the self in the generation of feedback that takes place when a teacher implements self-assessment in the classroom explicitly; and the natural occurrence of self-feedback when

students received feedback from other sources such as the teacher. Therefore, while all feedback should aim for the learner generation of self-feedback, the student can actually be involved via instructional self-assessment in a more explicit and direct way for the generation of self-feedback (Panadero et al., 2019). Because of the centrality of students in the feedback process (Carless & Winstone, 2020; Jonsson, 2013; Tai et al., 2018; Winstone et al., 2017), and the fact that the models analyzed here downplayed this aspect, next we devote some space to the discussion of students as creators and evaluators of feedback.

3.4.1. Students as creators and evaluators of feedback

One crucial goal of feedback is to enhance the capability of students to create their own feedback independently (Andrade, 2018; Boud & Falchikov, 2007; Brown & Harris, 2014; Hattie & Clarke, 2019; Nicol, 2020; Panadero et al., 2019; Sadler, 1989). That is, instructors need to help students to move away from overreliance on external sources of feedback and develop skills to identify correct and incorrect feedback, to seek for feedback when needed and to become effective providers of feedback. Actually, in organizational psychology this seeking of feedback is crucial and it is divided between the inquiry of feedback and the monitoring of the veridicality of that feedback. Or, even from a closer field, in the self-regulated learning theory, one of the key strategies is "help seeking" which would be the inquiry of feedback (Newman, 2008) and the monitoring/evaluation of feedback (Butler & Winne, 1995). Therefore, students need to become effective evaluators of the feedback they receive: is this piece of feedback correct? Is this what I need? This idea is less emphasized in the self-assessment literature (Andrade, 2018; Nicol, 2020; Panadero et al., 2019). Although there is initial research describing self-assessment processes (Panadero et al., 2020; Yan & Brown, 2017) we need to pay closer attention to the evaluation of the feedback received for self-assessment purposes.

Until recently, feedback literature has focused on the perspective of the teacher (Black & Wiliam, 1998). In this sense, feedback was something to be "done" to the learner. Interestingly, some of the models analyzed here were based on the perspective of students as self-assessors (e.g. Butler & Winne, 1995; Sadler, 1989) but certainly less so than the general focus on an external provider. However, over the past decade the field has accumulated enough evidence that showed that students' involvement in the creation of feedback had positive effects on their learning (Brown & Harris, 2013; Dochy et al., 1999; Double et al., 2020; Li et al., 2019; Topping, 2003; van Zundert et al., 2010). These studies have been conducted within the scope of self-assessment and peer assessment. Our intention here is to provide a short overview of what is known in this domain and put it in the context of students as creators of feedback.

Self-assessment, as an instructional strategy, can be traced back to the previous century (Boud, 1995), and it is not surprising: after all, one of the purposes of education is to aid students' in reaching a great level of autonomy, and it can be achieved if the learner is able to self-assess or effectively internalize the external feedback that is provided to them. The literature on self-assessment is filled with tensions. First, there is not a consensus in the field in regards to what constitutes self-assessment. For a long time, it was conceptualized as the similarity between the student's self-awarded grade and the teacher-assigned grade, and even currently this is still the most common view (Andrade, 2018). However, this is problematic because the grade is just one part of what self-assessment involves, and there have been calls to more important aspects such as content accuracy (Panadero et al., 2019). Second, there has been a repetition of studies on how accurate students were when self-grading without really changing aspects of the instructional setting. Therefore, our understanding of the topic has not yet been sufficiently developed (Panadero et al., 2019). And third, humans are imperfect self-assessors in general as demonstrated by the vast research into cognitive biases (i.e. Tversky & Kahneman, 1974), and the extent of bias is greater in learners who are novices. Therefore, should researchers and instructors have no hope in their quest to examine and develop excellent self-assessors? Our answer is a categorical "No!": effective and deliberate self-assessment should remain as one of the ultimate goals of instructional feedback because self-assessment increases academic performance (Brown & Harris, 2013), self-regulated learning, and self-efficacy (Panadero et al., 2017). Furthermore, training can improve the accuracy of self-grading (Brookhart et al., 2004), and thus help to mitigate the Dunning-Kruger effect and other biases (Kruger & Dunning, 1999).

A similar research trajectory can be found in peer assessment with a greater emphasis on peer grading processes (Reinholz, 2016) showing that, in general, peer grading accuracy is above acceptable (Falchikov & Goldfinch, 2000; Li et al., 2015). Most importantly, peer assessment has been consistently shown to increase academic performance (Double et al., 2020; van Zundert et al., 2010), with peer feedback viewed as more helpful than teacher's under certain circumstances (Cho & MacArthur, 2010). Studies also revealed that the negative effects of interpersonal variables could be counteracted by changing some aspects of the interventions, and there is a claim

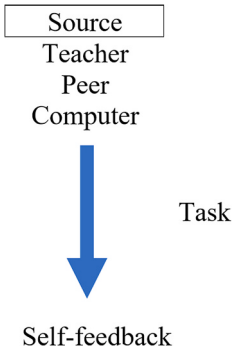


Fig. 2. *Sources of feedback.*

that peer assessment could enhance self-regulated learning (Panadero, 2016).

When combined, self and peer assessment are positive for education but, even more importantly, they are central for encouraging students to become effective creators and users of feedback. There has been research trying to compare the efficiency of the two approaches with some researchers attesting to the greater effectiveness of peer assessment (e.g. Iglesias Perez et al., 2020; Omelicheva, 2005), whereas others showing greater benefits of self-assessment (e.g. Sadler & Good, 2006; Sanchez et al., 2017). It is not our goal to reconcile these threads of research. We would like, however, to push forward one idea: these approaches are complimentary and having students in both roles can be highly beneficial for their development as autonomous learners (e.g. Dochy et al., 1999). Researchers and instructors need to think of self- and peer assessment as parts of the process of helping students in becoming creators of their own feedback. Self-assessment is the process of comparing one's own performance to a certain internally or externally providedcriterion, and peer assessment is the process of comparing someone's performance against a standard (Nicol, 2020). Additionally, receiving feedback from three active feedback sources (teacher, peer, and self) would result in something akin to what industrial organizational psychologists call 360° feedback. Triangulation of sources, as it is known from research, should get you closer to your true personal score.

As a field, research is moving towards the exploration of how to increase students' use of feedback and how to involve students in the creation of feedback (i.e. self- and peer assessment). In our view, to understand specific strategies that may help us to increase students' use of feedback, it is crucial that researchers study the complexity of links among variables in the process of feedback delivery and use (i.e., interactional models), and focus on the *presentation* and the *source* categories as they will have a significant influence of how the feedback is received by the student.

3.5. Summary of the new typology

As discussed above, the categories of typologies have had an uneven theoretical development, with *content* and *function* having received the most attention from researchers, and *presentation* being an underdeveloped category that is now coming into the focus. Whereas in *content* there is basically no agreement on subcategories or their number, in *function* we have identified three central areas around which most of the subcategories could be organized. Additionally, we proposed an inclusion of a new category to the typology, the *source* of feedback, which could enhance our understanding of how feedback that comes from different sources may influence students in the creation, delivery, and receptivity of feedback, and importantly, in the evaluation of the feedback received.

4. Comparing and integrating models: five thematic areas

It is important to compare the models themselves, apart from the typologies, to understand what their common and distinct areas are and how they construe the mechanisms by which feedback operates. To this end, we performed three actions. First, we focused on the figures depicting models as they represent the main components and links among them. Second, we analyzed the content of the original publications that we selected as representative of the models. And third, we analyzed if further publications advanced the model. Although the fourteen models have a lot of unique features, we have identified commonalities to group them into five thematic areas: descriptive, internal processing, interactional, pedagogical, and student characteristics. Table 2 shows our categorization of the fourteen models into the five aforementioned areas. Color saturation represents the extent of the emphasis of the model on each of the five categories.

The criterion for inclusion was that the model in question needed to address the area as one of its main emphases. Additionally, some of the models touch upon some areas sufficiently to be included but not as deeply as others. For that reason, we used color coding to show models with more and less emphasis on different thematic areas.

4.1. Descriptive

This area comprises models that address foundational aspects of feedback such as definitions or typologies. We identified seven models having feedback description as their central theme and four exploring it with less emphasis (See Table 2). Additionally, in nine of those eleven models, a typology of feedback was presented. Hence, all manuscripts that in addition to the model included typologies that we discussed in the previous section belong to the descriptive category. Among the models with a higher emphasis are Ramaprasad, Bangert-Drowns et al., Tunstall and Gipps, Mason and Bruning, Narciss, Hattie and Timperley, and Lipnevich et al. Among the models with less of an emphasis are Kulhavy and Stock, Sadler, Butler and Winne, and Kluger and DeNisi. Importantly, both the definitions of feedback (see Lipnevich & Panadero, 2021) and typologies (See section 3) have been discussed at length previously so we will not repeat ourselves here.

4.2. Internal processing

Feedback processing is a crucial mediator between the feedback provided and its outcomes in terms of its cognitive, motivational, and/or metacognitive effects (Butler & Winne, 1995; Narciss, 2008, 2012). Models that were assigned to this area provide a description of how feedback affects students' internal processing of information. These can be placed along a continuum as depicted in Fig. 3. In some models (Kulhavy & Stock, 1989; Kluger & DeNisi, 1996) the feedback message is central and directly influences the type of internal processing that students are assumed to do. Other models in this category describe the processes as the foundation, with the feedback message moving away from the center stage and being regarded as information to be processed. This is an important

difference because according to the models on the left side of the continuum, feedback evokes specific processing in students, whereas for the models on the right side of the continuum, students come with a number of characteristics that influence the receptivity and the use of feedback. Hence, the focus of the latter models is on the student, as opposed to feedback.

