# Assessing Graduate Attributes:

# Building a Criteria-Based Competency Model

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**Abstract**

Graduate attributes (GAs) have become a necessary framework of reference for the 21st century competency-based model of higher education. However, the issue of evaluating and assessing GAs still remains unchartered territory. In this article, we present a criteria-based method of assessment that allows for an institution-wide comparison of the various acquisition levels of different GAs. In order to achieve this, we first propose an understanding of GAs as knowledge, skills and attitude constructs, which directly impacts the operational development of GA scales. Second, after briefly discussing some shortcomings in current assessment/evaluation tests for GAs, we present the many features of the criteria-based model for assessing GAs, such as the importance of the proper interpretation of GAs as can-do statements, a theory-based development of the abstract categories that make up a scale for GA assessment and concrete examples of GA scales based on these abstract theories.

**Keywords:** Graduate attributes, Competencies, Assessment, Criteria-based method, Learning objectives

## 1. Introduction

Many aspects of graduate attribute (GA) assessments have been discussed in recent years, be it at the level of GA conceptualization, stakeholder identification and relative weighting, implementation strategies, curriculum approaches, staff development, quality assurance or the role of students (Hughes & Barrie, 2010). This article focuses on the particularly thorny issue of evaluating and assessing GAs. It presents a criteria-based method of assessment that allows for an institution-wide, perhaps even interinstitutional, comparison between the acquisition levels of different GAs.

GAs are notoriously difficult to assess, and many have expressed skepticism about current attempts. In the words of Pitman & Broomhall (2009),

> [h]ow exactly could one measure "awareness and respect for others" – an attribute produced by as many universities as problem-solving skills? Can "behaving ethically" – an attribute purportedly inculcated in almost two-thirds of Australia's graduates – be metricated? [...] In this formulation, generic skills have been transformed from a relatively universal, publicly-owned and measurable concept, to a personalized, unmeasurable asset' (p. 450).

Nonetheless, there is a general consensus that assessing GAs is essential to its successful implementation (Hughes & Barrie, 2010; Fraser & Thomas, 2013). This implies our taking to heart the theoretical principles of assessment. For instance, within a framework of assessment for learning, GAs would be best assessed in a model in which both students and instructors engage in self-evaluating acquisition and/or pertinence of a specific GA to the learning process where the criteria for each GA is detailed and explained for both stakeholders (Popham, 2007). Moreover, a proper assessment of GAs needs to be well anchored in the principles of assessment. In order for a systematic assessment process to work, it needs first to emanate from the vision and the mission that a given institution has set for itself; second, to be based on specific competencies that guide the learning outcomes of the institution, and; third, to involve strategic key stakeholders in the assessment process (Popham, 2007). These aspects will be addressed in this article.

While the principles of assessment will be taken into consideration in this article, the primary focus will be on the presentation of a criterion reference model of assessment, its theoretical basis as well as its potential application for specific GAs. In such a model of assessment, the performance of the examinees – in the case of this article, instructor and students – is compared to a set of criteria defined beforehand. Linn and Gronlund (2000) define

*Criterion-Referenced Assessment* as a 'type of assessment designed to provide a measure of performance that is interpretable in terms of a clearly defined and delimited domain of learning tasks' (p. 42). Clearly and firmly defining the criteria that each GA measures and encompasses is at the core of the model we are proposing.

In order to properly present the criteria-based model for assessing GAs, we will first propose an understanding of GAs as knowledge, skills and attitude constructs, which will have an impact on the operational development of GA scales. After briefly discussing some shortcomings in current assessment/evaluation tests for GAs, we will present the many features of the criteria-based model for assessing GAs, such as the importance of the proper interpretation of GAs as can-do statement, a theory-based development of abstract categories that make up a GA assessment scale, and concrete examples of GA scales based on these abstract theories. This, we hope, will lay a solid foundation for eventual implementation of GA assessment strategies. We believe it important to first clarify the conceptual prerequisites for assessing GAs before applying empirical methodologies (Steur, Jansen, & Hofman, 2011).

