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A cyclical self-assessment process: towards a model of how students engage in self-assessment

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ABSTRACT

While significant progress has been made on understanding the effects of student self-assessment, the processes by which these effects occur are much less studied. The present research identified the actions involved in a cyclical self-assessment process. In this qualitative study, 17 undergraduate students from a teacher education institute took part in in-depth interviews focusing on the common actions students normally undertake to self-assess. The findings identified the following three actions that are commonly undertaken in the self-assessment process: (1) determining the performance criteria, (2) self-directed feedback seeking and (3) self-reflection. The paper discusses the implications of the findings and concludes with suggestions for promoting student self-assessment.

KEYWORDS

Self-assessment; self-directed feedback seeking; self-reflection; higher education

Introduction

The process of self-assessment is a human and internal psychological process in which the individual evaluates his or her own work quality in the light of internal psychological factors (self-esteem, self-efficacy, motivations, etc.), inter-personal psychological factors in relationship to peers, parents, instructors and other important stakeholders and external and perceived standards (Andrade and Brown 2016). Complex judgements have to be made relative to external demands and internal priorities and values, meaning there is likely to be great variation in the way that students fulfil the instruction 'self-assess your work'. The ability to self-assess has positive effects on academic performance (Ibabe and Jauregizar 2010; Brown and Harris 2013; Jay and Owen 2016), learning autonomy (Andrade and Du 2007; Cassidy 2007), commitment and engagement with learning (Brown and Harris 2013) and self-efficacy (Kissling and O'Donnell 2015), and is clearly an indispensable skill for self-regulated learning and lifelong learning that university students are expected to acquire (Mok et al. 2006). However, currently, there is little understanding of what resources students use and how they go about using those resources in order to create a self-assessment (Panadero, Brown, and Strijbos 2015). Educational psychology has established that reflective monitoring of one's own work combined with evaluative judgements about that work is an important process in the regulation of learning. Thus, inductive analysis of student self-described phenomenological experiences concerning how they go about formulating a self-assessment should provide useful insights into this 'black box'.

Student self-assessment

Student self-assessment generally involves learners making judgements about their achievements and the outcomes of their learning (Boud and Falchikov 1989). As Panadero, Brown, and Strijbos (2015, 2) stated, 'student self-assessment most generally involves a wide variety of mechanisms and techniques through which students describe (i.e., assess) and possibly assign merit or worth to (i.e., evaluate) the qualities of their own learning processes and products. In this sense, self-assessment overlaps with other similar terms, such as 'self-evaluation', 'self-reflection' and 'self-appraisal'. These terms generally refer to the practice of looking reflectively at one's own work often, but not exclusively, aiming for revision or improvement. Self-assessment requires the initiation of learners into reflective practice, making them aware of the purpose and skills needed to identify issues that do not meet quality expectations (Brown and Harris 2013; Andrade and Brown 2016). The judgements students make are based on the information and evidence about their own performance collected from others, such as teachers and peers, and/or themselves, including their own internal intuitions, emotions and physical sensations (Boud 1995; Butler and Winne 1995; Sargeant et al. 2010). In line with these arguments and based on previous studies (e.g. Boud 1995; Paris and Paris 2001; Andrade, Du, and Wang 2008; Yan 2016a, 2016b), self-assessment is operationally defined in this article as a process during which students collect information about their own performance, evaluate and reflect on the quality of their learning process and outcomes according to selected criteria to identify their own strengths and weaknesses.

Student self-assessment differs from other externally generated assessment processes (tests, questions, teacher marking, etc.) in that, first, it is an internal practice that is conducted by and within the student. Thus, in self-assessment, students dominate the whole process and their internal values, ideas, goals and skills are extremely important, especially in informal self-assessment without external prompts. While formal or structured self-assessments are initiated and designed in educational settings by the teacher or the curriculum, the process of self-assessment is still conducted and monitored by students themselves. Although students might have different levels of control in formal and informal self-assessment (e.g. determining the performance criteria or sources of feedback), the process of implementing self-assessment, which is the focus of the current study, could be shared by both kinds of self-assessment.

Second, since the evaluative process (e.g. marking or grading) occurs within the student rather than within the external marker, self-assessment offers multiple pathways and sources of feedback not accessible to the student when the evaluation is carried out externally. In self-assessment, feedback can be generated from external scores and commentary provided by the marker, or from documents that indicate the quality standards expected (Ashford and Cummings 1983), but the individual's own internal values, ideas, goals and emotions are more easily accessed. Hence, it is possible that in self-assessment, completely idiosyncratic heuristics might be used to evaluate work (e.g. I worked hard, so it must be good) that are independent of official quality criteria. The combination of internal and external sources of feedback means that students have to conduct self-reflection and calibrate their judgements interactively based on different, possibly conflicting, information.