Moving along the continuum, we have Kulhavy and Stock (1989) and Kluger and DeNisi (1996) who depicted mechanisms through which different feedback elements trigger very specific reactions in students. Narciss and Lipnevich et al. represent intermediate models that devote as much time to the student as they do to the message, combining characteristics of both. So, Narciss (2004, 2008) and Lipnevich et al. (2016) portrayed feedback type as the key element influencing the processing, but she also indicated that there were many other elements that were equally important (e.g. individual and instructional factors). Further, Lipnevich et al. model discussed a number of characteristics of feedback that influenced its implementation and emphasized students' internal characteristics (e.g. ability, prior success) and how the interaction among these characteristics triggered different affective or cognitive responses.

Finally, at the right end of the continuum Bangert-Drowns et al. (1991) and Butler & Winne's (1995) models. took the focus away from feedback message and anchored their models almost exclusively in the internal characteristics of the learner. Bangert-Drowns et al. discussed five phases with only the fourth one describing feedback as central to the students' learning process. These five phases are (1) initial state, (2) search and retrieval, (3) learner response to question, (4) evaluates the response comparing it to the feedback received, and (5) makes adjustments. Similarly, Butler and Winne presented a model in which they described how students regulated their learning. They proposed a number of task and cognitive conditions that influenced the execution of feedback. The authors suggested that student performance was organized around four phases which were recursive and open: (1) definition of task, (2) goals and plans, (3) tactics and strategies, and (4) adaptation. The latest can be influenced by both the internal feedback generated by the student and the external feedback from another source. This model emphasizes internal feedback over external by stating that students could generate their own feedback and, even when they received it from an external source, they still had to process it internally.

Additionally, there are two other models with a significantly weaker emphasis on internal processes, but they mentioned it nevertheless. First, Nicol and McFarlane-Dick (2006) proposed seven formative assessment principles that influenced learner self-regulation. The internal processing aspect of this model draws upon Butler and Winne's self-regulation model, discussed above. Secondly, Carless and Boud (2018) mention three learner's processes: appreciating feedback, making judgments, and managing affect. However, the description of these processes is anchored in pedagogy. Therefore, these two models will be discussed in more detail later.

In conclusion, although there are six models addressing learners' internal processing, they are located in different positions along a continuum: from models focusing on the feedback content to models focusing on the mental processes, in which feedback is just one of the variables that influences the depth and the outcome of such processing. These are, therefore, very different approaches to conceptualizing feedback. In general, if researchers plan to conduct a study that focuses on more general aspects of feedback they will benefit from framing it within the models that present feedback as one of the many elements within a model (e.g. Bangert-Drowns et al., 1991; Butler & Winne, 1995). However, if the study's aim is to explore a very specific aspect of internal feedback processes, the models, in which feedback message is the main element of action may be a better choice (e.g. Kluger & DeNisi, 1996; Kulhavy & Stock, 1989). Keeping the focus on both the process and the student can be aided by the application of the intermediate models.

4.3. Interactional

Interactional models describe how different sources and agents interact during the delivery and implementation of feedback. As it can be seen in Table 2, it is the least explored thematic area. We identified Narciss (2008) as being the model that offered the most emphasis on describing how all of the components interacted during the process of feedback delivery and uptake, with three other models (Lipnevich et al., 2016; Evans, 2013; and Butler & Winne, 1995) addressing these interactions to varying degrees of specificity.

Narciss (2008) provided a detailed picture and explored a range of interactions among the feedback receiver and the feedback source (i.e. teacher, peer or instructional medium). The model discusses how learners performed several internal adjustments to generate internal feedback that was influenced by the external feedback source. The model is intended for computer assisted learning environments and, hence, may not be fully transferable to other instructional settings. The high level of specificity can also be explained by its context.

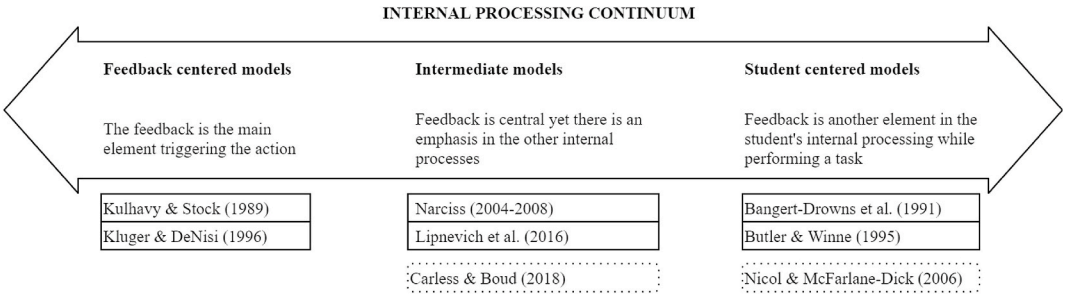


Fig. 3. Internal processing continuum.

The central purpose of the Lipnevich et al. (2016) Student – Feedback Interaction model is to examine what occurs between the time when the student receives the feedback and the time when the student acts on that feedback (or chooses not to do so). That is, this model attempted to explicate the process that underlined the efficacy (or lack thereof) of feedback by examining how feedback characteristics interacted with students' characteristics triggering a response and an action. Although the context is represented, it is not the central part of the figure.

Further, Evans (2013) called her model the feedback landscape, in which she described the interaction between the instructor and the student in a more general framework of the academic learning community. The underlying idea of the model is in the close interaction between students and instructors. Evans suggests that feedback was moderated by twelve variables shared by feedback receivers and givers (e.g. ability, personality, etc.), with three additional mediators selected for instructors (i.e., awareness of other contexts, alignment of other modules, and knowledge of students). Surrounding this interaction there is the academic learning community (e.g. resources, academic peers, etc.) and an emphasis of temporal and special variability of specific mediators.

Butler and Winne (1995) can also be regarded as interactional, although to a lesser degree, as their focus is on the internal processing of feedback. According to Butler and Winne (1995) feedback is the information that learners perceive about aspects of thought (e.g., accuracy of beliefs or calibration) and performance (e.g., comparison to a standard or a norm) and that may come from external sources when additional information is provided by an external agent. At any given point of the performance, students generate internal feedback comparing the profile of their current state to their ideal profile of the goal. This happens via self-assessment by comparing different features of a task and through learners' active engagement with the task.

This thematic area may be the most complex in terms of components and interactions, especially when considering the work by Narciss (2008) and Evans (2013), and it may be most conducive to designing studies and research programs that would systematically investigate the complexity of links among feedback, student, and a range of other variables.

4.4. Pedagogical

Pedagogically oriented models focus on how feedback can be implemented and delivered to enhance its impact. Six models have been assigned to this area: Sadler (1989), Mason and Bruning (2001), Nicol and Macfarlane-Dick (2006), Hattie and Timperley (2007), Evans (2013) and Carless and Boud (2018); additionally, three models also explore it with less emphasis: Tunstall and Gipps (1996), Narciss (2004, 2008) and Lipnevich et al. (2016).

Starting in the chronological order, Sadler (1989) has been highly influential not only for the field of feedback but also for formative assessment (Wiliam, 2011). One of the reasons for its influence is that Sadler transferred the foundational ideas of Ramaprasad (1983) to an educational context. Sadler suggested that feedback was more than mere information and that it should have a clear purpose and a context giving it meaning (Wiliam, 2011). Sadler also proposed three conditions for feedback to be effective: a standard that needs to be set up and explicated, the comparison of learners' performance against such standard, and motivating the learner to close the gap. These ideas were, for example, foundational for Hattie and Timperley (2007) model: "As Sadler (1989) convincingly argued, it is closing the gap between where students are and where they are aiming to be that leads to the power of feedback." (p. 90). Finally, Sadler claimed that the ultimate purpose of feedback should be promoting self-monitoring (also known as self-assessment) as the

Table 2
Models thematic areas.

Models	Descriptive	Internal processing	Interactional	Pedagogical	Student Characteristics
Ramaprasad, 1983					
Kulhavy & Stock, 1989					
Sadler, 1989					
Bangert-Drowns et al., 1991					
Butler & Winne, 1995					
Kluger & DeNisi, 1996					
Tunstall & Gipps, 1996					
Mason & Bruning, 2001					
Narciss, 2004-2008					
Nicol & McFarlane-Dick, 2006					
Hattie & Timperley, 2007					
Evans, 2013					
Lipnevich et al., 2016					
Carless & Boud, 2018					

Note: darker colors indicate more emphasis in that thematic area as concluded from the authors' content analysis.
Descriptive: area addressed by models including definitions, typologies or discussing relations and links among variables included in the model.
Internal processing: area addressed by models describing how students process feedback from a cognitive, emotional or motivation perspective.
Interactional: area addressed by models that describe how different sources or agents interact during the presentation and reception of feedback.
Pedagogical: area addressed by models that explore how to implement and present feedback so that it has a learning impact.
Student characteristics: area addressed by models that analyze how the individual characteristics of the learner affect the reception and processing of feedback.

learner should be the final creator of feedback.

Another model in this thematic area is that of Mason and Bruning (2001). It is the first that explored the role of learners' individual differences, even though it differentiated between limited characteristics (low vs. high achievers). It also presented complex relations that can happen in real-life settings. As summarized by Shute (2008), Mason and Bruning examined research combining: "type of feedback and level of elaboration in relation to student achievement level, task complexity, timing of feedback, and prior knowledge" (p. 174). Additionally, Mason and Bruning presented a very specific decision tree of the best types of feedback/level of elaboration that could be delivered, while taking into account the four variables of students' achievement, task level, timing of feedback, and prior knowledge. This can easily be used as a guide to taking pedagogical decisions and creating specific forms of feedback.

The next model in this thematic area is that of Nicol and Macfarlane-Dick's (2006). The authors' impact on formative assessment has come from the clarity of their pedagogical recommendations, anchored in self-regulated learning. This publication established seven principles for "good feedback practice": (1) clarify what good performance is, (2) facilitate self-assessment, (3) deliver high quality feedback information, (4) encourage teacher and peer dialogue, (5) encourage positive motivation and self-esteem, (6) provide opportunities to close the gap, and (7) use feedback to improve teaching. Hence, it is very clear and applicable by educators. Their model builds up on some of Sadler's ideas and advances them by offering more specific pedagogical recommendations.

