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# Designing complex, challenging and creative assessments for work preparedness: A review of competency-based assessment

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## ABSTRACT

This review article reports on assessment practices drawn from the recent international Technical and Vocational Education and Training (TVET) literature. The literature suggests that college tasks, if they are to be valid, need to assess something of the complexity of the social and material variances of authentic work situations. This is referred to broadly as a form of competency-based assessment (CBA), which is an advance on earlier, more limited technically orientated CBA interpretations. The purpose of the article is, first, to provide teachers with snapshots of innovative practices from CBA in order to enrich their understandings of assessment. Secondly, it is proposed that the CBA literature may provide the sector with assessment tools to mitigate some of the criticisms of current assessment practices in quality reviews.

## KEYWORDS

*Competency-based assessment (CBA), assessment for work, authentic assessment, assessment principles*

## **Introduction**

‘Assessment drives learning’ is a much-used dictum in education, reflecting the significant role assessment plays in the curriculum (Ramsden, 1992). Despite this assertion, much less attention has been paid to assessment than to other facets of the vocational curriculum, such as instructional design and pedagogy (Achtenhagen & Winther, 2014; Gulikers, Runhaar & Mulder, 2018). As testimony to this, the desktop research conducted for this article was able to locate only approximately 46 international and local articles focused primarily on internal college-level vocational assessment. Similarly, Yusop, Rasul, Yasin, Hashim and Jalaludin (2022), in their Technical and Vocational Education and Training (TVET) assessment review, were able to narrow their research to 29 assessment articles between 2015 and the present.

This review article reports on research into college-level vocational assessment practices from the past 15–20 years. Vocational education in the TVET sector is qualitatively different from more regular schooling, as it is based on actual work practices in workplaces rather than being based primarily on the acquisition of bodies of knowledge in disciplines (Stenström & Laine, 2006). Vocational education looks outwards from the college to the workplace, possibly assisting students to work across and bridge the boundary between college and employment. A key assessment approach is therefore that of competency-based assessment, or CBA, in which the competencies are those that are required in workplaces. This focus on CBA is commensurate with other review work on assessment in the TVET sector. For example, Yusop et al. (2022), in their assessment review article, note that nearly half the articles they cited were CBA-based. However, the percentage of CBA was most probably much higher as they classified assessment articles according to whether the authors had self-identified assessments as, for example, portfolio, scenario, criterion-based and formative assessments. As was found in this review, many such recent assessment approaches are also CBA-focused.

All the articles examined in this review dealt in one way or another with the affordances offered by more recent versions of CBA. These newer versions of CBA are characterised by a focus on designing more integrated, challenging and authentic tasks as opposed to the previously itemised and technically orientated assessment types found in vocational education.

Accordingly, this article, through focusing on the design and delivery of CBA, does not deal centrally with issues of the administration and moderation of assessments. Furthermore, the article focuses on CBA as part of the curriculum, predominantly within the college environment itself or in isolated college-supervised work events rather than on assessment during more extended periods of experiential learning. In so doing, the article draws on the distinction made between assessment for work preparation and assessment of and at work (Brennan & Little, 1996), the former being within the primary ambit of college staff. One advantage of assessment for work conducted in the college is that it is possible to expose students to a range of potential tasks ‘all at once’ in addition to affording them the opportunity to learn from their mistakes – a luxury not always afforded students during work placements (Berner, 2010; Öhman, 2018; Schwendimann, Kappeler, Mauroux & Gurtner, 2018).

Through highlighting the ways in which CBA has been used productively, it is hoped that this review article will provide current vocational lecturing staff with a mirror against which they can critique their own practices and perhaps expand their assessment repertoire.

In so doing, and more specifically, this article may also help lecturers, managers and policy-makers to respond to some of the issues raised in the South African *Report on the Quality Assurance of the Examinations and Assessment of the National Certificate (Vocational) and NATED N2–N3* (Umalusi, 2015). For this reason, a summary of the report is given below.

While acknowledging that much has already been written about CBA, this article attempts to consolidate understandings of and suggestions for the implementation of more recent forms of CBA from various countries and sources. Following on from this purpose, the aim is that this consolidated understanding can be used to help TVET staff expand and improve on their assessment repertoires and practices, in part responding to criticisms of current practices.

It must be pointed out that this is a review article of the available literature on assessment rather than an empirical article on actual practices carried out in South African colleges. While recognising this as a limitation, it is the intention of the author to use the review findings as an analytical framework with which to examine current practices in future research. This work is planned for the second half of 2022.

### **Umalusi quality report on assessment**

The quality assurance body, Umalusi (2015), raised concerns about the quality of assessment in the TVET sector in South Africa. Although much of the criticism centred on examination and moderation systems and other procedural issues – for example, the lack of internal moderation and non-adherence to the subject assessment guidelines – concerns were also raised about the suitability, quality and cognitive demand of some of the in-house college assessment practices.