## 2. Graduate Attributes

Though there is no standard definition, GAs can be broadly defined as the qualities that assist individuals' integration into both society in general and the working world after graduation (ABUS, 2004). According to the Australian Technology Network Report, GAs are

> the qualities, skills and understandings a university community agrees its students should develop during their time with the institution. These attributes include, but go beyond, the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. They are qualities that also prepare graduates as agents of social good in an unknown future. (Boud & Solomon, 2006, p. 212; Bowden, Hart, King, Trigwell, & Watts, 2000)

Some efforts have been deployed in the academic community to establish a 'definitive' set of GAs as a response to a perceived 'inconsistency' (Bennett, Dunne, & Carre, 1999; Sumsion & Goodfellow, 2004). This, in our minds, is fruitless, as GAs should be considered a response to contextual interests and pressures that, *per definitionem*, are mutable and peculiar to institutions and societies (Barrie, 2006). It makes little sense that a large institution would target all possible competencies at all time. First and foremost among the relevant contextual elements are the institution's philosophy and values, which may differ considerably from one institution to another. In fact, cultures *within* a large institution may display significant differences: the Engineering culture and goals certainly differs from the Arts culture, which in turn is different from the Education culture, and so on. Faculties and departments can respond to different market pressures when planning the development of their students. Any GA assessment model must take into consideration such variances within an institution, the institution's overarching values and the variable outcomes they are targeting for graduates. Hence, depending on the institution's philosophy and values (*e.g*. citizenship- or society-centered values vs. work- and employability-centered concerns), different sets of GAs can be espoused. For the purpose of this project, the GAs recently adopted by the Sub-Committee on Graduate Attributes at the University of Alberta will be used. Briefly, these competencies are: ethical responsibility, scholarship, critical thinking, communication, collaboration, creativity and confidence.

An additional difficulty related to GA assessment has to do with the fact that they are not homogeneous. They comprise learning content that is referred to alternately as 'qualities', 'skills', 'competencies', 'understandings', 'attitudes', 'dispositions', 'values' and so on. Indeed, GA lists adopted by institutions often include such attributes as critical thinking, communication skills, collaborative skills, information literacy, or even more abstract traits such as ethical awareness, intercultural awareness, confidence or creative thinking – concepts and mental phenomena of a different nature, evidently. Such diversity does not seem to lend itself to a straightforward form of assessment (Knight & Page, 2007). However, these concepts all have the following traits in common:

1. *They can be learned or improved upon.* At the very least, learnability must be postulated in the context of an educational institution (Kember, 2009). According to Hager (2006), some of the learning can be 'tacit', yet this should not be seen as a limitation (p. 30). Learning it is, nonetheless.

2. *They are praxis-oriented.* They refer to a 'know-how' as opposed to a 'know-that' and require practice to be maintained (Dreyfus & Dreyfus, 1986).

3. *They are strongly contextual or situational*. Indeed, GAs are qualities deemed advantageous in the workforce or in society, not as cultural goods that have value in themselves or for the sake of a *vita contemplativa*. This is highlighted by most commentators, including Hager (2006), who believes that 'graduate attributes are inherently holistic and contextual in character,' (Hager & Holland, 2006, p. 10; Hager, 2006), and Holland (2006), for whom GAs 'are demonstrated in situations rather than being separate entities'

(p. 305).

The first point involves the educational activity *par excellence*, that is, learning. Given the complexity and diversity of its learning contents, it is clear that GAs must encompass the whole range of learning objectives. At least since Bloom (1956, 1968), this range has been defined in terms of three 'domains' or three types of learning: knowledge (cognitive domain), skills (psychomotor domain) and attitudes (affective domain). Note that the 'knowledge, skills and attitudes' (KSA) triad should not be confused with the 'knowledge, skills and abilities' triad, often used and referred to in training and hiring practices, but also used in the context of GAs (e.g. Barrie, 2006, p. 217; 2007, p. 440) .

The KSA group must be adapted to our purposes if it is to serve as a framework for GAs. First, 'knowledge' needs to be conceived as praxis-oriented, in accordance with the second point of commonality. This will have consequences in the way the hierarchical criteria for knowledge-based GAs will be determined. Second, 'skills' as a psychomotor concept is inappropriate for GAs in the context of the university, where skills refer rather to more intellectual abilities (*i.e.,* to something one can 'do' or accomplish with the help of one's intellectual faculties). In this sense, written communication skills refer more to the intellectual ability to organize a text and convey meaning than to calligraphic dexterity. Third, 'attitudes' should be understood in its broad sense as defined by psychologists, that is, as 'an evaluative judgment,' be it feelings, a tendency, an object of memory, a categorization, etc., which 'influence how we process information and how we behave' (Maio & Haddock, 2009, p. 4). In this sense, values are also attitudes. It is postulated that all specific GAs are susceptible of being subsumed under a KSA category.