Hattie and Timperley's (2007) model is unique because it was derived as a result of conducting a meta-analysis and an excellent interpretation of the pedagogical and psychological literature on feedback. It is by far the most cited model (Lipnevich & Panadero, 2021). Its impact on both theory and practice of feedback is quite substantial. From a pedagogical perspective, the model is strong because it is simple, makes intuitive sense, and it draws upon solid empirical evidence. The model has five important pedagogical characteristics. First, it further emphasizes Sadler's ideas and suggests that reducing the gap between the goal and the current level of performance is the purpose of feedback. Second, Hattie and Timperley proposed that there were several feedback agents and they all had responsibilities in closing the gap. Third, they suggested that feedback should answer three questions: (1) where am I going? (the goals) known as feed up, (2) how am I going? known as feed back, and (3) where to next? known as feed forward. By providing feedback that answers these three questions teachers will be capable of giving far more powerful feedback leading to increased performance. Fourth, the authors also identified that the questions could work at four levels: task, process, self-regulation, and self-level, discussing direct implications of feedback presented at each of these levels. Finally, the whole model is in itself a pedagogical contribution that summarizes and presents empirical evidence into a parsimonious model.

Evans (2013) is another publication with a very strong pedagogical influence. Evans' review distilled crucial assessment principles to increase the impact of feedback. Evans summarized twelve pragmatic actions to enhance the effectiveness of feedback and presented a list of explicit recommendations that could aid in educators' implementation of more powerful peer feedback interventions. Throughout her review, Evans did an excellent work from a pedagogical standpoint, with her list of recommendations being clear, detailed, and easily applicable. However, there is a certain degree of disconnect between her depiction of the model where she presented a list of student and lecturer feedback mediators, and the actual review, with mediators not having been addressed in the text. Evans' contribution is without a doubt very important for the area of pedagogy, with assessment practices represented as a complicated landscape, which they unarguably are.

Carless and Boud presented a model that was a culmination and an integration of ideas ranging from evaluative judgment (Boud et al., 2018), sustainable feedback practices (Boud & Soler, 2016; Carless et al., 2011), to feedback loops and spirals (Carless, 2019). The model focused on building students' feedback literacy with the purpose of potentiating their uptake of feedback. Their model is simple with three interactive elements: students need to appreciate the feedback, to make judgments about feedback, and to manage their affect. Each of these elements is broken down into three specific actions (e.g., for making judgments "participate productively in peer feedback processes"). When the three components are active, students are more likely to take action and use feedback to improve their learning.

Finally, we identified three models that also addressed pedagogical aspects but placed a weaker emphasis on it. First, Tunstall and Gipps (1996) proposed a feedback typology along with specific pedagogical actions (e.g. positive non-verbal feedback, more specific praise) corresponding to their proposed feedback types. Second, Narciss (2008) mentioned the instructional context and how learning objectives and tasks preset the feedback process. Additionally, her empirical work is grounded in computer based interventions with clear pedagogical applications. Lastly, Lipnevich et al. (2016) model explicated how various types of feedback delivered by an external source would influence how students process such feedback.

Within this thematic area, the six primarily pedagogical models can be further classified by the level of generality of their recommendations and implications (Fig. 4). Representing this area as a continuum, on the one end we locate the more general models, mostly coming from higher education pedagogical scholars Sadler (1989) and Carless and Boud (2018). Both of these models discussed foundational pedagogical principles while mentioning some general assessment practices (e.g. peer assessment). In the center of the continuum are Hattie and Timperley (2007) who suggested that instructors should ask three key questions when delivering feedback at four levels. This model is more specific than previous ones because Hattie and Timperley provided a clear set of questions for educators to implement. Moving along the specificity continuum, we locate Nicol and Macfarlane-Dick (2006) who described seven principles on how to deliver feedback that influenced self-regulated learning, followed by Evans (2013) with different suggestions on how to enhance feedback impact. Finally, at the end of the continuum we locate Mason and Bruning (2001) who provided a list of very detailed pedagogical recommendations.

In our opinion, each of the three groups along this continuum serves a specific function. The more general models (Sadler and Carless & Boud) provide descriptions of philosophical foundations for feedback. The intermediate models (Hattie & Timperley, Nicol & McFarlane-Dick and Evans) have a large potential to influence instruction, providing enough specificity but not constraining educators' choices; and, finally, the most specific model (Mason and Bruning) can be used in situations with high control of variables such

as students' prior knowledge.

It is clear that students are at the very center of the feedback process. Hence, focusing on their use and receptivity of information may be the right direction for the field. However, as with anything in life and research alike, researchers must be mindful of where to invest their energy. So, Van der Kleij and Lipnevich (2020) provided a scoping overview of the field of student perceptions of feedback and concluded that there were hardly any studies examining links of student perceptions to meaningful outcomes, and that the findings were largely repetitive. The authors also pointed to a number of methodological shortcomings with the studies that put available conclusions into question. Their review shows that focusing on how students experience feedback and what their perceptions are may be insufficient. We need systematic examinations that provide evidence of students' actual cognitive, behavioral, and affective responses to feedback from "objective" measurement such as eye tracking, automatic emotion recognition, physiological responses, think aloud protocols, or artefact analyses, among others.

4.5. Students' characteristics

The fifth thematic area, students' characteristics, is unique because it significantly influences the four others. This area refers to the effects of individual characteristics in the way feedback is received and processed by the learners. Six models include direct reference to individual characteristics, ranging from two models with less emphasis to four others, in which individual characteristics are central and specific.

Starting with the models with less emphasis on personality characteristics, Kluger and DeNisi (1996) incorporated the influence of individual differences as a factor in their feedback intervention theory. They stated that personality moderated students' reactions and processing of feedback. Further, Mason and Bruning (2001) mentioned that student achievement level was to be considered when taking decisions on what type of feedback to deliver in computer-based instruction.

Regarding the models with more emphasis, Butler and Winne (1995) listed a number of cognitive factors (e.g., motivational factors and orientations, domain knowledge) that vary among learners and discussed ways in which these conditions influenced the regulatory actions and processing of feedback. Narciss (2004–2008) integrated three categories of individual characteristics that mattered for the uptake of feedback: (1) learning goals, (2) prior knowledge and meta-cognitive skills, and (3) motivation. Evans (2013) provided a very comprehensive list of "student and lecturer feedback mediators" such as personality, gender, culture, etc. Lastly, Lipnevich et al. (2016) also integrated students' characteristics such as ability, prior success, general receptivity to feedback and expectation for feedback, and described how these characteristics affected students' responses to feedback, and were, in turn, influenced by student performance. Finally, we consider this thematic area of utmost relevance such that it becomes the central element in our model, as we will present in section 5.

4.6. Summary

In conclusion, as it can be seen in Table 2, descriptive, internal processing, and pedagogical models have been most widely investigated, whereas the interactional area had received significantly less attention. This could be due to the fact that feedback literature has focused more on the role of the teacher in the process of feedback delivery and the type of the feedback message, and not so much on the uptake of feedback or the features of other feedback agents (e.g. peer and self-assessment). It is also important to acknowledge that pedagogical models cover some interactional aspects but they mostly focus on how to deliver effective feedback or what a student's role in the process is.

An additional way of thinking about the fourteen models is to consider their contextual specificity. The definitional models of Ramaprasad (1983) and Sadler (1989) are very general and context independent, as are models of Hattie and Timperley (2007) (pedagogical) and Lipnevich et al. (2016) (interactional). Conversely, Narciss (2013) (interactional) has focused specifically on the delivery of feedback in the computer-assisted environment, and Tunstall and Gipps (1996) (descriptive) explored feedback delivered in the primary school setting. We do not wish to impose our categorization upon the reader but we do hope that it will serve as a useful organizational framework. The utility of such framework is in choosing the right model to frame or guide thinking, studies, or

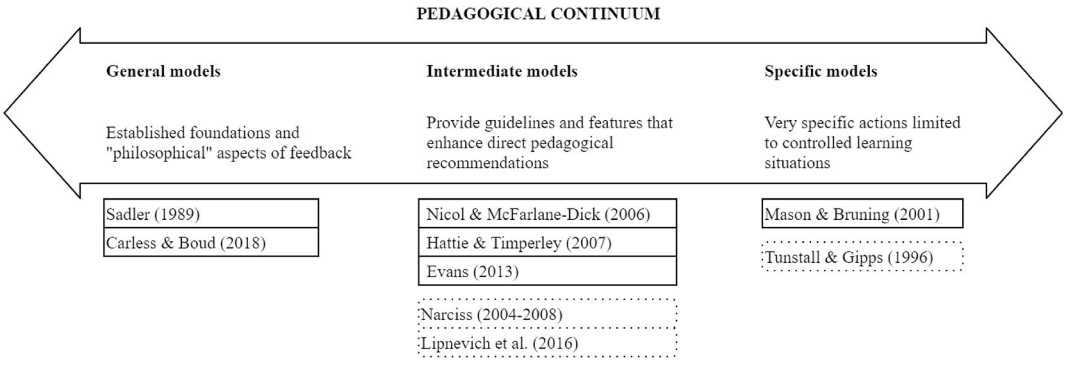


Fig. 4. Pedagogical continuum.

interventions.

5. An Integrative Model of Feedback Elements: the MISCA Model (Message Implementation Student Context Agents)

In the first part of this review (Lipnevich & Panadero, 2021) we described the fourteen selected models, integrated their definitions of feedback and analyzed the empirical evidence behind each model. In the current paper, up to this point, we have performed two main actions. Firstly, we compared nine typologies proposing an integrative one that combined elements from previous ones. In this new typology we specified the *content* and *function* categories, developed the *presentation* category, and proposed the inclusion of the *source* of feedback as a new category to emphasize that feedback can also come from various agents (i.e. task, self, and peer). Secondly, we created a categorization of models into five thematic areas and discussed models within each category. Next, we take a final step and propose a meta-model that describes and integrates both the typologies and the models. We called this model MISCA (Message, Implementation, Student, Context, Agents), with each letter representing one of the elements and situating the student in the center of the model.