The current assessment practices in the TVET colleges were criticised for not providing room for student creativity or sufficient cognitive challenge (Umalusi, 2015:62, 80). Umalusi suggested that there should be more adherence to cognitive analytical frameworks such as Bloom's taxonomy. The tasks set tended to be more theoretical rather than challenging students about how knowledge and skills can be used in actual practice (Umalusi, 2015:38, 80). This was the case with technical subject assessments, such as those for plumbers and electricians, with business or social assessments, such as those for tourism, and with core subjects such as Mathematics, Language and Life Orientation (this difficulty was also raised by Sephokgole and Makgato (2019) in their analysis of TVET college assessment practices). There was, furthermore, a need to 'better link theory to practice' and provide students with assessment experiences that develop and cement this link (Umalusi, 2015:128). What may provide benefit here, it is suggested, would be more involvement of stakeholders from the target workplaces (Umalusi, 2015:82).

Secondly, the assessment tools used are often criticised in the report for being ‘inferior’, with limited ‘opportunities to assess skills, attitudes, values and reasoning’ (Umalusi, 2015:5–18). Finally, students are not always provided with post-assessment feedback to guide them towards improving their performance (Umalusi, 2015:49) – a point also raised by Nkalane (2019) in her study of TVET business assessment practices.

## **Method**

This review article is based on an analysis of trends in vocational assessment reported on in the literature over the previous 15 to 20 years. The author first targeted the main vocational journals in the field and searched for articles with ‘assessment’ in their titles or keywords or discussed substantively in the text. The journals investigated were:

- *Empirical Research in Vocational Educational and Training*
- *International Journal of Vocational Education and Training Research*
- *Journal of Education and Work (JEW)*
- *Journal of Workplace Learning (JWL)*
- *Journal of Vocational Education and Training (JOVET)*
- *Journal of Vocational, Adult and Continuing Education and Training (JOVACET)*
- *Nordic Journal of Vocational Education and Training*
- *Vocations and Learning*.

Secondly, a search was performed for ‘vocational assessment + colleges’ more generally as some assessment articles were published in other journals. Some reports on vocational assessment in different regions were also uncovered (for example, in Australia and Europe) and these were mined for evidence of assessment trends. Articles which dealt predominately with assessment in workplaces (during Work-integrated Learning (WIL)) or higher education were eliminated, leaving a core sample of approximately 41 articles and five reports which formed the basis for the trends reported in this article.

The review broadly followed the structure of a systematic review in that there was a reproducible search strategy and further explicit criteria for screening articles for inclusion or exclusion were applied (Evans, Menaca, Andrew, Koffman & Harding, 2012). A key overall trend in assessment practices emerging in the articles sourced was that of CBA, which constituted a theoretical framework that enabled the author to thematically analyse the data gathered. Such thematic, theoretically based analysis is characteristic of a critical, systematic review (Evans et al., 2012). Furthermore, in a critical review the reviewer wishes to gain an enhanced understanding of problems in the field so that gaps can be identified and improved practices suggested, rather than simply reporting what others have stated (Eva, 2008).

The reader will note that in the present article some articles are more extensively referenced than others. These were authors who appeared to have impact in the field. For example, 16 of the 46 articles reported on here make reference to Gulikers (2011), and the Sluijsmans et

al. (2008) and Poikela (2004) articles are quite highly referenced more generally, at 58 and 45 citations respectively. One or two earlier articles were also included because they highlighted key principles (for example, Inman & Vernon's (1997) reference to assessment for, of and at work, with 27 citations).

The following section explores the way the authors reviewed in the article understand more recent versions of CBA, and some of the principles these authors suggest should underpin this important assessment concept.

### **Principles of competency-based assessments**

Vocational competency, in more general terms, refers to the knowledge and skills which can be used to solve specific workplace problems and which can be taught and in this way be made available to students (Monnier, Tschöpe, Srbeny & Dietzen, 2016). CBA is therefore derived from the kinds of problem typically experienced by workers on the job in specific contexts (Biemans, Wesselink, Gulikers, Schaafsma, Verstegen & Mulder, 2009:268). Competency-based learning and assessment practices may in the past have focused more on an individual's acquisition of isolated technical skills, particularly at British colleges (Rolle, 1996; Inman & Vernon, 1997), or such skills with their underpinning knowledge and attitudes (Garavan & McGuire, 2001), which was more typical of European vocational education (Brockman, Clarke, Mehaut & Winch, 2008). However, because of the nature of educational institutions and their need to measure skills precisely, often based on curriculum standards, assessment designers may have reduced assessments to easily measurable atomistic tasks which did not capture the real skills and knowledge required in workplaces. In such instances, students' focus may then be on passing tests rather than on being motivated to develop appropriate workplace competencies (Ehman & Roth 2008). Furthermore, as Kvale (2007) points out, the messy, incomplete and often contradictory nature of real-world problems is difficult to capture and measure through more typical institutional standardised tests and exams.