**3. Existing GA Tests and their Shortcomings**

The research on GAs has led to the development of evaluation models, with Australian universities no doubt leading the way in this respect. The University of Sydney, notably, uses the Student Course Experience Questionnaire (SCEQ) to collect data from students about teaching and learning goals, including generic attributes. The SCEQ comprises a number of items, scored on a five-point Likert scale, as well as some open-ended questions that cluster around factor scales, one of which is generic skills. The items relating to each scale are averaged over the respondents to produce scores at the faculty and university level (SECQ, 2010).

With the signing of the Bologna Declaration in 1999, and over the course of the ensuing Bologna Process, a number of European countries have also pledged to implement program reforms leading to a convergence towards a European Higher Education Area. This will, among other things, prepare students for their future careers and for life as active citizens in democratic societies and support their personal development, as well as establish a norm and quality standards for easy movement within EU nations among the recent graduates (Bologna Process, 2010). In response to this process, researchers at the University of Graz developed the Graz Instrument for the Evaluation of Competencies (GEKo) (Dorfer & Ressler, 2009). GEKo uses the input of both students and instructors to conduct course evaluations that comprise different types of competencies. Through surveys and literature, the university identified five competence areas, each comprised of ten items. The evaluations were conducted with ordinal scales for each item.

Other approaches have also been adopted. The Evaluation in Higher Education: Self-Assessed Competencies (HEsaCom) mechanism (in German: 'Berlin Evaluation Instrument for Self-Reported Student Competencies,' BEvaKomp) is based on an idea similar to GEKo (Braun & Leidner, 2009). Where traditional evaluations measure the satisfaction with the course or the instructor, the HEsaCom focuses on the students' personal benefit in terms of competencies (Braun & Leidner, 2009). Like GEKo, this tool also breaks down the relevant competencies into individual items, which are then scored on ordinal scales.

These questionnaires all have shortcomings that need to be improved upon. The SCEQ, being the oldest tool, is the most rudimentary. It does not indicate the level to which GAs are actually targeted in a course, as perceived by the instructor, leaving little way to assess to what extent course content needs to be modified from a curriculum management perspective. It does not give any indication of the level of acquisition of attributes, but simply ascertains a subjective perception of improvement. Finally, the attributes measured lack the level of complexity that should be expected.

The GEKo certainly represents an improvement over the SCEQ. It is a much more complex measure of graduate attributes. It comprises four different questionnaires, one intended for 'interactive' (e.g., seminars), one for 'teaching-oriented' (e.g., lecture), one for 'practical' (e.g., laboratory) and one for 'e-learning' courses. Optionally, the teacher can also complete the questionnaire, and in so doing establish his/her learning objectives. This methodology is obviously not adapted to the North American context of education, which is less rigid in its teaching formats. Moreover, the questions in the GEKo are often formulated in such a way that it does not relate to a student's acquisition of competencies, but rather to the quality of an instructor's teaching.

The HEsaCom does specifically target the acquisition of competencies but it does not provide descriptive criteria for the levels of acquisition, which makes it unsuitable for course comparison and curriculum management and development (Braun & Leidner, 2009). Our criteria-based competency model intends to improve on these existing tools.

**4. GA Levels of Acquisition**

The first step in establishing the model is determining the intensity levels of GA acquisition in order to set up a scale with intuitive labels. We have opted for a 5-point Likert scale, including a N/A entry. At level 3, mastery and/or acquisition of an attribute is deemed acceptable in a university setting. Levels 1-2 correspond to levels of pre-acquisition. Levels 4-5 designate levels of excellence that may go beyond what is expected in a university setting and may not be reached by all students. Given the nature and subject matter of the courses, all attributes may not be targeted in all courses. The N/A entry allows thus to learn more about courses and the representation of GAs in the courses.