By comparing typologies and thematic areas we were able to identify four categories for the typologies –i.e. content, function, presentation, and source- and four areas explored by the feedback models –i.e. descriptive, internal processing, interactional, and pedagogical-plus an additional overlapping area of student characteristics. We suggest that these areas and categories can be arranged around four central *elements* and one overlapping element that are crucial for feedback to be successfully implemented (see Fig. 5). We hope our model can capture the current zeitgeist of what is known and where we need to go next in terms of making students central in our feedback practices and research. Also, the model depicts the complexity of the feedback process: the conditions that affect the success of feedback implementation and use are multiple and account for a wide variability of results.

5.1. Student characteristics: the central element

Our model emphasizes the centrality of the student in the feedback process. For decades, feedback literature has focused on the

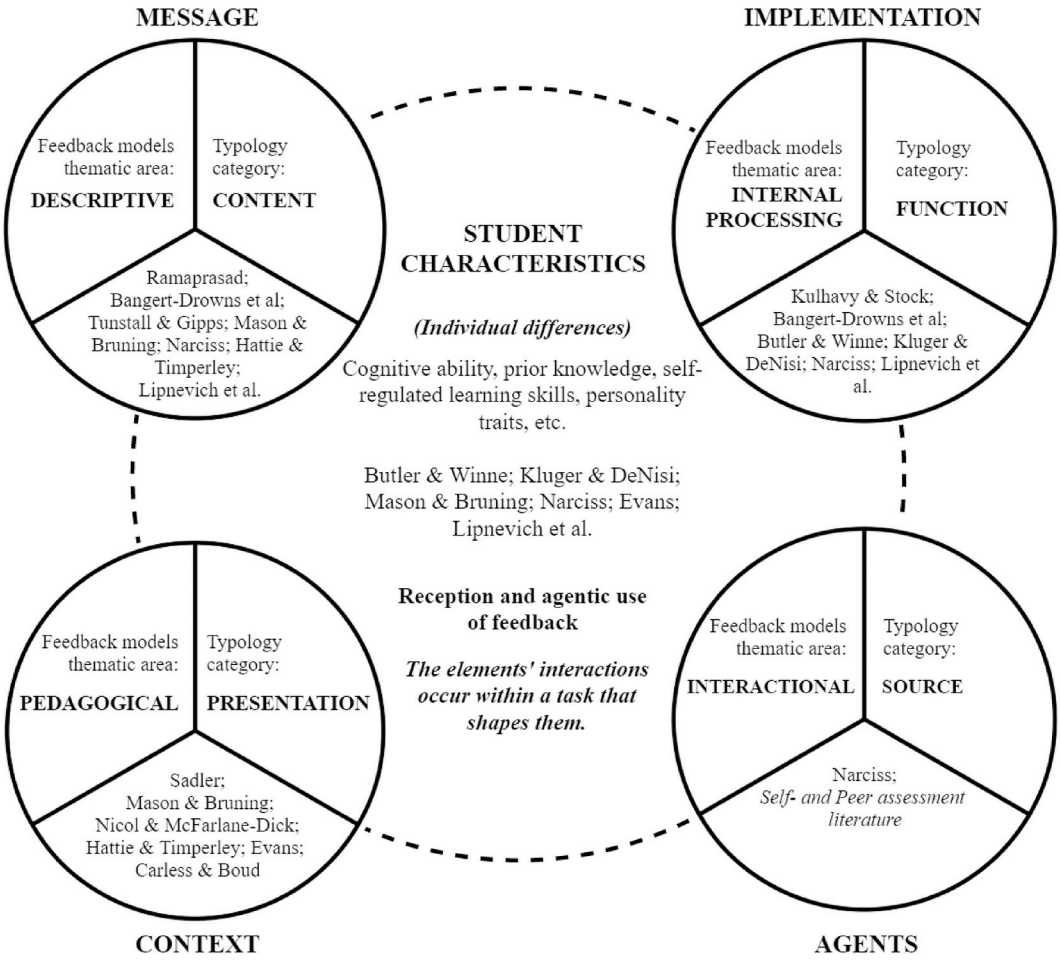


Fig. 5. The MISCA model (Message Implementation Student Context Agents).

feedback and its effects on learning. Research has told us that feedback interventions, even when well planned, can still be unsuccessful: Kluger and DeNisi (1996) found that 38% of the studies had produced negative effects. One of the reasons is that research was missing the importance of students' individual differences and also factors that influence in the actual use of the feedback by the students. In the last years there has been a shift towards focusing on the agentic use, uptake of feedback, feedback receptivity, etc. Therefore, we need a model that clearly situates the learner where it belongs in the feedback process: in the very center of it.

It is critical to be aware that learners process feedback differently as a result of their individual characteristics. These can range from motivational beliefs, prior knowledge, gender, cultural differences, self-efficacy, personality traits, among others (Lipnevich et al., 2016). Hence, the element of student characteristics is unique in that it influences and moderates the rest of interactions among all other elements.

By focusing on students' characteristics, teachers can get better at tailoring feedback to specific educational needs. However, researchers need to explore in details the role that individual differences play in the reception and uptake of feedback, a direction that the field has started to follow (Aben et al., 2019; Lechermeier & Fassnacht, 2018; Lipnevich et al., 2016; Narciss et al., 2014). We then can provide feedback that is better aligned with learners' needs and that facilitate their effective use of feedback; because in the end what matters is what the learner does with the feedback.

5.2. Feedback message: the information that needs to activate agentic use

The feedback message element subsumes the *descriptive* category of the feedback models and the *content* category of the typologies. Traditional feedback research has focused on the feedback message as the central component of any feedback process (e.g. Kluger & DeNisi, 1996), although some scholars claimed that this element could not be considered feedback unless the student put it into action (Boud & Molloy, 2013). We want to stress that, without a doubt, the feedback message is a crucial component of the feedback receptivity process because it is the information that learners receive about their performance.

As we discussed in the typologies section, the feedback message can take different forms and there are numerous subcategories that had been previously described by researchers (e.g., verification, topic contingent, bug related). However, we would concur with Hattie and Timperley's proposal that the best content for feedback should answer three key questions if the instructors want the feedback message to reach its full potential: (1) Where is the student going? (goals, feed up); (2) How is the student going? (current state, feed back); and (3) Where to next? (closing the gap, feed forward). It does not matter how many subcategories researchers and instructors implement in the feedback message, if the information the student receives answers those three questions, it has a great potential to increase students' performance and learning. By focusing on the essence of feedback information, researchers have provided clear guidelines for teachers but also for researchers to explore in their empirical studies.

To summarize this section, we would like to emphasize that despite the current shift in focus toward students' agentic use of feedback, the information contained in the feedback message should be of quality. We understand quality as the information tailored to students' characteristics that is clear, accessible, and that can be used by a learner. Without this foundation, feedback shall not have effects at all even if delivered in the most formative setting from the most well-meaning instructor.

5.3. Implementation: understanding the instructional and learning purposes

This is a fundamental element focusing on the purpose of feedback and the processes it triggers in the learner. It is crucial to keep in mind that feedback is ultimately about improving the learner, not just the task. The implementation element combines the *function* category of the typologies and the *internal processing* category of the feedback models. It covers the instructional and learning *purpose* of the feedback process. Teachers can achieve better learning results if they are aware of the function their feedback serves: just to clarify an incorrect final mathematical result, to provide information about the lack of planning, etc. And they also should be aware of the internal processing students go through while decoding, analyzing, and implementing the feedback. This knowledge includes how students react cognitively, emotionally and motivationally to feedback but also the regulatory strategies they activate.

Two conclusions can be extracted from this integration. First, the central purpose of any feedback should be to increase students' performance and learning (Black & Wiliam, 1998; Sadler, 2009). As we proposed in Fig. 3, there are varying degrees of emphasis on how central the feedback message is in the learning process, from feedback-centered models –i.e. Kluger & DeNisi, 1996, Kulhavy & Stock, 1989- to student-centered models–e.g. Bangert-Drowns et al., 1991, Butler & Winne, 1995. Regardless of the emphasis, these models explored how feedback influenced students' learning and proposed pathways to increase the likelihood of such influences to occur. Second, feedback is not only about influencing cognitive processes but also about self-regulation and affective processes.

Importantly, and as pointed out by others (e.g., Bangert-Drowns et al., 1991; Kluger and DeNisi, 1996; Narciss, 2008), the processing of feedback is not only crucial but different than the presentation of feedback. For that reason, our model separates the implementation of feedback that comprises the function and internal processing, from the instructional context, composed of presentation and pedagogical aspects, with the latter presented next.

5.4. Instructional context: ensuring the right conditions for a successful uptake

A well-designed message with an ambitious instructional implementation will not have the right effect in a non-optimal learning context. It seems obvious, but it is often forgotten that the best feedback message that could lead to deep learning will not have an effect in a poor instructional context (Alonso-Tapia & Fernández-Heredia, 2008; Educational Endowment Foundation, 2021; Hattie & Clarke, 2019). One of the classical examples of poor feedback implementation is offering feedback at the end of a course when students no

longer have the opportunity to implement it. For that reason, the need for the *context* element: the pedagogical approach to feedback combined with the way it is presented –e.g. timing, delivery mode-is the key to success. Because feedback cannot be disentangled from the learning context and instructional design.

There are three key aspects that we would like to emphasize. First, it is crucial to pay attention to how the teacher designs instruction, especially the aspects closely related to feedback, such as its presentation, opportunities to implement it, open dialogue, time allocated to feedback processing, etc. As we described earlier, there are pedagogical models that have clear guidelines on how feedback should be instructionally delivered to make an effect on student performance and learning (e.g. Mason & Bruning, 2001; Nicol & Macfarlane-Dick, 2006). However, the presentation category from typologies has been barely explored, thus it should be a fruitful avenue for future research.