The more recent trends in competency-based learning and assessment have accordingly progressed beyond an individual's possession of isolated technical skills, knowledge and attitudes. Assessments have rather developed in the direction of focusing on the way in which skills, knowledge and attitudes may be articulated within the variations and complexities of the social and material settings typical of authentic workplaces (Brockman et al., 2008; Gulikers, Bastiaens, Kirschner & Kester, 2008; Sluijsmans, Straetmans & Van Merriënboer, 2008; Department of Training, Australia, 2013; Rausch, Seifried & Wuttke, 2016; Gulikers et al., 2018).

Gulikers, Bastiaens and Kirschner (2004) highlight a key facet of validity in vocational assessment: construct validity. This refers to whether the assessment reflects real-world purposes and the kind of thinking required by experts. Furthermore, the authors highlight the fact that a valid assessment should also support desirable forms of learning in the

curriculum, or consequential validity. This concept of ‘consequential validity’ relates to Biggs’ (2012) principle of constructive curriculum alignment.

Somewhat surprisingly, given that this was originally a higher education concept, constructive alignment is referred to specifically as an important assessment principle in CBA by Stenström and Laine (2006), Sluijsmans et al. (2008), Gulikers (2011), the European Union review of vocational assessment (CEDEFOP, 2015) and Gulikers et al. (2018).

The rationale for using this traditionally higher education principle becomes clearer, however, when assessment is considered to be a means of promoting students’ ability to operate competently in complex social and material work environments – which is underpinned by higher-order learning and is a key component of CBA.

In the CBA-oriented articles referred to here, validity is mostly anchored to the concept of ‘authentic assessment’, or assessment which mirrors real-world problem-solving, which is itself a core principle of CBA (Gulikers et al., 2018; Yusop et al., 2022). Principles of reliability, fairness and the related concept of formative preparation are in turn embedded in the use of criteria in integrated holistic assessment approaches (see, e.g., Sluijsmans et al., 2008). Authenticity, the design of integrated, holistic assessments and the use of criteria as key CBA principles are further elucidated below.

### *Authenticity in assessment*

Authenticity refers to replicating, as closely as possible, the actual conditions students will encounter at work without their actually being at work (Gulikers et al., 2008:402). Such assessment should, furthermore, correspond to, or at least link to, their college learning (Rusalam, Munawar & Hardikusumah, 2019). Case studies, roleplay, simulations and contained and structured ‘real situations’ are all used as authentic assessment methods (Gulikers, 2011). Authenticity is not just about replicating regular tasks but also about how these tasks may carry an element of surprise or upset, requiring quick response and creativity, and the ways in which they may occur in the social and material systems of workplaces, often over more extended periods. These latter observations are drawn from Herrington, Parker and Boase-Jelinek’s (2014) conceptualisation of authentic assessment in the school or university classroom, and include teamwork and group reflection, which also serves to incorporate something of the social aspects of solving workplace problems.

One approach to authentic assessments is to choose ‘critical incidents’ to showcase what matters in a field and about which appropriate decisions have to be made and courses of action followed (Schwendimann et al., 2018). These are typically complex problem-solving situations that new employees will be exposed to. Lecturers can seek out such incidents through working collaboratively with their respective workplaces and transform them into problem-solving tasks (Achtenhagen & Winther, 2014). Such collaboration helps to shift assessments from an internal, curriculum-oriented process to a more outward-looking focus,

as well as providing a bridge between the two sites. The usefulness of assessment design collaboration more generally is described in Northern Europe as the 'tripartite system' (Stenström & Laine, 2006). Here, students, lecturers and workplace representatives are involved in the co-construction of assessment tasks.

However, as Monnier et al. (2016) point out, the social skills required at work are difficult to pin down in any concrete fashion, and are even more difficult to access successfully in college tasks. This difficulty may explain why, despite the evidence of the effectiveness and predictive value of authentic assessments, they are often avoided by college teachers (Sluijsmans et al., 2008; Gulikers et al., 2018).

A further rationale for teachers' resistance to assessing social skills is their potential variability. While the social skills that are characteristic of particular occupations may be identifiable (Winch & Clarke, 2003) and therefore assessable, different firms within the same broad occupation may valorise some skills over others (Brockman et al., 2008). For college teachers, therefore, it may make more sense for students to learn these social skills during work practice rather than their being constituted and taught as some form of standardised and assessable curriculum item.