The labels given to each GA level need to be appropriately descriptive of the acquisition/mastery of each targeted GA. Following our understanding of GAs as KSA, this acquisition process is not limited to knowledge but also includes skills and attitudes. In this respect, for instance, it makes little sense to speak of 'advanced' levels of acquisition when speaking of ethical values, even though it would be appropriate with regard to acquisition of written or oral communication skills. The following labels were chosen because they are suited to all types of GAs while indicating a clear hierarchical progression:

Table 1. GA Levels of Acquisition

| Level | Label |
|---|---|
| 1 | Emergent |
| 2 | Basic |
| 3 | Adequate |
| 4 | Superior |
| 5 | Exceptional |

In order to measure the GAs and their indicators (identified below), we have used descriptive rating scales (Haladyna, 1997). Known generally as the Likert rating scale, the graded-category scale allows us in this context to measure performance at a general yet explicit level on an interval basis. Descriptive rubrics allow us in this context to measure the performance on each GA, and they provide pertinent and explanatory details for each level. Because of their richness and ease of use, as Haladyna (1997) refers to them, the descriptive scale is the best choice for assessing performance: users will have a sentence-long explanation of each of the five levels within the Likert scale.

Anticipating somewhat on a later theoretical explanation, each level describes a similar degree of learning complexity. At the *emergent* level, GA acquisition refers to the awareness of individual (or atomic) elements that are needed to perform a specific task, such as the cognizance of facts, ideas or rules. At the *basic* level, GA acquisition involves manipulation and combination of the basic individual elements (facts, ideas or rules) in a coherent (molecular) whole aimed at performing a specific task. At the *adequate* level, the minimum standard/norm for performing a specific task has been met and a GA is deemed functional in the academic context. At the *superior* level, a GA is acquired to the extent that it allows for new applications in, and generalizations to, unforeseen contexts. Finally, at the *exceptional* level, there is a consistency and spontaneity in the capacity to generalize GA application and adapt to new situations, including outside the academic environment.

Each level needs to be associated with a general theoretical principle that will guide the formulation of the description of indicators for all GAs. This will allow for some consistency in assessing different types of GAs. We recall that, as learning content, GAs have been analyzed into Bloom's three learning 'domains', *i.e.,* knowledge, skills and attitudes (KSA). Each of these types of learning presents levels of accomplishment and complexity. Because they differ in nature, the description of their learning levels also has its peculiarities. Bloom (Krathwohl et al., 1964) elaborated three taxonomies – cognitive (knowledge), affective (attitudes) and psychomotor (skills) – which, at first glance, seem to be good candidates as a basis for assessing GAs. Unfortunately, the correspondence between the types of GAs and Bloom's KSA is mostly nominal. For instance, as mentioned earlier, the psychomotor domain is restricted to physical

skills, and cannot, as a result, apply to the intellectual skills targeted in the GAs. As for knowledge, its orientation toward praxis must be emphasized. For the purposes of GA assessment, Bloom's work needs to be adapted and complemented. This will be the object of the subsequent sections. But before discussing this question, we need to look at the form taken by GA lists in institutions and how they can be operationalized to allow assessment.

## 5. Interpretation of GAs

Institutions that define graduate attributes usually set up a short list with fewer than 10 items. As a result, there is often the need to define a series of sub-attributes, whose number can vary from one attribute to the other. Strictly speaking, sub-attributes are GAs united in a subgroup defined by a common generic attribute. The following list in Table 2 below has been set by a student-driven initiative at the University of Alberta in 2013 (Chelen, Andrews, & Dew, 2013). The first column lists the generic attribute that groups the specific GAs of the second column. The third column defines a possible interpretation of the GAs. The formulation of a clear interpretation is crucial to establishing assessment criteria for the attributes and sub-attributes and usually serves as a baseline for the criterion defining the 'adequate' level of a GA acquisition. Given the many cultures within a large institution (the values and interests of the faculty of, say, Medicine is certainly different from those of Engineering or Arts or Education) and the different requirements of specific programs, there is often a need to define a specific interpretation of the sub-attributes peculiar to a faculty or a unit, for even though GAs may apply across the board, their interpretation may vary from program to program, from faculty to faculty and so forth. Whereas attributes and sub-attributes are general concepts applicable to the whole university, the interpretation should take on the praxis-oriented form of a can-do statement and can differ from one faculty to the other.