Second, teachers and researchers need to be mindful of the classroom climate. As research show us, differences in climate result in very different learning outcomes (Alonso-Tapia & Fernández-Heredia, 2008; Trzesniewski et al., 2021). Although the classroom climate might seem too broad of an influence, it greatly affects what happens around feedback too. In a negative climate, students might be terrified of the feedback they receive, or will be hesitant to implement feedback and, hence, fail both in terms of their grades and learning. Conversely, a positive learning climate will enhance dialogue, clarify learning goals, and students may strive to obtain feedback to improve and implement it. In sum, one of the more profound influences on how and why there is a variability in receiving, seeking, and using feedback is 'climate'.

And third, the context is shaped by the institutional level, educational system, and even disciplines. These three influence the way teachers design their instructional approaches, their assessment and, thus, also the feedback process (Henderson et al., 2019; Lipnevich et al., 2021). Without changes at the institutional level some of the improvements that need to occur for feedback to be successfully implemented might be impeded. This also affect the next element, agents. There might be constraints at the institutional or educational levels that might not allow students to participate in assessment through self and peer activities (e.g. Harris & Brown, 2013).

In conclusion, the instructional context is a key element in the successful application and uptake of feedback. Teachers should promote the most beneficial context for feedback to have an effect on student learning. Otherwise the best feedback message among the most brilliant students will vanish like tears lost in the rain.

5.5. Feedback agents: visualizing the potential of all the participants

The feedback agents element unifies the *interactional* category of the feedback models and the *source* category of the typologies. Educational feedback is generated in a context with at least three main active agents: the teacher, peers, and the learner, although technology or the task itself can serve as the source of feedback. These agents interact in creating different types of feedback messages, implementation, and instructional contexts. Researchers cannot fully understand the feedback process without considering these agents, their roles, and interactions. To further emphasize their importance we included the *source* of feedback as a category that needs further exploration.

The role of the teacher is clear for the field and, as argued earlier, feedback literature has predominantly assumed that feedback came from the teacher. Hence, a lot of research has been built around feedback delivered by a teacher. However, self- and peer feedback is no less important and deserves our attention. As discussed throughout, more attention should be given to the how students hear, interpret, and use feedback.

One important conclusion is that students, when trained and provided with tools such as rubrics, are capable of providing excellent feedback to themselves (Lipnevich et al., 2013) and their peers. Hence, within this element, students are viewed not just as receivers but also as creators of feedback. When implementing self- and peer assessment with formative purposes –i.e. beyond just guessing a grade-, students need to analyze, synthesize, and integrate information. Involving students in the creation of feedback is the ultimate step in the feedback process. Importantly, and as outlined earlier, researchers already know a significant deal about students' involvement in assessment via research into self and peer assessment. Therefore, the research community needs to bridge that knowledge with what is known from the teachers' feedback literature.

5.6. Interactions among the elements

The majority of the models discussed here focused on the specifics of one or two of the feedback elements, with just a few exceptions that covered more aspects (e.g. Lipnevich et al., 2016; Narciss, 2008). Our integrative model classifies and integrates the previous models into a coherent framework based on five elements giving a reference point to understand what the contributions of previous models are.

A crucial contribution of the MISCA model is the fact that it accounts for complex interactions among elements. The model emphasizes how these five elements are interrelated and how they need to be aligned to create a more effective learning environment, in which feedback can be used by learners to enhance their performance and learning. If one of the elements fails, the others are affected. We decided not to include the interactions in Fig. 5 as to keep it simpler for the reader. However, emphasizing interactions is critical, so we created a separate one (Fig. 6) that reflects these.

Fig. 6 presents interconnections among the elements that researchers and practitioners need to keep in mind. Importantly, we have not explicitly discussed the moderating effect of student characteristics as all of these interactions are influenced by characteristics of learners. Four of the interactions are presumed to be bidirectional with two others having a well-established unidirectional relation. Figs. 5 and 6 can be used for practical purposes. Teachers can visualize how different concrete actions (e.g. self and peer assessment) may influence the global feedback process. Researchers can use both figures to map out which of the elements and relationships they

are exploring and provide a more comprehensive picture of the feedback phenomenon.

5.7. Educational implications of the model

First and foremost, the implementation of feedback in the classroom is a complex enterprise as evidenced by the different elements outlined in the model. Teachers need to consider a large number of feedback variables: from the feedback message itself to students' characteristics trying to account for the complex cognitive, emotional, motivational, self-regulatory, and behavioral processes activated by feedback. Importantly, a deliberate preparation of the instructional context such as the type of task (Educational Endowment Foundation, 2021) or the classroom learning climate (Trzesniewski et al., 2021), are of key importance due to their role in the receptivity and enactment of feedback. Therefore, teachers need professional development courses that help them develop such knowledge and improve their instructional implementation of feedback.

In this sense, a way to use our model for teaching purposes is to establish it as the framework for the professional development courses. Using the model, the course could have five units, in correspondence with the five elements. The content of each unit could be the information on the typology category and the thematic area included in each element. Importantly, as we identified the original models in each element, those particular models could be presented to help teachers to understand their utility within each element.

Our model emphasizes the centrality of students in the feedback process. Feedback reaches its full potential when students use it. We already know a significant deal about how teachers can increase students' uptake of feedback (Jonsson & Panadero, 2018; Winstone et al., 2017), and there are even larger interventions aiming at student-centered feedback (Brooks et al., 2021). In the end, what we teachers do with the five elements is crucial, but it should all be directed to what really matters – that is, what students do with

Fig. 6. Interconnections among the MISCA feedback elements.

feedback.

6. Conclusion

For decades, feedback literature has been developing and proliferating. After all, feedback is a key variable in instruction and learning. Far from being a discovered land, feedback researchers are pushing towards new domains by reconceptualizing our understanding of it – from the more simplistic, teacher-driven, behavioral approaches of the very early days, to more complex scenarios where feedback should be not only actively received by the students but also created. Our field has been successful at creating models to explain many different aspects of feedback processes and effects and at collecting data about how feedback influences instruction and learning. However, there is still a long road ahead of us.

Our review outlines crossroads and paths that have been already explored, and shows areas that have not been researched enough. Our Integrative Model of Feedback Elements named MISCA creates an ample framework from which to conduct feedback research and interventions as it integrates the previous models and proposes ways to move our field forward. We believe the community needs to find a balance between having to "reinvent the wheel" in each new model and remembering that researchers are and should "stand on the shoulders of giants". This review, in its two parts, has shown that, in many aspects, the new improvements come from adding to what is already known while carefully specifying what has previously been missing. Our new model presents the complexity of the feedback process and also communicates that it is possible to consider multiple elements, in tandem. Plenty of teachers are already delivering successful feedback and we hope the MISCA model will help even more educators to accomplish this desirable instructional goal.

Our hope is that our Integrative Model of Feedback Elements, also known as MISCA (Message, Implementation, Student, Context, and Agents) will contribute to our understanding of the three fundamental questions for the field: Where are we now? Where are we going? And – jointly – the feedback researchers will work on figuring out How do we get there?

Author statement

Both authors have equally participated in all research processes.

Funding

Review funded by: (1) UAM-SANTANDER collaboration with the USA (Reference: 2017/EEUU/12) and (2) Generación del conocimiento 2020 from the Spanish Ministerio de Ciencia, Innovación y Universidades (Reference: PID2019-108982GB-I00).

Acknowledgement

To our feedback experts: Rola Ajjawi, Heidi Andrade, David Boud, Susan Brookhart, Gavin Brown, David Carless, Roy Clariana, Siv Gamlem, Mark Gan, Steve Graham, John Hattie, Avraham Kluger, Angela Lui, Jackie Murray, Susanne Narciss, David Nicol, Ron Pat-El, Reinhard Pekrun, Elizabeth Peterson, Joan Sargeant, Mien Segers, Valerie Shute, Jan-Willem Strijbos, Jeroen Van Merriënboer, Dylan Wiliam, Phil Winne, and Naomi Winstone. Thanks to our interviewees: David Boud, David Carless, Avraham Kluger, Susanne Narciss, Arkalgud Ramaprasad, Royce Sadler and Phil Winne. Thanks to the author who were not available for an interview but with whom we exchanged emails: Robert Bangert-Drowns, Carol Evans, Caroline Gipps, John Hattie and David Nicol. Special thanks to Dylan Wiliam for providing comments on an earlier version of the manuscript. Thanks to Javier Fernández for the figures design software.

Appendix A

Typologies of feedback from the selected publications.

Publication	Typology/taxonomy
Ramaprasad (1983)	Two types: Positive: if the action triggered by feedback widens the gap between the reference and the actual levels of the system parameter Negative: if the action reduces the gap between the two levels *Note from authors*: in the educational psychology perspective, positive and negative usually refers to the valence of feedback in terms of its content, expected outcome (reinforcement by Skinner), or emotions triggered (+for emotions as happy, - for sadness)
Kulhavy and Stock (1989)	Two components: Verification: dichotomous judgment that the response is right or wrong Elaboration: consists of all substantive information contained in the feedback message. Three categories: - Type: task-specific, instruction-based and extra-instructional elaboration - Form: changes in stimulus structure between instruction and the feedback message - Load: refers to the total amount of information contained in the feedback message

(*continued on next page*)

(*continued*)