Gulikers et al. (2004) and Gulikers, Bastiaens, Kirschner and Kester (2006) have developed a series of criteria for evaluating the authenticity of assessment tasks set within the ambit of the college curriculum. The authors highlight the need for representing as much of the complexity of a real work situation as possible in student learning. In addition, students need to be willing to engage in such tasks and understand what is required of them. The authors have attempted to capture as many as possible of the dimensions of authenticity discussed above in a series of criteria, each of which may be allocated a score according to its resemblance to real-life situations. Their proposed criteria (after Gulikers et al. 2004) are:

- How real is the content of the assessment task? Does it reflect the kinds of task and problem typically found at work, which involve the integration of knowledge, skills and worker attitudes?
- How appropriate is the form of the assessment task in relation to the actual work practice? Is it, for example, a test or an exam, a roleplay, a simulation or a case study?
- Is the assessment meaningful for the student? Do they understand its relevance to their future vocation?
- Do the physical conditions in which the task is conducted reflect real-world messiness or disorder (for instance, a clean college workshop where time is not of the essence in completing tasks versus a noisy, messy work environment in which a task needs to be completed rapidly)?
- Are the criteria used to measure success those that are important in real work situations? Furthermore, are students apprised of what they will be expected to do and what level of performance is required?

- If the authentic work task typically involves social interaction and group decision-making, are these catered for in group activities? (Alternatively, the task may involve individual problem-solving and decision-making instead.)

As Engeström (2009) points out, though, attempts to make school practices authentic are always moot, because authenticity derives from the objective of the activity and the context in which it occurs. In college assessments, the object would be overt testing or learning rather than ‘doing the work’.

A further issue is that what teachers may see as ‘authentic’ may not be viewed in a similar light by students (cf. the third bulleted criterion above). The problem may be that whereas teachers interpret and reassemble a work situation for educational purposes, the resultant assessment task may no longer manifest itself as authentic to the students. The students may as a consequence be less motivated to engage with the assessment. Gulikers et al. (2008) therefore suggest that teachers and students first discuss a task. During such discussion, the task of the teacher should then be to highlight why the task is authentic and why it is done in the way proposed according to such-and-such criteria.

### *Holistic, integrated assessment*

Gulikers et al. (2018) suggest that for CBA to be effective, lecturers need to understand what is meant by ‘competency’ and how competency may best be assessed. First, workplace competencies are complex to measure and cannot be determined by simply displaying knowledge of technical skills (Gulikers, 2011). Furthermore, competencies cannot be measured as a number of separate pieces of knowledge and skills (Johnson, 2008). They need, rather, to be assessed in an integrated, holistic fashion (Gulikers et al., 2018). Holistic assessments should therefore be an attempt to overcome the ‘disintegrative’ list of competencies favoured by vocational assessors in the past (Biemans et al., 2009:268). Furthermore, a number of CBAs of a similar type at the same level of demand should be applied in order to capture students’ ability to cope with contextual variation. A need exists, therefore, for contextual, holistic and complex forms of assessment to be applied that focus on assessing multiple competencies rather than a single competency (Gulikers et al., 2018). In addition, CBA should involve different forms of assessment, such as simulation tasks, roleplay and paper-based cases.

Furthermore, the concept of holism in assessment highlights the fact that competencies are complex and multi-faceted qualities. CBA therefore needs to be integrated within a framework of increasingly complex tasks, with simpler tasks building up to more complex ones, with the later tasks being most similar to real workplace tasks (Gulikers et al., 2018).

### *Assessment criteria for reflection and learning: The role of feedback*

Assessment criteria provide an important tool with which to direct students towards what it is they are expected to focus on in their assessments. They are therefore integral to ensuring

the fairness of assessment practices (Bloxham & Boyd, 2007). In vocational assessment, as well as in other forms of assessment, authors recommend that the assessment criteria to be applied be discussed with students before they are assessed so that the assessment requirements and criteria are more fully understood (Sluijsmans et al., 2008). By doing so, vocational students may be helped to grasp the real-world relevance and importance of the assessments, in this way helping them to improve their motivation to engage with them.

Reflection requires students to take stock of what they need to bring to a task and which gaps need to be explored (and closed) in the moment, in addition to the new knowledge and skills that may be required for future similar tasks. Authors refer to Schön's (1995) helpful distinction between reflection before action, reflection in action on what is happening during a task, and reflection after a task on the efficacy of the students' actions. One aspect of such reflection is sometimes also the repurposing of taught skills and knowledge from the classroom to the often-novel task at hand; in other words, the development of the working knowledge required to complete a certain task satisfactorily (Poikela, 2004; Schwendimann et al., 2018).

Reflection forms an important function in the process of learning from assessment; it can influence the extent to which students are able to learn from experience, which is understood to be a valuable workplace ability (Schön, 1995; Akkerman & Bakker, 2012). Specifically, workers are often required to perform in circumstances that are different from prior experiences and learning, however small or substantial those differences may be, and they therefore have to be able to detect differences and adapt their performance to new situations (Rausch et al., 2016).

Assessing in this way may provide some measure of what Walker, Link and Nickolaus (2016:5) refer to as 'fluid intelligence', or the ability to transfer learning across similar tasks in a field. As suggested by the authors, the ability to transfer learning is an important, though often underrepresented, component of CBA.