A technical challenge in self-assessment has to do with establishing a valid criterion to judge whether or not a student self-assessment is accurate. While it is conventional to refer to teacher judgements or test scores as a benchmark, it is difficult to know how a *self*-assessment could be classified as *wrong*. Nonetheless, discrepancy of the student's own self-assessment from other measures has been used as a valid standard by which to evaluate the construct validity of a self-assessment (Brown, Andrade, and Chen 2015). Realism about the quality of one's own performance permits valid changes in further learning, and helps students focus on important aspects of their learning that need work (Boud, Lawson, and Thompson 2013). Butler (2011) suggests that the critical handicap is having an overly negative sense of one's work quality since an overly optimistic view contributes to optimistic perseverance. However, from a pedagogical perspective, the benefits of self-assessment may come from active engagement in the learning process, rather than by being 'veridical' or coinciding with reality, because students' reflection and metacognitive monitoring lead to improved learning (Yan 2016a). Therefore, it may be enough if students develop learning skills from self-assessment rather than having their self-assessments corroborated by the marking of tutors or teachers or scores on tests (Boud 1995; Andrade 2010;

Tan 2012). Nevertheless, the veridicality of self-assessment is a hallmark of mature self-awareness and seems to be an important curricular ambition (Brown and Harris 2014). Independent of whether this claim is valid (i.e. accuracy is irrelevant as long as students engage in evidence-based reflection), the processes and actions taken by students to conduct self-assessment need to be understood.

The self-assessment process

Surprisingly, there are not many studies examining the process of self-assessment. van Diggelen, den Brok, and Beijaard (2013) identified the following components in self-assessment in their study on teachers' coaching competencies: (1) a criterion-based tool for teachers to self-assess their own performance, (2) a self-reflection report written by the teachers and (3) peer feedback on both performance and the reflective report. Andrade and Du (2007) described a pedagogical three-step procedure: (1) the teacher shares the desired performance or the expectations with students, (2) students work on the assignment and check their work against the rubric and (3) students revise and improve their work according to the feedback generated in self-assessments. Fastré et al. (2012) described the student self-assessment process as: (1) selecting relevant performance criteria, (2) making judgements of performance according to the selected criteria and (3) identifying areas for improvement.

None of these studies have unpacked the inner process of self-assessment and the actions commonly conducted by participants in self-assessment. The self-assessment procedure described by van Diggelen, den Brok, and Beijaard (2013) was more or less a package of instruments or tools that could be used in self-assessment, but did not give access to the process of self-assessment. Andrade and Du's (2007) study depicted a flow of instruction/learning which is facilitated by self-assessment, but not the self-assessment process itself. Fastré et al. (2012) presented a general process of self-assessment, but did not gauge the way in which the self-assessment was conducted. While the function of self-assessment was recognised in the learning process, the way in which self-assessment was conducted still remained in a 'black box'. What sources of information are used to inform self-assessment? How do students gather relevant information or feedback in order to formulate a self-assessment? What actions are conducted that facilitate the judgement making process? The answers to these questions need to be explored.

Boud (1995) identified two defining characteristics of self-assessment: (1) determining criteria for judging the quality of the work and (2) making judgements about the extent to which the work has met the criteria. Sargeant et al. (2010) proposed a conceptual model, the 'processes and dimensions of informed self-assessment', which consists of five components: (1) sources of information, (2) interpretation of information, (3) responses to information, (4) external and internal conditions and influences and (5) tensions. The first three components describe how data are collected or accessed, interpreted and responded to so as to inform a self-assessment. Four categories of conditions are identified as 'external and internal conditions and influences', including learning/practice climate, relationships with others, credibility of information processes and information and personal attributes. The component 'tensions' refers to pressures emerging from competing internal and external data and conditions. This model understands self-assessment as a process, and covers important aspects of self-assessment, such as the role that information (or feedback) plays in self-assessment; however, it does not explicitly identify the common actions students conduct and how they do so within these various stages.

Yan (2016a) has claimed that self-assessment practices cover two major actions (*self-directed feedback seeking* and *self-reflection*). Self-directed feedback seeking refers to the process by which students initiate and take responsibility for seeking feedback from various sources for the purpose of self-assessment. 'Self-directed' is used to emphasise that the characteristics (the content, source, direction, etc.) of feedback are determined by the student him/herself rather than following external instructions. Butler and Winne (1995) classified external and internal feedback, and emphasised the importance of both in the process of self-regulated learning. In other words, feedback could be obtained from both external and internal sources. External feedback from *the outside* could be obtained from two sources including people and processes (Sargeant et al. 2010), or inquiry and monitoring, in line with Ashford and Cummings's (1983) classification. Inquiry enables students to seek feedback from relevant people (e.g.

teachers, parents and/or peers). Through monitoring, students identify and collect feedback regarding their performance from external evidence against selected standards and criteria (e.g. performance records; past examination papers).

In contrast with external feedback, internal feedback comes from *within the self*, such as emotions, motives, physical sensation and internal states. Epstein, Siegel, and Silberman (2008, 11) argued that 'The power of self-assessment lies in two major domains – the integration of high-quality external and internal data to assess current performance and promote future learning'. Self-reflection is the action by which students reflect on and evaluate the quality of their learning process and outcomes with the support of available/gathered feedback, and identify their own strengths and weaknesses. Reflective thinking is regarded as an integral and crucial component of the self-assessment process (McMillan and Hearn 2008; Sargeant et al. 2008). Self-reflection helps students explore and elaborate their understanding of problems encountered during learning. By critical reflection, students may have a better understanding in terms of their strengths and weaknesses as well as how to facilitate achieving their goals. The self-assessment judgement could be subsequently made on the basis of self-reflection results.