Publication	Typology/taxonomy
Bangert-Drowns et al. (1991)	Feedback differs according to: Intentionality: - Formal/Intentional: typifies instructional settings (especially direct or expository instruction). It can be further categorized based on delivery method: interpersonal action (e.g. teachers to learners), through intervening agents (e.g. computers). - Informal: it is not instructionally planned but it can have educational effects (e.g. unstructured cooperative peer interactions) Target: - Affective: such as influencing motivation or self-attributions - Self-regulated learning: by cuing self-monitoring and other metacognitive processes - Correction: to correct the retrieved specific information Content: - Load: total amount of information given - Form: structural similarity between information as presented in feedback compared to the instructional presentation - Type of information: whether feedback restated information from the original task, referred to information given elsewhere in the instruction, or actually provided new information
Butler and Winne (1995)	Two types of feedback: Outcome feedback/knowledge of results: binary information describing whether or not results are correct. Cognitive feedback: provide students with information that links cues and achievement. Three types: - Task validity feedback: describes an observer's perception of the relation between a task's cue and achievement - Cognitive validity feedback: describes a learner's perceptions about the relationship between a cue and achievement - Functional validity feedback: in general, describes the relation between the learner's estimates of achievement and his or her actual performance
Kluger and DeNisi (1996)	Feedback Interventions are differentiated based on the focus of attention they draw toward various aspects of a task. The three-level hierarchy includes: 1. task learning processes that focus one's attention on details of the focal task (i.e., task at hand); 2. task motivation processes that involve the actual task; 3. meta-tasks (including self-level feedback) that turn attention to the self, affect, and framing effects. Most effective interventions are at the task motivation level.
Tunstall and Gipps (1996)	Feedback of socialization: relates to the values, attitudes and classroom procedures which form the basis of infant teachers' practice. Its role is socialization/management. Feedback of assessment: not explicitly defined in the paper. It can be of four types each subdivided creating a dualistic continuum structure: A) Rewarding vs. Punishing. Role: classroom/individual management B) Approving vs. Disapproving. Role: Performance orientation C) Specifying attainment vs. Specifying improvement. Role: Mastery orientation D) Constructing achievement vs. Constructing the way forward. Role: Learning orientation
Mason and Bruning (2001)	8 categories: (1) No Feedback: provides learners with the performance score with no reference to individual test items. This minimal level of feedback contains neither verification nor elaboration, but simply states the learners' number or proportion of correct responses. (2) Knowledge of response: tells learners whether their answers are correct or incorrect. (3) Answer until correct: provides verification but no elaboration, and requires the learner to remain on the same test item until the correct answer is selected (4) Knowledge of correct response: provides individual item verification and supplies learners with the correct answer (5) Topic contingent: provides item verification and general elaborative information concerning the target topic (6) Response contingent: In addition to providing knowledge of the correct response, it gives response specific feedback that explains why the incorrect answer was wrong and why the correct answer is correct (7) Bug related: relies on "bug libraries" or rule sets to identify and correct a variety of common student errors. While bug-related feedback does not provide learners with the correct response, it can assist them in identifying procedural errors so that self-correction is possible (8) Attribute isolation: provides item verification and highlights the central attributes of the target concept. Attribute-isolation feedback focuses learners on key components of the concept to improve general understanding of the phenomenon
Narciss (2004, 2008)	It is a **triple typology**. In terms of its **function**, there are three types: - Cognitive: can be informative, completion, corrective, differentiation and restructuring. - Metacognitive: informative, specification, corrective, and guiding. - Motivational: incentive, task facilitation, self-efficacy enhancing and reattribution. In terms of **content**, there are eight types: - Knowledge of performance: 15 or 20 correct - Knowledge of result/response: correct/incorrect - Knowledge of the correct results: description of the correct response *Elaborated concepts* - Knowledge about task constraints: rules, requirements, etc. - Knowledge about concepts: information on conceptual knowledge - Knowledge about mistakes: number, location, type and source of errors - Knowledge about how to proceed: know-how or procedural information - Knowledge about metacognition: on strategies and guiding questions In terms of **presentation**, these are: - Immediate vs. delayed feedback timing: self-explanatory label - Single vs. multiple try (simultaneous vs. sequential): it refers to the number of performance tries before giving feedback. Additionally, multiple try feedback can be presented simultaneously (i.e. all information in one step) or sequentially (cumulatively or step by step)

(*continued on next page*)

(*continued*)

Publication	Typology/taxonomy
	- Adaptive vs. nonadaptative: whether the feedback is tailored to the individual and task characteristics - Unimodal vs. multimodal: coming in one form (e.g. written text) or using several forms (e.g. written and oral)
Hattie and Timperley (2007)	It is a **dual typology**. In terms of its **function**, feedback should answer three questions: where am I going? = feed up; how am I going? = feed back; and where to next? = feed forward Additionally, the **content** of the feedback can be of four types: - Task: specific comments relating to the task itself - Process: comments on processes needed to perform the task - Self-regulation: higher-order comments relating to self-monitoring and regulation of actions and affect - Self: personal comments

Note from the authors: we have kept in the table the original terms introduced by the authors. This means that we have not used our classification of typology, category, and subcategories. For that reason the table might appear inconsistent in the use of terms (e.g. types, components) but we wanted to have the most accurate depiction of the original source.

Appendix B

Our classification of the feedback typologies from the selected publications.

Publication	Categories	Subcategories
Ramaprasad (1983)	Function	Two types: Positive and Negative
Kulhavy and Stock (1989)	Content	Verification Elaboration:
	Content	- Type
	Function/presentation	- Form (*interpretation based on Bangert-Drowns et al., 1991 which is a more precise definition*)
	Content	- Load
Bangert-Drowns et al. (1991)	Presentation	Intentionality: - Formal/Intentional - Informal
	Function	Target: - Affective - Self-regulated learning - Correction
	Content **Form is also presentation*	Content: - Load - Form - Type of information
Butler and Winne (1995)	Content	Outcome feedback/knowledge of results Cognitive feedback: - Task validity feedback - Cognitive validity feedback - Functional validity feedback
Kluger and DeNisi (1996)	Function	- Task learning processes - Task motivation processes - Meta-tasks (including self-level feedback)
Tunstall and Gipps (1996)	Function	Feedback of socialization Feedback of assessment: - Rewarding vs. Punishing - Approving vs. Disapproving - Specifying attainment vs. Specifying improvement - Constructing achievement vs. Constructing the way forward
Mason and Bruning (2001)	Content	- No Feedback - Knowledge of response - Answer until correct - Knowledge of correct response - Topic contingent - Response contingent - Bug related - Attribute isolation
Narciss (2004, 2008)	Function	- Cognitive - Metacognitive - Motivational
	Content	- Knowledge of performance - Knowledge of result/response - Knowledge of the correct results Elaborated concepts:

(*continued on next page*)

(*continued*)

Publication	Categories	Subcategories
		- Knowledge about task constraints
		- Knowledge about concepts
		- Knowledge about mistakes
		- Knowledge about how to proceed
		- Knowledge about metacognition
	Presentation	- Immediate vs. delayed feedback timing
		- Single vs. multiple try (simultaneous vs. sequential)
		- Adaptive vs. nonadaptative
		- Unimodal vs. multimodal
Hattie and Timperley (2007)	Function	- Where am I going? = feed up - How am I going? = feed back
		- Where to next? = feed forward
	Content (also function)	- Task
		- Process
		- Self-regulation
		- Self

References

Aben, J. E. J., Dingyloudi, F., Timmermans, A. C., & Strijbos, J. W. (2019). Embracing errors for learning: Intrapersonal and interpersonal factors in feedback provision and processing in dyadic interactions. In M. Henderson, R. Ajjawi, D. Boud, & E. Molloy (Eds.), *The impact of feedback in higher education: Improving assessment outcomes for learners* (pp. 107–125). Springer International Publishing. https://doi.org/10.1007/978-3-030-25112-3_7.

Allal, L. (2020). Assessment and the co-regulation of learning in the classroom. In *Assessment in Education: Principles, Policy & Practice* (pp. 1–18). https://doi.org/10.1080/0969594X.2019.1609411

Alonso-Tapia, J., & Fernández-Heredia, B. (2008). Development and initial validation of the classroom motivational climate questionnaire (CMCQ). *Psicothema, 20*, 883–889.

Andrade, H. (2018). Feedback in the context of self-assessment. In A. A. Lipnevich, & J. K. Smith (Eds.), *The Cambridge handbook of instructional feedback* (pp. 376–408). Cambridge University Press.

Athota, V. S., & Malik, A. (2018). 360-Degree feedback at the workplace: A transformative learning perspective. In *The Cambridge handbook of instructional feedback* (pp. 313–332). Cambridge University Press.

Bangert-Drowns, R. L., Kulik, C. L. C., Kulik, J. A., & Morgan, M. (1991). The instructional effect of feedback in test-like events. *Review of Educational Research, 61*, 213–238.

Bimba, A. T., Idris, N., Al-Hunaiyyan, A., Mahmud, R. B., & Shuib, N. L. B. M. (2017). Adaptive feedback in computer-based learning environments: A review. *Adaptive Behavior, 25*(5), 217–234. https://doi.org/10.1177/1059712317727590

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, 5*(1), 7–73. https://doi.org/10.1080/0969595980050102

Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability, 21*(1), 5.

Black, P., & Wiliam, D. (2018). *Classroom assessment and pedagogy. Assessment in Education: Principles, Policy & Practice* (pp. 1–25). https://doi.org/10.1080/0969594X.2018.1441807

Block, J. (1995). A contrarian view of the five-factor approach to personality description. *Psychological Bulletin, 117*, 187–215.

Boud, D. (1995). *Enhancing learning through self-assessment*. RoutledgeFalmer.

Boud, D., Ajjawi, R., Dawson, P., & Tai, J. (2018). *Developing evaluative judgement in higher education: Assessment for knowing and producing quality work*. Routledge.

Boud, D., & Dawson, P. (2021). What feedback literate teachers do: An empirically-derived competency framework. *Assessment & Evaluation in Higher Education*, 1–14. https://doi.org/10.1080/02602938.2021.1910928

Boud, D., & Falchikov, N. (2007). Developing assessment for informing judgement. In D. Boud, & N. Falchikov (Eds.), *Rethinking assessment for higher education: Learning for the longer term* (pp. 181–197). Routledge.

Boud, D., & Molloy, E. (2013). Rethinking models of feedback for learning: The challenge of design. *Assessment & Evaluation in Higher Education, 38*(6), 698–712. https://doi.org/10.1080/02602938.2012.691462

Boud, D., & Soler, R. (2016). Sustainable assessment revisited. *Assessment & Evaluation in Higher Education, 41*(3), 400–413. https://doi.org/10.1080/02602938.2015.1018133

Broadbent, J., Panadero, E., & Boud, D. (2018). Implementing summative assessment with a formative flavour: A case study in a large class. *Assessment & Evaluation in Higher Education, 43*(2), 307–322. https://doi.org/10.1080/02602938.2017.1343455

Brookhart, S. M. (2017). In *How to give effective feedback to your students* (2nd ed. ed.). Alexandria, Virginia USA: ASCD.