Furthermore, professional and vocational competency is more than simply showing an ability to use the right skill and knowledge in a particular work situation; it is also about possessing the ability to attune one's knowledge and skills to the work culture. For example, who else should be involved in solving a problem in accordance with the particular rules and procedures of the workplace (Poikela, 2004)? Being able to conduct such reflection may go some way towards resolving difficulties in working with and assessing variances in social skills – a point raised earlier about the need to reflect variance and the difficulty of doing so (Winch & Clarke, 2003).

Furthermore, Poikela (2004) suggests that a true measure of competence should include attempts to measure processes that students select and take towards task accomplishment. The author therefore suggests the formulation of assessment criteria which can be applied to these learning processes. For example, those assessment criteria which zoom in on the reflective and social processes students undergo when working on the assessment.

### *Summary of principles*

In summary, current conceptions of CBA expose students to realistic or authentic situations. Doing so necessitates a number of skills and knowledge being mobilised holistically all at once and involves formative or learning elements, assisted by the use of appropriate assessment criteria and student reflection. The need for assessment experiences to be authentic requires that assessment tasks should be designed in collaboration with workplaces and should as closely as possible match realistic and complex workplace contexts (see Gulikers et al.'s (2004) authentic criteria above) – for example, by simulating critical incidents. Such incidents often involve creative responses on the part of students, and some decision-making. Holistic tasks integrate the assessment of related competencies, including social and dispositional aspects, and use a variety of challenging assessment types. Furthermore, the assessment of competencies should ideally be graduated: from simpler (i.e. challenging but involving fewer variables) to complex, and with sufficient feedback to support student learning at the different stages. Feedback can be enhanced by providing assessment criteria, which are preferably to be discussed with the students before their assessments are performed. Criteria can also be used as a tool to promote students' reflection on how they have approached their assessment tasks and whatever else besides that they need to respond to.

The following section gives examples of initiatives in CBA design, drawn from the available literature, to illustrate the incorporation of the above principles of CBA.

### **Exemplars of CBA from the literature**

Writers of the articles referenced in this assessment review were mostly concerned with developing authentic and holistic assessments which represented the complexity of real work activities that could be delivered predominantly in the institutional environment. The assessment tasks were therefore mostly in the form of case studies, roleplay and simulations. Simulations could further be divided into those that were practical and interpersonal and those that were computer-generated, although still interactive. Approximately 10% of the articles reviewed also dealt with portfolio or reflective journal assessments. Accordingly, the exemplars of CBA are divided into three sections: practical case studies, roleplay and simulations; interactive computer-assisted simulations; and portfolio and journal assessments. As stated above, the cases were selected because they exemplified the principles underpinning CBA; in addition, many of them were drawn from the most strongly referenced authors in the review (Gulikers, Sluijsmans, Stenström and Poikela).

#### *Practical case studies, roleplay and simulations*

Attempting to measure multiple competencies in a single assessment may involve too great a cognitive overload for students, and it may also be difficult to identify where 'gaps' in their knowledge and skills lie and what can be done about them. Furthermore, a single

assessment event may not capture all the real-world contingencies that a student will encounter at work. Sluijsmans et al. (2008) therefore suggest that a raft of linked, developmental and summative assessments at different levels of complexity be employed, using different methods. This is a task-focused curriculum model which closely ties the curriculum to assessment, drawing on Biggs' (2012) concept of constructive alignment. A key component of this model is the identification of sub-competencies as criteria which are assessed reiteratively across the different tasks, thus both ensuring a more valid measure of competency and also being able to identify more precisely where problems might lie – which can then be dealt with through further supportive instruction. The example given is the training of a security guard in the competence of 'supervising a public space'. This involves the sub-competencies of recognising problems, managing conflicts and using adequate conversational techniques.

This means that tasks are set at different levels of complexity. For example, a public space under normal conditions, one when there are market stalls, and another under conditions of a large-scale event such as a concert. At each level, the students engage with written tasks, simulations and roleplay or real tasks for which they are observed in situ, all at the same level of complexity. In addition to differing in method, the tasks at each level start with much support, which is gradually withdrawn, until the final task at that level can be used as a summative assessment. Once they have passed that level of assessment, the student can move to the next level of complexity. Theoretical and procedural knowledge (e.g. writing a ticket) is provided in accordance with the needs of the particular task. As Sluijsmans et al. (2008) note, the approach can be flexible here because the students may have different prior learnings. During the assessment process against the required sub-competencies, the students effectively build up a portfolio of evidence of what they can do well, as measured against their knowledge, skills and attitudes, and what may need further attention.