Table 2. GA Interpretation

| Attributes | Sub-attributes | Interpretation |
|---|---|---|
| Ethical responsibility | | Can adopt the perspective of moral principles rather than self-interest |
| | Global citizenship | Can consider issues from a global perspective |
| | Community engagement | Can consider issues from the perspective of their impact on the community |
| | Social and environmental awareness | Can adopt the perspective of the public good and take into consideration our embeddedness within society and nature |
| | Professionalism | Is willing to meet the level of expertise and deontological expectations of her intended profession |
| Scholarship | | Can rely on a body of established knowledge to guide her action |
| | Knowledge breadth and depth | Can make use of a broad range of knowledge while displaying mastery in specific areas |
| | Interdisciplinarity | Can integrate into a single activity / project knowledge drawn from more than one academic discipline |
| | Life-long learning | Is willing to engage in autonomous self-teaching in our outside the classroom |
| | Investigation | Can effectively conduct research with the help of established methods and tools |
| Critical thinking | | Can contextually assess given information (incl. self-related) through reflection and debate, taking nothing for granted |
| | Analytic and synthetic reasoning | Can gather various detailed information, organize it for specific purposes and assess its validity |

| | | |
|---|---|---|
| | Interpretive proficiency | Can convert individual facts into meaningful information and knowledge |
| | Intellectual curiosity | Is eager to learn beyond what is readily available (in classrooms or in common knowledge) |
| | Information literacy | Can effectively identify and assess information within its broader societal contexts, incl. knowledge-dependent contexts requiring scientific, digital or technology literacy |
| Communication | | Can exchange thoughts, feelings and information effectively in various situations |
| | Writing skills | Can write effectively in various types of writing pieces |
| | Oral skills | Can speak effectively in various formal and informal settings |
| | Visual communication | Can convey ideas effectively through visual aid |
| | Multilingualism | Can communicate effectively in more than one language |
| Collaboration | | Can complete tasks effectively by working jointly with others who share a common goal |
| | Openness to diversity | Can engage with a diversity of people (in terms of race, religion, cultures, classes, sex orientation and appearance) |
| | Interpersonal skills | Can demonstrate skills necessary for effective interaction and communication (incl. empathy, active listening, respect) |
| | Adaptability and compromise | Can change or suspend a personal belief in order to further the realization of a common goal or to adjust to new circumstances |
| | Individual contribution | Can take an active role in collaborative work |
| Creativity | | Can produce something new and valuable (incl. ideas, works or products) |
| | Imagination | Can conjure up new ideas and representations in a productive manner |
| | Innovation | Can devise novel and better ways of doing things through knowledge (scientific, technological, methodological) |
| | Divergent thinking | Can explore new avenues in a non-conformist and risk-taking fashion |
| | Artistic sensibility | Can be compelled by artistic work and, ideally, partake in expressive artistic production |
| Confidence | | Can act and think decisively |
| | Leadership and empowerment | Can influence others into adopting an appropriate course of action toward a common task |
| | Independence | Can work and think productively with no or little supervision |
| | Initiative | Can initiate a course of action without prompting |
| | Resilience | Can follow through on a course of action over time |

Note that the GAs can be viewed from different perspectives. For instance, 'knowledge breadth and depth' can be considered an attitude, a skill or knowledge, depending on the direction one wishes to give to the understanding of this GA. As a result, it could mean a willingness or an eagerness to expand and deepen our knowledge based on the value attached to it (attitude), the capacity to expand and deepen our knowledge (skill) or the possession of broad and deep knowledge (knowledge). GAs can also be interpreted as both values and skills, or both skills and knowledge (Pitman & Broomhall, 2009). The appropriate perspective is not carved in stone, but rather depends on the intended goal, which in turn is conditioned by the values and goals of the institution. The appropriate understanding of the GA should be reflected in its interpretation (i.e. in the can-do statement). With this additional 'hermeneutical' layer, one overcomes Knight & Page's (2007) argument that GAs may not be amenable to assessment because of their multifarious, underdetermined and context-dependent nature.

Once an unequivocal interpretation of the GA has been established, a five-point Likert scale and its items can be set. This step of the process is contingent on the type of GA (knowledge-type, skill-type or attitude-type GA). In the following sections, each type of GA is associated with a theoretical framework that guides the choice indicators (the Likert items): Bloom's taxonomy of the cognitive domain for knowledge-type GAs, the Dreyfus model of skill acquisition for skill-type GAs and Bloom's taxonomy of the affective domain for attitude-type GAs.