Yan's conceptualisation of self-assessment could be traced back to, but was different from, Eva and Regehr's (2008) work, which contrasted self-assessment with several relevant concepts including *self-directed assessment seeking, reflection* and *monitoring*. Self-directed assessment seeking was here similar to self-directed feedback seeking (from the outside), while reflection and monitoring were echoed by self-reflection in Yan's terminology. Self-directed *feedback* seeking by the self was not discussed in Eva and Regehr's article. The most fundamental difference lies in the view of self-assessment. Eva and Regehr (2008) regarded self-assessment as a personal ability of reflection on performance for the purposes of generating a summative judgement of one's own level of knowledge, skill and understanding in a particular area. In contrast, Yan's conceptualisation, as well as the operational definition adopted in the current study, viewed self-assessment as a process during which students engage in feedback seeking, evaluation, reflection and making judgements regarding the quality of their learning process and outcomes. Consequently, self-assessment is not conceived as a personal ability different from self-directed feedback seeking or self-reflection, but rather is seen as a process that embraces all these actions.

One point worth noting is that cultural factors influence self-assessment. Cultural variation in what is considered appropriate to say about one's own work raises challenges for understanding the accuracy of self-assessment and the power of self-assessment to contribute to appropriate improvement actions (Brown, Andrade, and Chen 2015). By carrying out this study in Hong Kong, it is possible that there are potentially Chinese cultural values that influence the process of self-assessment. This means that any identified mechanisms reported in this study should be interpreted within Chinese cultural contexts.

This study seeks empirical evidence about the processes of self-assessment from Hong Kong university students' claims about what they do and did for self-assessment. The study aimed to extend our knowledge of the inner processes of self-assessment and to shed light on the varying effects of self-assessment.

Methods

Design

Individual interviews allowed students to describe their personal experience of self-assessment, and to explore what they did and how they came to an assessment of their own work or abilities. Hence, a multiple case semi-structured interview technique was used to elicit patterns of variation in how students generated their self-assessment.

Participants

To ensure that all participants shared a common cultural background, only Cantonese-speaking Chinese students educated in Hong Kong were interviewed, effectively excluding students from Mainland China

or those born overseas. All participants were enrolled in a Bachelor of Education teacher education programme, and had been taught by the first author in a previous class in the programme. Invitations were emailed to 25 students selected in proportion to the programme's academic performance distribution (i.e. 6 students with A grade, 15 students with B grade and 4 students with low passing grades of C or D). A total of 17 students (68% response rate) agreed to be interviewed with 5 A grade, 10 Bs and 2 Cs. The chi-square statistic indicated that the difference in the percentage of A/B/C grades between the invited and interviewed groups was statistically insignificant ($p = .243$). Among the participants, 11 are women and 6 are men.

It is worth noting that the current study used a sample of teacher education students preparing to work in schools structured on an assessment for learning and outcomes-based curricular framework (Curriculum Development Council 2000; Berry 2011). Compared to students in other university majors, these participants are likely to have more exposure to self-assessment relative to expected criteria or standards, which is a key practice that teachers are expected to implement in schools (Berry 2008; Brown and Ngan 2010). Thus, it is highly likely the interviewees will be familiar with the concept and role of self-assessment against criteria or rubrics in education through compulsory courses and teaching practice in schools. Hence, the current results may have more limited generalisability to non-teacher education students.

Interviews

Given that the interview topic was self-assessment of one's own work, individual interviews were used to ensure participants would be comfortable in sharing such personal experiences (Emerald and Martin 2013). Because self-assessment is a complex and content-specific process, a scenario-based interview method was used. Content-specific scenarios were presented to participants who were asked to complete the relevant self-assessment task or to recall a previous self-assessment task that they had performed. A think-aloud protocol was used to elicit information about the actions and processes of self-assessment.

The operational definition of self-assessment was first presented to participants and further explanations were provided upon request. The interview-guiding questions focused on two major research objectives: the mental actions students undertook to conduct a self-assessment and the processes and sequences of those actions. To elicit this information, six questions were posed: two referred to generic situations (#1 and #4), one referred to a relatively low-threat phenomenon (#2) and three referred to aspects of their academic career or future career as a teacher (#3, #5, and #6). The scenarios were:

- (1) How good a student are you?
- (2) How good are you at learning a new physical skill (e.g. typing, swimming and/or driving a car)?
- (3) How good a teacher do you think you will be once you finish your current studies?
- (4) Is there any kind of situation where you know how to rate yourself (how good you are) without having to think about it?
- (5) When you are preparing for an essay assignment, how do you evaluate the quality of your work (i.e. the essay) before you show it to anyone else or hand it in? and
- (6) When you are preparing for an examination, how do you rate your readiness for that examination?

As interviewees responded to each scenario prompt, five questions were used to stimulate their think-aloud:

- (1) What criteria did you use to conduct self-assessment?
- (2) What information or feedback did you draw on to arrive at your self-assessment?
- (3) How do you obtain that information or feedback?
- (4) How did you deal with that information or feedback? and
- (5) How did you arrive at your final self-assessment judgement?

Procedures

Standard informed consent procedures approved by the first author's institutional review board were followed. All interviews were conducted by the first author in Cantonese and each session lasted between 45 and 60 min. The risks of social desirability were minimised because the interviewees were not current students of the interviewer, and their future academic or employment career did not depend on interaction with the researcher. All interviews were audio-taped and field notes were taken. Participants were assured that the researchers would not use the content of the self-assessments because only the processes of creating a self-assessment were of interest. All interviews were transcribed by a research assistant; four randomly selected transcripts (nearly 25% of all interviews) were checked by the first author for accuracy against the recordings. Participants' responses were translated into English only when they are cited in this paper.