The authors acknowledge that the assessments do not effectively measure groupwork and decision-making, something that also needs to be built in to improve the validity of assessments. One example of assessing social competencies in healthcare work is suggested in the scenario or simulation assessment given below. Although such competencies are generally important in most workplaces, they have a particular relevance to lower-level health workers (Monnier et al., 2016). The first stumbling block to such assessments is defining exactly what is meant by 'social competencies'. Are they, for example, about interpersonal communication, understanding others or personal attitudes such as showing assertiveness? And under what conditions should these skills or competencies be demonstrated? Such competencies, Monnier et al. (2016) assert, are likely to be strongly specific to particular fields and situations. In order to get around this problem, Monnier et al. (2016) asked health workers in the field to suggest some typical 'critical incidents' in their day-to-day work and the kinds of socially oriented responses that could actually occur. Their responses were then graded according to their situational and professional appropriateness. From these it was possible to develop three core competencies: emotional

regulation, perspective coordination and communicative strategies. These could be further broken down into three different locations, each with its associated contexts (hospital reception, ward and meeting room) and whether they concerned mostly internal (e.g. ‘Do I need to be more assertive?’) or external (e.g. ‘Do I need to calm a patient down?’) conflicts.

The next stage is to develop a simulation or roleplay as a video clip of an interaction related to the critical incident. Students are then asked to pass judgement on the interaction and provide answers to open-ended and multiple-choice questions regarding what action they would take. In this way, there was room for creativity in passing judgement. These were assessed using graded criteria (from most to least appropriate), based mostly on the grounded expertise of practitioners (computer-assisted assessments are discussed below).

A further refinement of the critical incident concept is advocated by Gulikers et al. (2018:217). The authors suggest that CBA tasks should include ‘situated professionalism’, which refers to the particular fashion in which generic competencies play out in different fields (e.g. problem-solving in plumbing as opposed to accounting).

The authors therefore propose a system that both assesses students’ competencies and helps teachers to design and grade assessment tasks. In their vocational assessments, employers and teachers identify ‘critical tasks’ that students will be expected to perform at work. One or more of these is used to design a representative and authentic case study which integrates knowledge, skills and attitudes. The next stage is to select the four most relevant generic competencies for the particular case and to articulate these in the vocational field and the demands of the critical task set in the case (in the Netherlands, for instance, there are 18 national generic competencies for vocational education). For example, in the case of floristry training (Gulikers et al., 2018), under the generic of ‘professional expertise’, the student must select flowers by shape and colour appropriate to the requirements of the customers. These then form the competencies to be assessed when students work on the assessment case. The underpinning knowledge, skills and attitudes associated with these competencies are then covered in documentary (materials for students) and classroom teaching provision but they are not directly assessed. The design of the actual assessments is devised by groups of teachers (and sometimes employers).

Once the generic competencies, knowledge, skills and attitudes have been identified, the teacher groups are engaged in discussions about what constitutes a CBA approach. For example, more expert assessors would raise the six dimensions of ‘authentic assessment’ in CBA (see above), as described by Gulikers et al. (2004). In being so exposed and undergoing the above steps, the researchers claim that teachers gain an enhanced understanding of the competencies in their respective fields and the best way to assess them. Once the design has been completed and the tasks implemented, two assessors then grade the students on their planning of how to do things, their actual performance and their justification for their actions. Although this is not specifically stated, it is assumed that students are observed in some form of simulation of the case, in addition to through written and oral responses.

In interviewing students who have completed this style of assessment, Gulikers et al. (2018) report that students gain a better understanding of the requirements of the field and of what they know and can do in relation to this – which is a measure of their own self-efficacy.

### *Interactive computer-assisted simulations*

Authentic CBA tasks are often problematic to design because they may require individual observation if they are ‘hands-on’ or they can lose some of their authenticity if they are answered in written form (De Klerk, Eggen & Veldkamp, 2014). Observations are, furthermore, difficult to standardise. One solution is to design computer-based simulations (De Klerk et al., 2014). A problem with such simulations, though, is that they have to be authentic enough to cover a variety of possible contexts, but they cannot at the same time capture particular organisational cultures (Achtenhagen & Winther, 2014). One useful response to this problem in computer-simulated assessment design is to gather a diverse group of field experts or employers, to highlight typical field-related tasks and to develop assessment criteria accordingly that apply to a variety of authentic contexts (Achtenhagen & Winther, 2014).

In Gekara, Bloor and Sampson’s (2011) ship maintenance example, the simulation is performed entirely on a PC by individuals and groups of students. Scenarios illustrating authentic mechanical problems are designed by mechanical engineers in the field and transposed by teaching staff into IT simulations. The students are first required to prime the engines to work most efficiently under different circumstances and they are then assessed on their adoption of the appropriate protocols (instrumentation, flue lines, air flow, etc.). Subsequently, the simulation shows the engine running but a problem occurs, as signalled by an alarm. The students then have to analyse the problem within a time limit (they get marked down for taking too long) and effect solutions, which are then assessed for their appropriateness. One problem acknowledged by the authors is that only a limited number of typical problem scenarios have been developed and that students are able to prepare for these rather than having them problem-solve from basic principles. One solution would be to develop a large number of problem situations, but this takes time and resources.

At higher levels of problem-solving in the VET sector, electrical technicians being trained to operate automated systems (e.g. conveyor belts) can be assessed using computer-generated scenarios (Walker et al., 2016). In this approach, lecturers and employers collectively generate analytical scenarios in which students have to troubleshoot problems through arriving at proposals for their correction. At a higher diploma level, students actually have to design programmes to improve the efficiency of the conveyor.