**6. Knowledge-Type GAs**

When GAs correspond to knowledge, the obvious way to determine the level of acquisition is to refer to Bloom's well known taxonomy of cognitive learning. In our context, the categories for assessing GAs would be set as follows:

Table 3. Categories for Assessing Knowledge-Type GAs

| Level | Label | Principle | Action | Bloom analog |
|---|---|---|---|---|
| 1 | Emergent | Knowledge of facts and ideas | Describe, define, identify | Knowledge |
| 2 | Basic | Understanding the meaning of facts and ideas | Explain, infer | Comprehension |
| 3 | Adequate | Using knowledge to solve problems | Apply | Application |
| 4 | Superior | Break information into parts and patterns, and combining them in a different way | Compare, distinguish, combine, compose | Analysis and synthesis |
| 5 | Exceptional | Asses and defend ideas | Assess, evaluate, critique | Evaluation |

For the purpose of this project, analysis and synthesis have been merged into one indicator, as they both conform to the general definition of the 'superior' level described earlier. The assessment categories (1 through 5) can serve as 'template' for the actual rubrics in the criteria-based scale used for assessing specific GAs. For instance, when applied to the 'knowledge breadth and depth' sub-attribute under the 'scholarship' GA, we get the following criteria-based scale:

Table 4. Scholarship – Knowledge Breadth and Depth Rubrics

| | | |
|---|---|---|
| | | Can make use of a broad range of knowledge while displaying mastery in specific areas |
| 1 | Emergent | Can describe a wide array of ideas and facts, some of them in great detail |
| 2 | Basic | Can explain a wide array of ideas and events, some of them in great detail |
| 3 | Adequate | Can use a wide array of ideas and events, some of them in great detail for specific purposes |
| 4 | Superior | Can break a wide array of ideas and events into parts and patterns, some of them highly specialized, and combine them in a novel way |
| 5 | Exceptional | Can assess the value of a wide array of ideas and events, some of them being highly specialized |

It is important to note that the wording of level 3 corresponds fairly closely to the interpretation (the can-do statement) of the sub-attribute 'knowledge breadth and depth.' All other levels (1, 2, 4 and 5) align with the categories defined in table 3. Note also that, in accordance with the praxis-oriented nature of GAs, emphasis has been placed on what the learner can 'do'.

**7. Skill-Type GAs**

Because intellectual skills, as opposed to psycho-motor skills, are generally targeted in GAs, there is a need to look elsewhere than in Bloom's taxonomy for an appropriate description of acquisition levels. Dreyfus's model is particularly interesting for the context of assessing generic GAs, especially given its suitability for assessing complex situational skills that develop in 'unstructured' situations (Dreyfus & Dreyfus, 1986, p. 20). Such situations 'contain a potentially unlimited number of possibly relevant facts and features, and the ways those elements interrelate and determine other events are unclear. Management, nursing, economic forecasting, teaching, and all social interactions fall into that very large class.' Conversely, in 'structured' situations, the 'goal and what information is relevant are clear, the effects of decisions are known, and verifiable solutions can be reasoned out' (Dreyfus & Dreyfus, 1986, p. 20)

As Benner (2004) puts it, the Dreyfus model 'is situational rather than being a trait or talent model because the focus is on actual performance and outcomes in particular situations' (p. 189). It follows an Instructional Design approach that has strong roots in the North American context. Similar elsewhere is the notion of 'constructive alignment' (Biggs, 1996). The Dreyfus model assesses skills in a context of indetermination in which the required action and its context are not predefined: 'As the Dreyfus model suggests, experiential learning requires the stance of an engaged learner rather than a stance of one expert in techné who skillfully applies well-established clear circumstances' (Biggs,1996, p. 190). These traits make it a viable candidate for measuring skill-type GAs.

Dreyfus & Dreyfus (1986) have proposed a series of five stages of skill acquisition. The first stage is the *novice* level. The novice acquires rules that s/he applies to well-defined, context-free facts, with no use of her/his judgment. Because the rules are not context-sensitive, there may be situations in which they will not be valid. Formal description: when fact $f$ occurs, action $a$ is required ($f_n \rightarrow a_n$).

The *advanced beginner* integrates limited situational judgment and starts to recognize patterns through similarities with other occurrences. However, all tasks and rules have equal weight and are not yet coordinated in a coherent pattern. Formal description: given situation $S$, fact $f_1$ calls for action $a_1$, $f_2$ for $a_2$, and so on. $S(f_n \rightarrow a_n)$.