Data analysis

The transcribed data were analysed inductively (Thomas 2006) to identify meaningful categories within the data and to establish defensible links among the categories. These coding and category systems were developed in an iterative process and driven by the research objectives (Krueger and Casey 2000). The coding systems were open for any actions of self-assessment that emerged from the interview data, while certain actions, such as self-directed feedback seeking and self-reflection, pertaining to self-assessment identified in previous studies were used as referencing codes. The chronological sequence of generating a self-assessment was used as a natural structural framework around which utterances could be classified. In the coding process, the thematic category of each utterance was determined in relation to the sequence of actions involved in the self-assessment process. For example, in the statement 'when I am doing my self-assessment, I usually consult my peers first to get some feedback, and then think back on my performance', two themes were identified since the first part of the statement referred to student taking initiative to seek feedback from peers, while the second half was about self-reflection.

Results

The major types of actions students used to formulate a self-assessment are first outlined, followed by the sequences by which those actions seem to be normally carried out.

Actions in self-assessment

The two major actions that students reported taking in their self-assessment were self-directed feedback seeking and self-reflection. However, these two actions were dependent on the pre-requisite action of determining the performance criteria.

Determining performance criteria

The search for relevant performance criteria was seen in all participants' descriptions of how they conducted their self-assessments. As one participant noted:

When doing self-assessment you need a criterion or standard against which you can evaluate your own performance. You can't just say 'I did well or I failed' without supporting evidence.

In most cases, the performance criteria come from the teacher or were resources provided with the task instructions students were asked to complete (e.g. the marking rubrics for an assignment). For instance:

Most courses provide the marking rubrics for the assignments. Teachers normally provide the criteria for the assessment tasks they designed. For example, the teacher specifies what is the standard for a pass grade and what is for a distinction grade. That's what I use to self-assess my work.

The performance criteria could be the student's own prior performance. One participant reported:

To me, an important criterion is whether I have made improvement. If I think that my performance is better than last time, I will be satisfied.

Sometimes, students conducted self-assessment relative to the performance of others. For example, one participant commented when she was asked to self-assess her performance in learning a new physical skill:

I think I am not good at this kind of stuff since my classmates always learn better than me.

It was found that while students seldom formulated their own assessment criteria for a specific self-assessment, almost half had some internalised standards and/or criteria that were used intuitively in self-assessment. Among the eight participants who mentioned this point, one participant described the criteria she used in self-assessing her assignment:

In addition to the assessment criteria provided by the teacher, I also have my own standards to evaluate my assignment ... those standards are more or less some common sense, such as no typos, no grammar errors, the presentation should be clear, the arguments should be logical and consistent, and so on.

The 'common sense' mentioned above is likely to have been internalised from previous learning experiences and assessments. It would seem these common sense or tacit criteria might apply to all similar learning tasks as a general rule, but may not be invoked for a particular assessment task, depending on task features. As one participant reported:

Sometimes I use my own assessment criteria in self-assessment. For example, for all essay-type assignment, some common criteria, like coherent presentation, logical argument, appropriate citation, apply to almost all cases. I know how to self-assess even without a marking scheme.

It seems logical that determining the performance criteria is the first step on which students build their self-assessment. However, different kinds of criteria were noted, including formal course requirements, prior personal performance and the performance of others. It was also noted that performance criteria used in self-assessment might be either explicit, such as formal assessment rubrics formulated by external parties, such as teachers, or implicit, such as standards internalised from relevant previous tasks. Therefore, the level of students' control in determining the performance criteria varied case by case.

Self-directed feedback seeking

All 17 students reported initiating a search for relevant feedback, by inquiry and/or monitoring. Inquiry involved explicitly seeking corroborating feedback from relevant parties such as course teachers and peers. Together, these sources were the most frequently mentioned ($n = 14$). As one student reported:

When I have finished my assignment, I will send the draft to my tutor to seek his/her comments even though I think the assignment is good. If possible, I will also share it with my classmates whom I think might provide constructive feedback.

Although most of the participants indicated that they seldom sought feedback from parents or other family members because family members did not have the necessary expertise to comment on their work, some students ($n = 4$) occasionally sought feedback from their parents. As one student remarked,

I seldom seek feedback from my parents regarding my study, but they could be helpful in some cases. I remember that I once had a project on local education history and my dad had plenty of experience on this topic. I was not quite sure whether I had covered important things in my report. So I presented him my report and he provided some very good advice.

Another method of seeking feedback is monitoring which involves locating and gathering external evidence as to the quality of their own performance from various sources in the environment. This can include comparison to past examination papers and/or formal criteria issued for assignments. Nearly all the participants ($n = 15$) reported this approach to feedback seeking in their self-assessment. For example,

Sometimes I re-do past exam papers to check whether I have fully understood what the teacher had taught in the class.

Each time when I finished my assignment, I check it against the criteria provided by the tutor so as to have a rough estimation of the quality of my work.

The monitoring could be done explicitly as described above or it could also be accomplished implicitly within the mind, (i.e. simple self-questioning). For example,

I ask myself questions in my head to check whether I have understood what the tutor said... this could be done during the lesson, or after the lesson.