The above computer-based assessments are mostly technically orientated. Again, they do not necessarily cover the more social aspects of work nor do they assess the additional complexities that go with this. Therefore, these assessment methods may not be as authentic as the designers had hoped for. De Klerk, Eggen and Veldkamp (2014; 2018) propose a more complex form of computer-based assessment: multi-media-based problem assessments, or MBPA. Here, real

work situations are first identified. After that, the lecturers, with workplace assistance, design scenarios which highlight problematic situations or behaviours that a student must recognise as requiring attention. These problematic situations are then videotaped and the resultant scenarios are used as assessment tools. The students must then suggest ways in which the social problem could be resolved; they do so by typing a solution in a drop-down textbox.

In Rausch et al.'s (2016) modelling of domain-specific competency assessments in the secretarial or clerkship field, there is an attempt to capture and measure more complex behaviours, albeit again at an upper-secondary or diploma level. The students are first presented with a quite detailed computer-generated virtual tour of, for example, a bicycle manufacturing company, its offices, capabilities, working conditions, etc. They are then presented with different problem-solving scenarios: for example, whether to buy a particular model for resale or to manufacture the bicycle in-house. As the students work through the scenario, they are offered 'prompts' which are aimed at assessing their motivational and self-concept issues. Drop-down menus ask the students to select whether, for example, they feel nervous or not during a particular stage in the decision-making. The object is to derive a sense of the ways in which students approach problems and the extent to which they are able to learn through and respond appropriately to difficulties. The students are also required to apply and develop knowledge through gap recognition and metacognitive processes (e.g. reflection, planning and monitoring). The inclusion of these different factors – for example, knowledge development, metacognitive application and dispositional factors – in assessment in open and dynamic problem-solving situations confers on the task what the authors refer to as 'ecological validity' (Rausch et al., 2016:7). Such validity reflects some of the more personal and social difficulties students may encounter in workplaces, which may in turn influence their problem-solving ability.

Online CBA has a particular resonance with business fields, because much work is already conducted online – for example, preparing invoices, reports and financial statements and responding to queries via email (Achtenhagen & Winther, 2014).

The computer-based assessments reported on here may provide a viable method for assessing students' responses to complex problem-solving situations which otherwise would require actual observation in work situations. Such assessments may also involve students having to work with social and dispositional factors. As Rausch et al. (2016) and De Vos, Baartman, Van Der Vleuten and De Bruijn (2019), acknowledge, however, more work still needs to be done on successfully embedding such factors in assessments. Two related issues which are not highlighted are, first, the quite high level of technical assistance required to construct these assessments and, second, the time teachers would need to devote to assessment design.

### *Portfolios and journals*

In general, a portfolio will attempt to group a number of competencies that need to be assessed into one coherent whole (Mukhtar & Ahmed, 2015). As with other forms of assessment, the evidence presented by the student is assessed against set criteria. In the

Assessment Guidelines (DOE, 2007) and the Umalusi (2015) report, the use of portfolios is based more on the concept of a 'portfolio of evidence' of students' learning. Here, the students are expected to provide a collection of assessment tasks that have previously been assessed by their teachers.

Portfolios (and learning journals), as mentioned in the articles sourced in this study, on the other hand, are referred to as a means of testing whether curriculum objectives have been met in an authentic, holistic and integrated fashion (Nore & Lahn, 2014). They are typically used as a means of relating what is learnt at college to sites of application in workplaces or to practical tasks in the college context. In this way, they serve a theory–practice bridging function or one between the two sites (Enochsson, Kilbrink, Andersén & Ådefors, 2020). In so doing – as was also suggested with bringing critical incidents into assessments – this assessment method may also bring together workplace supervisors and college instructors in the design and practices of assessment tasks (Stenström & Laine, 2006).

Journals and portfolios are also used in vocational education as a form of formative assessment through promoting students' reflection on gaps between their college learning and actual practice, and as a guide to the initiatives they may need to take (Mukhtar & Ahmed, 2015) to fill those gaps in their knowledge and/or skills. They therefore frequently draw on Schön's (1995) model of reflection in planning tasks, in the process of conducting tasks and, finally, after the completion of tasks. As portfolios and journals cover an extended period and involve assessment criteria, there is much opportunity here for teachers to provide feedback to students on where their work could be improved.

Left-hand–right-hand reflective narrative learning journals are suggested by Inman and Vernon (1997) as both a reflective tool and a form of assessment. More specifically, Schwendimann et al. (2018) propose the use of structured online learning journals for bakery apprentices (these can be used during periods at work or at the college). The journal attempts to meet the need for apprentice bakers to develop metacognitive skills that help them to respond to changes, solve problems, maintain current learning and seek new learning.