At the level of *competence*, the learner can organize situational elements (facts that make up a situation) in a meaningful way while assigning relative importance to them in order to reach a goal. This involves planning in a deliberate and reflective fashion. Formal description: given the well-defined situation $S$ with facts $f_1$, $f_2$ and $f_x$, where $f_x$ is considered more or less important, action $a$ is required in order to reach goal $g$. At this level, however, tasks are somewhat rigidly defined as routines. $(S(f_n) \rightarrow a_n) \rightarrow g$.

At the *proficient* level, the learner can adapt her/his learning to new situations with the help of intuition, that is, based on experience and with no explicit deduction or reasoning. Patterns of tasks and rules are understood, not merely successions of elements, and the learner can recognize the most important and salient elements in a situation. Understanding becomes 'dynamic' as it changes according to the situation. Formal description: it 'seems' that situation $S$ as a whole calls for actions $a_1$, $a_2$ and $a_3$ in a particular order and weighing, while the similar situation $S'$ calls for a different set of actions. $(S \rightsquigarrow a_1, a_2, a_x, S' \rightsquigarrow a_3, a_4, a_y) \rightarrow g$.

Finally, the *expert* can perform all aspects of a task unconsciously, completely immersed in a situation, with no reference to a rule or a maxim. The learner no longer 'applies' rules but is rather guided by intuition. At this level, s/he grasps the different possible goals that can be set. Formal description: the learner 'sees' the salient elements of situation $S$ with little or no regard to facts $f_1$, $f_2$ and $f_3$, and 'knows' to apply actions $a_1$, $a_2$ and $a_3$. $(S \rightsquigarrow a_1, a_2, a_x) \rightsquigarrow g$.

This model can serve as a basis for establishing GA assessment categories. However, there is a need for adaptation and/or interpretation according to the special circumstances of GAs. In particular, an assessment procedure does not have the luxury of asking learners for self-descriptions and draft a phenomenological account of the learner's experience. Because an assessment procedure, in order to get buy-in from stakeholders, cannot be onerous, it must rely on observable features. Following the principles of the Dreyfus model, we propose the following categories for the assessment of skill-type GAs:

Table 5. Categories for Assessing Skill-Type GAs

| Level | Label | Principle | Action | Dreyfus Analog |
|---|---|---|---|---|
| 1 | Emergent | Context-free knowledge of facts and rules | Identify, recognize (facts and rules) | Novice |
| 2 | Basic | Contextual knowledge and pattern recognition | Compare, contrast, distinguish | Advanced beginner |
| 3 | Adequate | Organization of contextual facts and rules towards a goal | Plan, design, organize, prioritize, choose, infer, discuss | Competent |
| 4 | Superior | Fluid adaptation of learning through experience | Anticipate, adapt, commit, engage, have insight | Proficient |
| 5 | Exceptional | Consistent, assured and spontaneous action | Perform effortlessly, consistently and with assurance, critically reflects on actions | Expert |

The regulative concept behind skill attributes is effectiveness: to possess a skill means being effective at doing something. However, effectiveness takes different faces depending on the task. For instance, effective writing entails consistent, grammatically-correct and vocabulary-rich conveyance of a message; effective critical thinking involves identifying and explaining problems, recognition of evidence and assumptions, implicit or explicit, evaluating and the assessment of implication; and so on. In the actual rubrics used for assessing a particular GA, effectiveness needs to be made explicit. Here is what a criteria-based scale could look like for the 'analytic and synthetic reasoning' sub-attribute under the 'critical thinking' GA:

Table 6. Critical Thinking: Analytic and Synthetic Reasoning Rubrics

| | | Can gather various detailed information, organize it for specific purposes and assess its validity |
|---|---|---|
| 1 | Emergent | Can identify relevant information and arguments (e.g. the central problem, implicit and explicit assumptions) |
| 2 | Basic | Can identify alternative perspectives and justify the choice of relevant perspectives |
| 3 | Adequate | Can (re-)organize relevant information for specific purposes (e.g. reconstruct arguments) and evaluate assumptions (incl. methodology, evidence and inference) |
| 4 | Superior | Can assess the implications and potential conclusions of an argument |
| 5 | Exceptional | Cans consistently assess the validity of information and arguments |

**8. Attitude-Type GAs**

With regard to attitude-type GAs, Bloom's taxonomy in the affective domain seems quite appropriate. Its explicit goal is to define hierarchical levels of thinking behaviors that relate to attitudes, feelings, values, beliefs and the like. According to Savickienė (2010), the most commonly referred to psychological constructs in the affective domain are attitudes and values.