Internal feedback originates from within the self (e.g. feelings, emotions, internal states, sensations or subjective experiences). Some students ($n = 8$) commented that such internal data could be a useful source of evidence regarding the quality of their performance. As a student majoring in music education stated:

During my [piano] performance and after I finished, I was not satisfied with my performance... it's more like a feeling, or intuition... I just felt that something was wrong.

Unlike seeking external feedback that requires purposeful mental endeavour to collect relevant information, internal feedback sometimes may lack explicit meaning, but has strong guidance to students' self-assessment. As one student reported:

Sometimes I can have an immediate judgment on my work. I don't need to think too much... but I trust that judgment.

Seeking sources of feedback plays a pivotal role in self-assessment as a way of determining whether current work meets the relevant performance criteria. Self-directed feedback seeking emphasises students' initiative in seeking feedback regarding their performance with the purpose of facilitating self-assessment. Unlike determining assessment criteria, students have a high level of control over self-directed feedback seeking. They can determine the source of feedback, the approach to seek feedback and the way to deal with the feedback.

Self-reflection

Self-reflection was evident in the self-assessment practices of all 17 participants. Students reported that the reflection would happen based on the feedback they had sought out regarding their performance.

Some tutors would give me feedback on the draft of my assignment, if I asked him/her to do so. I valued that feedback very much because, based on their responses, I would know whether my work was acceptable and which parts should be enhanced.

I will check whether I have fully understood the course content by doing past exam papers. I don't care too much what score I can get on the papers, but I focus on those questions I got wrong and try to figure out why I got them wrong... those questions let me know which area I need to work on.

The main function of self-reflection is to help the student consider their performance and identify strengths and weaknesses, normally with an aim to improve the work.

For me, an important thing in self-assessment is to have an opportunity to reflect on my own performance so that I can know more why I have done it well or badly.

I try to find out why I succeed (or failed). Of course feedback from others is useful, but you have to do some in-depth and reflective thinking in order to find out the real reason underlying your performance. Nobody else, but yourself, can achieve this.

Self-reflection is also about how students evaluate the meaning of the feedback they obtained. Students may accept feedback from others and try to improve their work accordingly. However, they may ignore or reject the feedback if they consider it to be irrelevant or inappropriate, as one participant described:

Feedback is useful but I don't necessarily accept all of it. For example, I often seek feedback from my classmates on my assignment, but I will carefully check whether their comments make sense... in some cases I just ignore their comments because they are totally irrelevant.

In this case, the student calibrates the feedback provided by one source with insights gleaned from another source (i.e. a personal perception or intuition). Hence, self-reflection can trigger a process of calibration in which feedback and judgements are refined and made more realistic. For example, this student considers self-assessments gradually become accurate through repeated consideration of different sources of feedback.

I think self-assessment is accurate because, compared to others, I know myself best. However, the evaluation on my own performance could be more accurate if I keep doing and revising it.

Self-reflection, as indicated by participants' responses, refers to a conscious mental process aiming at enhancing one's understanding of the problem as well judging the characteristics of his/her own performance. Such reflection process will lead to a self-assessment judgement which might be subject to further calibrations.

Self-assessment process

The interview data indicated that participants might have different personal preferences in how they conduct self-assessment. For example, some participants ($n = 11$) reported that they spent more time in self-reflection than in seeking feedback, while the rest ($n = 6$) gave more importance to feedback seeking. A majority ($n = 13$) regarded external feedback as more reliable information than internal feedback, while the balance preferred internal feedback to external feedback. However, it was found that all participants followed the same basic process of self-assessment.

The process is presented in Figure 1. When the need for self-assessment arises, students first determine or adopt the performance criteria (e.g. formal criteria, performance of others and/or internal goals), which appears to be a pre-requisite of self-assessment. Subsequently, students follow two routes of self-assessment, depending on whether there is sufficient feedback regarding their performance. If students perceive they have 'sufficient' feedback or information on which to base a self-assessment, they engage in reflection and evaluation of the quality of their work processes and outcomes, and identify the strengths and weaknesses and needs of the work. On the other hand, when feedback is insufficient or not available, students are required to take the initiative to seek feedback regarding their learning from external and/or internal sources that will provide them with evidence on which to base a self-reflection. Such feedback seeking could be a search for: (1) external and explicit feedback, especially comments from course tutors or classmates, or (2) internalised standards or personal perceptions and sensations. Following self-reflection, students come to an evaluative judgement about their learning or ability. While such self-evaluation is the normal outcome of the self-assessment process, it is not necessarily the end of it.