Brookhart, S. M., Andolina, M., Zuza, M., & Furman, R. (2004). Minute math: An action research study of student self-assessment. *Educational Studies in Mathematics, 57*(2), 213–227.

Brooks, C., Burton, R., van der Kleij, F., Ablaza, C., Carroll, A., Hattie, J., & Neill, S. (2021). Teachers activating learners: The effects of a student-centred feedback approach on writing achievement. *Teaching and Teacher Education, 105*, 103387. https://doi.org/10.1016/j.tate.2021.103387

Brown, G. T. L. (2018). *Assessment of student achievement*. New York: Routledge.

Brown, G. T. L., & Harris, L. R. (2013). Student self-assessment. In J. McMillan (Ed.), *The SAGE handbook of research on classroom assessment* (pp. 367–393). Thousand Oaks, CA: SAGE.

Brown, G. T. L., & Harris, L. R. (2014). The future of self-assessment in classroom practice: Reframing self-assessment as a core competency. *Frontline Learning Research, 3*, 22–30. https://doi.org/10.14786/flr.v2i1.24, 2014.

Brummelman, E., & Sedikides, C. (2020). Raising children with high self-esteem (but not Narcissism). *Child Dev Perspect, 14*, 83–89. https://doi.org/10.1111/cdep.12362

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research, 65*(3), 245–281.

Carless, D. (2019). Feedback loops and the longer-term: Towards feedback spirals. *Assessment & Evaluation in Higher Education, 44*(5), 705–714. https://doi.org/10.1080/02602938.2018.1531108

Carless, D., & Boud, D. (2018). The development of student feedback literacy: Enabling uptake of feedback. *Assessment & Evaluation in Higher Education, 43*(8), 1315–1325.

Carless, D., Salter, D., Yang, M., & Lam, J. (2011). Developing sustainable feedback practices. *Studies in Higher Education, 36*(4), 395–407.

Carless, D., & Winstone, N. E. (2020). Teacher feedback literacy and its interplay with student feedback literacy. *Teaching in Higher Education*, 1–14. https://doi.org/10.1080/13562517.2020.1782372

Cho, K., & MacArthur, C. A. (2010). Student revision with peer and expert reviewing. *Learning and Instruction, 20*(4), 328–338. https://doi.org/10.1016/j.learninstruc.2009.08.006

Clariana, R. B. (1999). Differential memory effects for immediate and delayed feedback: A delta rule explanation of feedback timing effects. In *Paper presentation at the association for educational communications and technology annual convention*. Houston, TX, 10/02/1999-14/02/1999.

DeNisi, A. S., & Kluger, A. N. (2000). Feedback Effectiveness: Can 360-Degree Appraisals Be Improved? *The Academy of Management Executive (1993-2005), 14*(1), 129–139. Retrieved from http://www.jstor.org/stable/4165614.

Dochy, F., Segers, M., & Sluijsmans, D. (1999). The use of self-, peer- and co-assessment in higher education. A review. *Studies in Higher Education, 24*(3), 331–350. https://doi.org/10.1080/03075079912331379935

Double, K. S., McGrane, J. A., & Hopfenbeck, T. N. (2020, December 10). The impact of peer assessment on academic performance: A meta-analysis of control group studies [journal article]. *Educational Psychology Review, 32*, 481–509. https://doi.org/10.1007/s10648-019-09510-3

Educational Endowment Foundation. (2018). Teaching & learning toolkit. Retrieved from https://educationendowmentfoundation.org.uk/public/files/Toolkit/complete/EEF-Teaching-Learning-Toolkit-October-2018.pdf.

Educational Endowment Foundation. (2021). *Teacher feedback to improve pupil learning*. Retrieved from https://educationendowmentfoundation.org.uk/education-evidence/guidance-reports/feedback.

Evans, C. (2013). Making sense of assessment feedback in higher education. *Review of Educational Research, 83*(1), 70–120.

Facteau, C. L., Facteau, J. D., Schoel, L. C., Russell, J. E. A., & Poteet, M. L. (1998). Reactions of leaders to 360-degree feedback from subordinates and peers. *The Leadership Quarterly, 9*(4), 427–448. https://doi.org/10.1016/S1048-9843(98)90010-8

Falchikov, N., & Goldfinch, J. (2000). Student peer assessment in higher education: A meta-analysis comparing peer and teacher marks. *Review of Educational Research, 70*(3), 287–322.

Fyfe, E., de Leeuw, J., Carvalho, P., Goldstone, R., & Motz, B. (2019). ManyClasses 1: Assessing the generalizable effect of immediate versus delayed feedback across many college classes. *Psycharxiv*. https://doi.org/10.1177/25152459211027575

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction*. Longman Publishing.

Gennip, N., Segers, M., & Tillema, H. H. (2009). Peer assessment for learning from a social perspective: The influence of interpersonal variables and structural features. *Educational Research Review, 4*(1), 41–54. https://doi.org/10.1016/j.edurev.2008.11.002

Harris, L. R., & Brown, G. T. L. (2013). Opportunities and obstacles to consider when using peer- and self-assessment to improve student learning: Case studies into teachers' implementation. *Teaching and Teacher Education, 36*, 101–111. https://doi.org/10.1016/j.tate.2013.07.008

Harris, L. R., Brown, G. T. L., & Harnett, J. A. (2014). Understanding classroom feedback practices: A study of New Zealand student experiences, perceptions, and emotional responses. *Educational Assessment, Evaluation and Accountability, 26*(2), 107–133. https://doi.org/10.1007/s11092-013-9187-5

Harris, L. R., Brown, G. T., & Harnett, J. A. (2015). Analysis of New Zealand primary and secondary student peer-and self-assessment comments: Applying Hattie and Timperley's feedback model. *Assessment in Education: Principles, Policy & Practice, 22*(2), 265–281.

Hattie, J. A. (2009). *Visible learning. A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.

Hattie, J., & Clarke, S. (2019). *Visible learning: Feedback*. New York: Routledge.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112.

Henderson, M., Phillips, M., Ryan, T., Boud, D., Dawson, P., Molloy, E., & Mahoney, P. (2019). Conditions that enable effective feedback. *Higher Education Research and Development, 38*(7), 1401–1416. https://doi.org/10.1080/07294360.2019.1657807, 2019/11/10.

Iglesias Pérez, M. C., Vidal-Puga, J., & Pino Juste, M. R. (2020). The role of self and peer assessment in Higher Education. *Studies in Higher Education*, 1–10. https://doi.org/10.1080/03075079.2020.1783526

Irving, S. E., Harris, L. R., & Peterson, E. R. (2011). 'One assessment doesn't serve all the purposes' or does it? New Zealand teachers describe assessment and feedback. *Asia Pacific Education Review, 12*(3), 413–426. https://doi.org/10.1007/s12564-011-9145-1

Janelli, M., & Lipnevich, A. A. (2020). The peril and promise of pre-tests in informal Massive Open Online Courses. In D. Glick, A. Cohen, & C. Chang (Eds.), *Early Warning Systems and Targeted Interventions for Student Success in Online Courses*. IGI Global.

Janelli, M., & Lipnevich, A. A. (2021). Effects of pre-tests and feedback on performance outcomes and persistence in Massive Open Online Courses. *Computers & Education, 161*, 104076. https://doi.org/10.1016/j.compedu.2020.104076

Jonsson, A. (2013). Facilitating productive use of feedback in higher education. *Active Learning in Higher Education, 14*(1), 63–76.

Jonsson, A., & Panadero, E. (2018). Facilitating students' active engagement with feedback. In A. A. Lipnevich, & J. K. Smith (Eds.), *The Cambridge handbook of instructional feedback*. Cambridge University Press.

Kleij, F. M., & Lipnevich, A. A. (2020). Student perceptions of assessment feedback: A critical scoping review and call for research. *Educational Assessment, Evaluation and Accountability*. https://doi.org/10.1007/s11092-020-09331-x

Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119*(2), 254.

Knight, N. (2003). Teacher feedback to students in numeracy lessons: Are students getting good value. *SET Research Information for Teachers, 3*.

Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology, 77*(6), 1121–1134. https://doi.org/10.1037/0022-3514.77.6.1121

Kulhavy, R. W., & Stock, W. A. (1989). Feedback in written instruction: The place of response certitude. *Educational Psychology Review, 1*(4), 279–308.

Kulik, J. A., & Kulik, C. L. C. (1988). Timing of feedback and verbal learning. *Review of Educational Research, 58*(1), 79–97.

Lechermeier, J., & Fassnacht, M. (2018). How do performance feedback characteristics influence recipients' reactions? A state-of-the-art review on feedback source, timing, and valence effects. *Management Review Quarterly, 68*(2), 145–193. https://doi.org/10.1007/s11301-018-0136-8

Li, H., Xiong, Y., Hunter, C. V., Guo, X., & Tywoniw, R. (2019). Does peer assessment promote student learning? A meta-analysis. *Assessment & Evaluation in Higher Education*, 1–19. https://doi.org/10.1080/02602938.2019.1620679

Lipnevich, A., & Panadero, E. (2021). A Review of Feedback Models and Theories: Descriptions, Definitions, and Conclusions. *Frontiers in Education, 6*, Article 720195. https://doi.org/10.3389/feduc.2021.720195

Lipnevich, A. A., Berg, D., & Smith, J. K. (2016). Toward a model of student response to feedback. In G. T. L. Brown, & L. Harris (Eds.), *Human Factors and social Conditions in assessment, 169–185*. New York: Routledge.

Lipnevich, A. A., MacCann, C., & Roberts, R. D. (2013). Assessing non-cognitive constructs in education: A review of traditional and innovative approaches. In *The oxford handbook of child psychological assessment*.