Bloom's affective domain taxonomy is structured so as to describe an increasing level of internalization of intellectual content. The first level of affective learning, according to Krathwohl, Bloom & Masia (1964) is *receiving*. At this stage, a learner simply takes notice or is aware of an idea or phenomenon. The second level is *responding*, which involves active participation on the part of the learner in the form of reacting or responding to an idea or phenomenon. At the

third level, *valuing*, the learner assigns value or worth to an idea or phenomenon, which gives it meaning and importance. The fourth level is defined by *organization*. In this context, values are contrasted and prioritized according to relative importance into a coherent whole. The fifth level is called *internalization* or *characterization*. At this final stage, values are integrated into the learner's character, so much so that they consistently determine behavior.

These categories are compatible with the general GA levels of acquisition defined in table 1. 'Receiving' refers to the awareness of elemental facts and ideas, in accordance with the 'emergent' level of GA acquisition. 'Responding' implies the combination of an elemental fact with an appropriate action (or reaction). 'Valuing' is precisely, according to the definition of attitude given previously, what is 'done' when one holds an attitude and corresponds, accordingly, to the level of adequate acquisition of attitude-type GA. 'Organization' means that learners can go beyond given facts and ideas and generate something new – in this case, they can adopt an overview that allows for generalization. Finally, 'internalization' leads to consistent and habitual behavior.

Following Bloom's taxonomy of the affective domain, we propose the following categories for the assessment of attitude-type GAs:

Table 7. Categories for Assessing Attitude-Type GAs

| Level | Label | Principle | Action | Bloom Analog |
|---|---|---|---|---|
| 1 | Emergent | Awareness | Identify, recognize, take interest | Receiving |
| 2 | Basic | Active participation | Discuss, explore, cooperate, volunteer | Responding |
| 3 | Adequate | Subjective involvement | Takes a position | Valuing |
| 4 | Superior | Synthesis | Defend, generalize, synthesize, compose | Organization |
| 5 | Exceptional | Principled, consistent behavior | Consistently view, plan | Internalization |

Bloom's taxonomy of the affective domain applies quite smoothly to specific attitude-type GAs. Here is an example of a criteria-based scale for the attitude-type sub-attribute of 'social and environmental awareness' under the 'ethical responsibility' GA:

Table 8. Ethical Responsibility: Social and Environmental Awareness Rubrics

| | | |
|---|---|---|
| | | Can adopt the perspective of the public good and take into consideration our embeddedness within society and nature |
| 1 | Emergent | Displays and awareness of social and environmental issues |
| 2 | Basic | Shows a willingness to participate in discussions on environmental issues |
| 3 | Adequate | Adopts behaviour that demonstrates strong beliefs in and sensitivity toward environmental issues |
| 4 | Superior | Can explain and/or defend one's own beliefs and involvement in environmental issues |
| 5 | Exceptional | Displays an ingrained commitment for environmental issues |

Following the interpretation (can-do statements) given for each GA and categories for assessing knowledge-, skills- and attitude-type GAs (tables 3, 5 and 7), criteria-based scales can be created for all GAs.

## 9. Conclusion

The focus of this article was primarily on presenting a criteria-based model for assessing GAs, which still needs to be tested for validity and reliability in an empirical setting. This model is founded on the understanding of GAs as KSA (knowledge, skills and attitudes), a tripartite categorization that encompasses the many forms taken by GAs. It also relies on the idea that GAs need to be 'interpreted' as praxis-oriented can-do statements. These two measures allow for

subsequent operationalization, a crucial step prior to assessment. Emphasis was placed on the theoretical basis that supports the development of assessment scales, thus allowing for a flexible framework for creating new scales for any additional GA. Each KSA type rests on a particular theoretical frame (Bloom-cognitive, Dreyfus model, Bloom-affective) while displaying a common core.

In itself, this is but a first step in the task of assessing GAs. What is still required is an implementation model that establishes a proper assessment procedure that takes into account the needs, interest and concerns of all stakeholders and fulfills the pragmatic condition of successful application. These steps should provide the proper groundwork for the subsequent empirical study of GAs.

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