This means that no matter how students judge the quality of their work, their sense of what the appropriate standards or criteria are and their sense of their own work become more refined. This

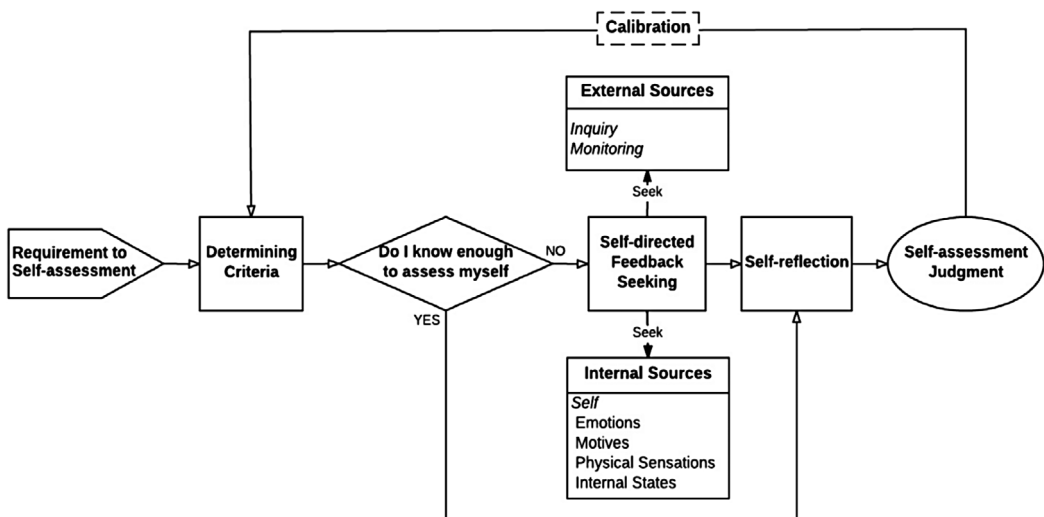


Figure 1. The cyclical self-assessment process.

refinement calibrates their judgements either by moving the standards closer to their work quality or by moving their work quality closer to the standards. This means that student self-assessments in the latter case become more realistic and in the former case become either more optimistic or pessimistic relative to a veridical analysis. Hence, self-assessment is a dynamic and cyclical process.

This process can be seen in participants' descriptions of self-assessment. As one participant reported:

The self-assessment judgment depends on the performance criterion. If you selected a different standard, the [self-assessment] results might change. I usually evaluate my work against different standards so that I could have a more holistic understanding of my own performance

Calibration also occurs when obtaining new feedback from a variety of sources which either confirms or modifies an initial judgement about the work quality. For instance:

The self-assessment results may change over time. I mean, self-assessment could be a continuous process. When I find new information, such as new comments from teachers or peers, I may change my initial judgment regarding my performance.

The course tutor has influence on my self-assessment. When I found that the tutor had different opinions regarding my work with my own judgment, I may change my initial judgment.

In terms of when calibration might stop, the majority of students ($n = 15$) reported two major criteria. One has to do with deadlines or lack of time and the other is self-satisfaction. As two participants commented:

I keep evaluating and revising my assignment until the last minute before the due date.

I stop doing so (evaluating and revising) if I think my work is ok.

Information gleaned from the self-assessment potentially feeds into future self-assessments, creating a calibration process that possibly adjusts up or down self-perceptions of quality to confirm the accuracy or veridicality of self-assessments.

Discussion

Overview

This study aimed to identify the actions and processes involved in university students' self-assessment. The interview data showed that self-assessment, as experienced by these teacher education students, is a cyclical process that consists of several common and sequenced actions. When engaging in self-assessment, students first determine the assessment criteria against which their own performance is assessed. They then take the initiative to seek feedback regarding their own performance from various sources. Based on available and collected feedback, students then reflect on the quality of the process and product of their learning, and identify their own strengths and weaknesses, normally for the purpose of improvement. Following this initial set of processes, a self-assessment judgement is arrived at and this judgement is subjected to continuous calibration based on various sources of feedback, and ought to lead to increasingly accurate or veridical self-assessments.

Self-directed feedback seeking

Feedback seeking initiated by students appears to play a crucial role in self-assessment. A major source of feedback is that given by external persons or resources. It is clear that students need high-quality feedback through which they learn to evaluate their work in a realistic fashion. Turning to the teacher or tutor is a logical decision given the authority of the teacher as both a content expert and as the person most likely to be marking the student work. Indeed, it is well established that students know the teacher is the real authority concerning the quality of their work (Peterson and Irving 2008; Harris and Brown 2013). However, this approach is problematic since the teacher will not always be available, and in most education systems, it is expected that students will become independently capable of performing and recognising the same standards as the teacher uses (Sadler 1989). Indeed, work with New Zealand

university students has shown that those who depend on feedback from teachers or classmates had lower grade point averages than students who relied on themselves to actively make use of feedback (Brown, Peterson, and Yao 2016). Thus, it is important that students develop skills in assessing their own work and learn how to depend on their own self-monitoring, rather than depending on the feedback of external parties (Sadler 1989; Yan 2016a).

An interesting challenge, other than the scaffolding the transfer of responsibility for feedback from the teacher to the learner, is whether teachers have the inclination and ability to provide sufficient and powerful feedback to students concerning their performance. Especially in a student-centred pedagogy, there is a temptation to protect the learner from negative feedback to ensure self-esteem or self-worth is not hurt. Hattie and Timperley (2007) have shown that this self-oriented feedback (e.g. unmerited praise or focus on the person instead of the work) has a negative impact on student learning. Further, if teachers do not have the content expertise to advise very high-performing students on how to further improve, it is unlikely their feedback will be of much value to the learner. Hence, lack of honest or quality feedback is a major constraint for student self-assessment and a potential reason for unrealistic self-assessment.