Becoming a baker in the modern industrial world involves much more than learning and making recipes (Schwendimann et al., 2018). To this end, students of baking are required to record their recipes learnt on the left-hand page of their e-journal and to respond to metacognitive prompts about the recipes on the corresponding right-hand page. Students write about critical incidents on the right-hand page in response to prompts provided by teachers, such as 'in this recipe I must pay attention to ...' and 'I still have to learn ...', and they receive feedback from their teachers on these responses.

Reflective journalling may also be conducted orally. For example, it may be conducted through 'assessment discussions' (Stenström & Laine, 2006:26). Here, students doing practical assessments are encouraged to self-evaluate against criteria and so identify areas for further development (although not specifically stated, the assumption is that students are

prompted with questions such as ‘What problems did you encounter?’ and ‘What areas require further development?’).

An interesting version of the assessment discussion as an ‘interactive classroom dialogue’ is described by Öhman (2018:426). Hairdressing students work with their teachers on mannequins and are encouraged to come up with new ways of hair design in response to the teacher’s input. Here, feedback is embodied in actual practice and is two-way, serving as assessment of appropriate concept-practice links and at the same time supporting learning and the development of creative insights (Öhman, 2018). In this sort of feedback in action (Schön, 1995) the tacit can be made more overt as students display their understanding of concepts, tools and processes through their responses to queries and suggestions from teachers.

Mazin, Norman, Nordin and Ibrahim (2020) describe an additional form of portfolio assessment: that of student-developed videos of their auto-mechanic competence. Although the article’s focus tends to be on the technology involved, the suggestion is that such videos may serve to capture multiple competencies, including social ones.

## **Discussion and conclusions**

The Umalusi report (2015) suggested that TVET assessment practices should resolve a number of burning issues. Key among these were improving task types; better integration of theory and practice; greater involvement of workplace stakeholders; improved levels of challenge for students; promoting creativity in students; and providing them with feedback so that they may improve their performance. The CBA tasks reported on here, which take the form of innovative simulations, roleplay and cases that confront students with real-world, often crucial and complex problems in practice, and reflective journals or portfolios, may contribute to resolving some of these issues.

Through focusing on CBA and guided by the principle of authenticity and holism, students are required to orientate *theoretical learning*<sup>1</sup> with practical problem-solving (see e.g. Gulikers et al., 2004; Enochsson et al., 2020). In addition, *workplace stakeholders* can be recruited to provide lecturers with critical incidents as a basis for authentic, problem-based assessment design (Achtenhagen & Winther, 2014; Walker et al., 2016; Schwendiman et al., 2018).

Furthermore, such innovative curriculum-based assessments engage students in *high levels of challenge* – for example, Rausch et al. (2016) on clerkship and Walker et al. (2016) on electro-technical training. Many of the assessments require students to construct responses, often *creatively*, rather than reiterate a set answer – for example, Monnier et al. (2016) in health and Öhman (2018) in hairdressing. All the CBA tasks reported on in the literature provide opportunities for lecturer–student *feedback* that can lead not only to self-improvement but

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1 *Italics highlights references to the above Umalusi issues.*

also to the development of structures for self-reflection – for example, using the left-hand–right hand journal entries of Schwendimann et al. (2018) in bakery training. Student feedback and reflection on the learning required is also supported through the use of cognitively and practically demanding criteria. The ‘policing a public square’ criteria of Sluismans et al. (2008) provide a good example of this fruitful use of criteria.

It can be suggested, therefore, that promoting a stronger version of CBA as described in the international literature can support the development of improved assessment practices and task design in the TVET colleges, both more generally and in response to the Umalusi (2015) criticisms, and ultimately to improved graduate outcomes. Such outcomes would necessarily be orientated to students’ potential to operate successfully and competently in their future workplaces.

As suggested in the 2015 Umalusi report, TVET college staff would require some level of training in assessment methods or techniques. Although assessor training was not the focus of this review, some suggestions were put forward in the literature. Teaching staff could be involved, for example, in designing assessments in which the principles of CBA are meshed with the generic competencies, theoretical knowledge and practices required at work, as was suggested in the article on the assessment of floristry students by Gulikers et al. (2018). Furthermore, such initiatives involve recruiting workplaces into identifying ‘critical incidents’, and this may go some way to responding to Umalusi’s call for a greater degree of workplace collaboration in assessment design. The suggested use of critical incidents as case or simulation material for assessment design could furthermore support the development of a closer constructive alignment of curriculum teaching and assessment that could lead to significant workplace outcomes (Stenström & Laine, 2006; Biggs, 2012), which could also be a focus of assessment training.

One caveat for assessment development is that, as Biemans et al. (2009) point out, it is often much easier for staff to carry out paper-and-pen tests than to construct these often complex, technologically and time-demanding CBA tasks. Improving assessment practices with a stronger CBA focus would consequently involve more than just ‘training’, as is suggested by Umalusi (2015); it would necessitate developing a better understanding of both the assessment materials (e.g. technical assistance for videoing) and the social conditions under which assessment could be considerably enhanced.

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