Lipnevich, A. A., Panadero, E., Gjicali, K., & Fraile, J. (2021). What's on the syllabus? An analysis of assessment criteria in first year courses across US and Spanish universities. *Educational Assessment, Evaluation and Accountability*. https://doi.org/10.1007/s11092-021-09357-9

Lipnevich, A. A., & Smith, J. K. (2009). Effects of differential feedback on students' examination performance. *Journal of Experimental Psychology: Applied, 15*(4), 319.

Lipnevich, A. A., & Smith, J. K. (Eds.). (2018). *The Cambridge handbook of instructional feedback*. Cambridge University Press.

Mahoney, P., Macfarlane, S., & Ajjawi, R. (2019). A qualitative synthesis of video feedback in higher education. *Teaching in Higher Education, 24*(2), 157–179. https://doi.org/10.1080/13562517.2018.1471457

Mandouit, L. (2018). Using student feedback to improve teaching. *Educational Action Research, 26*(5), 755–769. https://doi.org/10.1080/09650792.2018.1426470

Mandouit, L. W. (2020). *Investigating how students receive, interpret, and respond to teacher feedback*. PhD thesis defended at University of Melbourne.

Mason, B. J., & Bruning, R. (2001). Providing feedback in computer-based instruction: What the research tells us. *Center for Instructional Innovation, University of Nebraska–Lincoln, 14*. Retrieved April 15, 2020, from http://dwb.unl.edu/Edit/MB/MasonBruning.html.

Mory, E. H. (2004). Feedback research revisited. *Handbook of research on educational communications and technology, 2*, 745–783.

Murray, J., Gasson, N. R., & Smith, J. K. (2018). Toward a taxonomy of written feedback messages. In A. A. Lipnevich, & J. K. Smith (Eds.), *The Cambridge handbook of instructional feedback* (pp. 79–96). Cambridge University Press.

Narciss, S. (2008). Feedback strategies for interactive learning tasks. In J. M. Spector, M. D. Merrill, J. J. G. Van Merrienboer, & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed., pp. 125–143). Mahwah, NJ: Lawrence Erlbaum Associates.
Narciss, S. (2012). Feedback strategies. In *Encyclopedia of the learning sciences* (Vol. 6, pp. 1289–1293).
Narciss, S. (2013). Designing and evaluating tutoring feedback strategies for digital learning environments on the basis of the interactive tutoring feedback model. *Digital Education Review, 23*(1), 7–26.
Narciss, S., & Huth, K. (2004). How to design informative tutoring feedback for multi-media learning. In H. M. Niegemann, D. Leutner, & R. Brünken (Eds.), *Instructional design for multimedia Learning* (pp. 181–195). Münster: Waxmann.
Narciss, S., Sosnovsky, S., Schnaubert, L., Andrès, E., Eichelmann, A., Goguadze, G., & Melis, E. (2014). Exploring feedback and student characteristics relevant for personalizing feedback strategies. *Computers & Education, 71*, 56–76. https://doi.org/10.1016/j.compedu.2013.09.011
Newman, R. S. (2008). The motivational role of adaptive help seeking in self-regulated learning. In D. H. Schunk, & B. J. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 315–338). Erlbaum.
Nicol, D. (2020). The power of internal feedback: Exploiting natural comparison processes. *Assessment & Evaluation in Higher Education*, 1–23. https://doi.org/10.1080/02602938.2020.1823314
Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education, 31*(2), 199–218.
Omelicheva, M. Y. (2005). Self and peer evaluation in undergraduate education: Structuring conditions that maximize its promises and minimize the perils. *Journal of Political Science Education, 1*(2), 191–205. https://doi.org/10.1080/15512160590961784
Panadero, E. (2016). Is it safe? Social, interpersonal, and human effects of peer assessment: A review and future directions. In G. T. L. Brown, & L. R. Harris (Eds.), *Handbook of human and social conditions in assessment* (pp. 247–266). New York: Routledge.
Panadero, E., Jonsson, A., & Botella, J. (2017). Effects of self-assessment on self-regulated learning and self-efficacy: Four meta-analyses. *Educational Research Review, 22*, 74–98. https://doi.org/10.1016/j.edurev.2017.08.004
Panadero, E., Lipnevich, A. A., & Broadbent, J. (2019). Turning self-assessment into self-feedback. In D. Boud, M. D. Henderson, R. Ajjawi, & E. Molloy (Eds.), *The impact of feedback in higher education: Improving assessment outcomes for learners*. Springer.
Panadero, E., Fernández-Ruiz, J., & Sánchez-Iglesias, I. (2020). Secondary education students' self-assessment: The effects of feedback, subject matter, year level, and gender. *Assessment in Education: Principles, Policy & Practice, 27*(6), 607–634. https://doi.org/10.1080/0969594X.2020.1835823
Parkes, K. A. (2018). Instructional feedback in music. In A. A. Lipnevich, & J. K. Smith (Eds.), *The cambridge handbook of instructional feedback* (pp. 219–239). Cambridge: Cambridge University Press.
Ramaprasad, A. (1983). On the definition of feedback. *Behavioral Science, 28*(1), 4–13.
Reinholz, D. L. (2016). The assessment cycle: A model for learning through peer assessment. *Assessment & Evaluation In Higher Education, 41*(2), 301–315. https://doi.org/10.1080/02602938.2015.1008982
Ruiz-Primo, M. A., & Brookhart, S. M. (2018). *Using feedback to improve learning*. Routledge.
Ruiz-Primo, M. A., & Li, M. (2013). Examining formative feedback in the classroom context: New research perspectives. *Handbook of research on classroom assessment*, 215–232.
Sadler, D. R. (1989). Formative assessment and the design of instructional systems. *Instructional Science, 18*(2), 119–144.
Sadler, R. (2009). Indeterminacy in the use of preset criteria for assessment and grading. *Assessment & Evaluation in Higher Education, 34*(2), 159–179. https://doi.org/10.1080/02602930801956059
Sadler, P. M., & Good, E. (2006). The impact of self- and peer-grading on student learning. *Educational Assessment, 11*(1), 1–31. https://doi.org/10.1207/s15326977ea1101_1
Sanchez, C. E., Atkinson, K. M., Koenka, A. C., Moshontz, H., & Cooper, H. (2017). Self-grading and peer-grading for formative and summative assessments in 3rd through 12th grade classrooms: A meta-analysis. *Journal of Educational Psychology, No Pagination Specified*. https://doi.org/10.1037/edu0000190
Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research, 78*(1), 153–189.
Strijbos, J. W., & Sluijsmans, D. (2010). Unravelling peer assessment: Methodological, functional, and conceptual developments. *Learning and Instruction, 20*(4), 265–269. https://doi.org/10.1016/j.learninstruc.2009.08.002
Strijbos, J. W., Van Goozen, B., & Prins, F. (2012, August). Developing a coding scheme for analysing peer feedback messages. In *Paper presented at the EARLI-SIG 1 assessment and evaluation conference, Brussels, Belgium*.
Tai, J., Ajjawi, R., Boud, D., Dawson, P., & Panadero, E. (2018). Developing evaluative judgement: Enabling students to make decisions about the quality of work. *Higher Education, 76*(3), 467–481. https://doi.org/10.1007/s10734-017-0220-3
Topping, K. J. (2003). Self and peer assessment in school and university: Reliability, validity and utility. In M. Segers, F. Dochy, & E. Cascallar (Eds.), *Optimising new modes of assessment: In search of qualities and standards* (Vol. 1, pp. 55–87). Springer Netherlands.
Trzesniewski, K., Yeager, D., Catalán Molina, D., Claro, S., Oberle, C., & Murphy, M. (2021). Global mindset initiative paper 3: Measuring growth mindset classroom cultures. Available at SSRN: http://doi.org/10.2139/ssrn.3911591.
Tunstall, P., & Gipps, C. (1996). Teacher feedback to young children in formative assessment: A typology. *British Educational Research Journal, 22*(4), 389–404.
Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185*(4157), 1124–1131.
Wiliam, D. (2011). What is assessment for learning? *Studies In Educational Evaluation, 37*(1), 3–14. https://doi.org/10.1016/j.stueduc.2011.03.001
Wiliam, D. (2013). *Feedback and instructional correctives* (pp. 197–214). SAGE handbook of research on classroom assessment.
Wiliam, D. (2017). Learning and assessment: A long and winding road? *Assessment in Education: Principles, Policy & Practice, 24*(3), 309–316. https://doi.org/10.1080/0969594X.2017.1338520
Wiliam, D. (2018). Feedback: At the hard of -but definitely not all of- formative assessment. In A. A. Lipnevich, & J. K. Smith (Eds.), *The Cambridge handbook of instructional feedback* (pp. 3–28). Cambridge University Press.
Winstone, N. E., Nash, R. A., Parker, M., & Rowntree, J. (2017). Supporting learners' agentic engagement with feedback: A systematic review and a taxonomy of recipience processes. *Educational Psychologist, 52*(1), 17–37.
Yan, Z., & Brown, G. T. L. (2017). A cyclical self-assessment process: Towards a model of how students engage in self-assessment. *Assessment & Evaluation in Higher Education, 42*(8), 1247–1262. https://doi.org/10.1080/02602938.2016.1260091
Zundert, M., Sluijsmans, D., & van Merriënboer, J. (2010). Effective peer assessment processes: Research findings and future directions. *Learning and Instruction, 20*(4), 270–279. https://doi.org/10.1016/j.learninstruc.2009.08.004

Further reading

Boekaerts, M. (2011). Emotions, emotion regulation, and self-regulation of learning. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 408–425). Routledge.
Panadero, E., Jonsson, A., & Alqassab, M. (2018). Providing formative peer feedback: What do we know? In A. A. Lipnevich, & J. K. Smith (Eds.), *The Cambridge handbook of instructional feedback*. Cambridge University Press. https://doi.org/10.1017/9781316832134.020.
Sadler, D. R. (1998, 1998/03/01). Formative assessment: Revisiting the territory. *Assessment in Education: Principles, Policy & Practice, 5*(1), 77–84. https://doi.org/10.1080/0969595980050104
Tan, K. H. K. (2012). *Student self-assessment. Assessment, learning and empowerment*. Research Publishing.