Feedback seeking from others is a cognitively and emotionally demanding task for students, especially in a Chinese culture like Hong Kong where seeking help (e.g. asking a colleague for feedback) is a socially problematic process (Mok et al. 2008; Erez 2010; MacDonald et al. 2013). Indeed, East Asian university students in New Zealand had greater difficulty seeking academic help from university resources (e.g. the library) if they relied more on memorisation strategies for learning (Lee, Farruggia, and Brown 2013). Since Hong Kong education puts great emphasis on accurate recall of knowledge, learning to seek help from others is a difficult challenge, which pleasingly this group of students claims to have little difficulty with.

Another source of feedback for self-assessment, internal feedback, comes from 'the self', which could be personal feelings, emotions, sensations, internal states and subjective experiences. The interview data analysis indicated that, unlike seeking external feedback that requires students' mental endeavour, internal feedback appeared automatically or unconsciously. The meanings of internal feedback were often difficult to make explicit but they had a strong influence on self-assessment. As internal feedback is more easily accessible, sometimes, it can 'overwrite' the external feedback. This could bring about positive outcomes since the intuition might be closer to the truth than external feedback from others who do not really know the student. This may be especially more pronounced among students learning skills or abilities that have a strong aesthetic or physical component (dance, music performance, sports, wood or metal technologies, food technology, etc.). In these learning domains, physical sensation and psychological appreciation need to become deeply internalised, and as expertise is attained, internal sources of feedback become accurate and powerful. Nonetheless, in more cognitive domains with a less pronounced aesthetic component, reliance on internal feedback may not provide accurate guidance if idiosyncratic heuristics (e.g. effort) are relied upon.

Self-reflection

Self-reflection seems to be the step that brings the benefits of self-assessment to the fore. Only through critical self-reflection can students enhance their metacognitive skills which in turn leads to improved learning. As argued by Yan (2016a), a learning environment with low pressure is productive for developing reflective thinking. Thus, it is suggested that safe learning environments are needed to provide space and time for students' deep thinking. This means that students need opportunity to expose their reflection without fear of shame or embarrassment. This is especially challenging in Chinese contexts since shame and guilt are often used to motivate and control people (Wong and Tsai 2007). Thus, teachers need to create environments where students are allowed to not disclose their self-assessments to the teacher or classmates, but are encouraged to divulge these to trusted friends and/or family (Andrade and Brown 2016). However, it is not the teacher's sole responsibility to create such environments since many decisions about curriculum coverage and assessment are outside their control. Hence, school

administrators and policy-makers need to collaborate in creating policy and administrative frameworks wherein less pressure is put on the officially endorsed correct answer.

This study demonstrates that both feedback and reflection are indispensable elements to self-assessment. Without feedback, reflection might be subject to personal bias, such as the overconfidence–underperformance effect (Dunlosky and Rawson 2012). As a consequence, the calibration process might be devalued and result in inaccurate self-assessment judgements. On the other hand, seeking feedback without subsequent reflection may not allow the full potential of self-assessment to be achieved since such feedback has limited impact on the development of metacognition. Students who are not engaged in meaningful reflective thinking are less likely to make strategic adjustments to their learning strategies since they are unaware of their strengths and weaknesses. Dinsmore and Wilson (2016) described scaffolded self-regulation as a self-regulated learning process in which learners self-assess their own performance with the support of feedback from an external evaluator such as the teacher. Dinsmore and Wilson treated self-assessment and feedback as separate elements in the process of self-regulated learning, and argued that the existence of both self-assessment and external feedback can promote self-regulated learning. The lack of either, self-assessment or external feedback, makes it less likely that students will engage in self-regulated learning.

This study echoes the important role of self-assessment and feedback in self-regulated learning, and develops further the conception of self-assessment by arguing that self-assessment encompasses feedback seeking. Only when feedback is available or actively sought by students, and self-reflection occurs based on that feedback, can meaningful self-assessment take place.

Determining performance criteria

Although determining the performance criteria has been found in this study as a pre-requisite of self-assessment that precedes self-directed feedback seeking and self-reflection, it differs in that these two latter functions are student directed. In contrast, the performance criteria used by these students were determined by external parties, such as teachers and course aims and objectives. Even when students formulated their own assessment criteria, these were largely internalised versions of formal external standards and/or criteria. This suggests that students might have low levels of control, which has been raised as a serious problem in the development of effective professionals (Tan 2012; Bourke 2014). However, this external characteristic of the criteria does not mean that such criteria have less value. The assessment criteria selected by students have significant influence on their perceived outcomes and motivation in subsequent learning (Zimmerman and Moylan 2009), and the use of course requirement or prior performance for comparison in self-assessment seems rational. Such an approach is likely to encourage students to master the course content and enable entry into the professional community that uses and depends on mastery of such standards.

Calibration in self-assessment

The students clearly indicated that self-assessment is not a one-off action, but rather a cyclical process in which self-assessment judgements are gradually refined. This is in line with Nelson's (1996) argument that self-assessment is a metacognitive process in which individuals continuously monitor their knowledge about their performance. Tversky and Kahneman (1974) proposed that the self-evaluation of one's own performance starts from an initial judgement which is subsequently subject to continuous calibration based on various sources of feedback. Boud, Lawson, and Thompson (2013) posited that students' self-assessment ability can develop over time and the accuracy of self-assessment judgement can be improved through calibration. This process was evident in students' responses to the interview questions in this study. The initial self-assessment judgement might not be the end of self-assessment process, but possibly prompt continuous calibration. As Boud, Lawson, and Thompson (2013) argued, and as revealed in this study, calibration cannot be done in isolation and needs the input of others, especially recognised experts in the domain being learned.

The cyclical self-assessment process presented in the current study shares some similar elements to those identified in previous studies (e.g. Andrade and Du 2007; Fastré et al. 2012; van Diggelen, den Brok, and Beijaard 2013), such as performance criteria, feedback and continuous improvement. These elements were useful in addressing 'what' questions (i.e. what elements are included in self-assessment). By unpacking the inner process of self-assessment, this study takes a further step in understanding the micro-processes of self-assessment and attempted to answer 'how' questions (i.e. How do students conduct self-assessment?). In particular, the cyclical self-assessment process addressed important issues, such as the sequences and common actions used by students in the self-assessment process, the sources of information students use to inform self-assessment and the ways by which students gather relevant information or feedback to formulate self-assessment.

Pedagogical implications

This model of self-assessment has substantial implications for pedagogical practice. Attention needs to be given to ensuring students know how to seek feedback from trustworthy, high-quality sources and how to evaluate work using appropriate standards. Since a major goal of education is for students to exercise metacognition and regulation of their own learning processes for successful entry to professions, it is important that they know how to seek valid feedback and make appropriate judgements about their work. Because students seek feedback in a self-directed fashion when making self-assessments, it is important they have an appropriate appreciation of the desirable characteristics of a dependable feedback type and source. This suggests teachers need to help students differentiate between constructive and irrelevant feedback sources; simply presenting a scoring rubric is not enough. Students need to learn the principles by which a profession makes judgements about quality and those processes have to become explicit to future members of the profession.

It has been suggested that, without making principles of outcomes-based educational decision making explicit, students will not be able to detect the theory on which such decision-making is based (Deneen et al. 2013). Thus, appropriate training and focused intervention programmes are needed to nurture students' beliefs and competency favouring feedback seeking. Therefore, developing these competencies in students should be a major objective of learning within a domain. This is important because in professional life after higher education, relevant feedback may not be readily available or sufficient. Fortunately, the current sample of students showed strong willingness to seek feedback and had an adequate capability to identify useful feedback. Whether this willingness is a universal or simply a function of being trained in an outcomes-based programme cannot be determined at this point. Nevertheless, if students perceive that there is a low emotional, psychological or social cost in active feedback seeking, the more likely they will be able to calibrate their self-assessments.

Thus, efforts need to begin in developing a curriculum for student self-assessment that identifies pedagogical tools and processes by which students can learn to identify appropriate feedback sources, and ways of evaluating their own work relative to appropriate standards (Brown and Harris 2014; Yan 2016a). The current study reveals processes that students have developed themselves which need to be replicated throughout the educational system.

Conclusion

Notwithstanding that this is an initial attempt to unpack the inner process of self-assessment based on a relatively small sample, the findings of this study have potentially important implications. The self-assessment process has been described as hidden and blurred in a 'black box' in literature. This study has identified, through largely anecdotal but conceptually relevant data, a cyclical self-assessment process that involves a sequence of first determining relevant performance criteria, seeking feedback, self-reflection and gradual calibration of judgements. A better understanding of the self-assessment process helps reveal the reasons why so many self-assessments seem out of touch with external realities; developing all these competencies is not easy but is achievable. The study supports the idea that

self-assessment skills can be learned by students, but further work needs to be done to establish how these skills might be best taught.

More studies are needed to obtain a comprehensive picture of self-assessment. For instance, although this study attempted to examine the role of internal source feedback in the self-assessment process, the range and strength of evidence was weak, leaving unanswered such questions as: What are the mechanisms by which internal feedback influences self-assessment? How do students reconcile internal and external feedback? How can we differentiate constructive and irrelevant internal feedback? This study has pointed to the possibility that engagement in self-assessment and the calibration process of reflecting on multiple sources and multiple experiences may eventually lead to accurate or veridical self-assessments. Therefore, it would be productive for future research to identify the relationship between the self-assessment process and the development of realistic self-assessment. That is, what particular self-assessment patterns lead to a more accurate self-assessment judgement?

Furthermore, while it is of interest to understand the process of student self-assessment, the effectiveness of the processes derived from these interviews remains untouched. It is not known whether the processes described contribute to greater awareness of and performance in the relevant domain. Neither is it certain that these processes, assuming they help teacher education students function more effectively, would remain constant and effective in different disciplines or contexts. The relationship between the self-assessment process and its impact on learning is an important topic for future studies.

One limitation of this study that should be addressed in future investigations is related to the sample. First, although the self-assessment process could be confidently regarded as a general mental process, and there is no evidence supporting any specific relation between self-assessment process and student background, the sample used in this study consisted solely of undergraduates from a teacher education institute. Future investigations should test the claims made here using different samples or in a context other than teacher education. Second, using one's own students as interviewees, even though they are not current students, still has some risks of social desirability. Future studies ought to minimise possibilities of reflexivity, though the more intimate relationship may have generated better quality data. Last, but not least, cultural variations should be taken into account to understand the nature of self-assessment and its power to contribute to learning. Caution should be taken when generalising the findings of this Hong Kong study to other cultural settings. Future studies should attempt to investigate cross-cultural factors that impinge on self-assessment.

Nonetheless, this study contributes to the field of known unknowns in student self-assessment by shedding light on the mechanisms and structures that students use when asked to self-assess.

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