

# Course: Assessment in Science Education (697)

## Semester: Spring, 2022

### ASSIGNMENT No. 2

**Q.1 Describe the nature of practical skills and abilities. How these skills can be assessed in a school setting?**

In the world of human resources and corporate education, the acronym KSA stands for Knowledge, Skills, and Abilities. It is most often used to define the requirements of a job opening and compare candidates when making a final selection. If you're looking for a job, a recruiter may be looking at your KSA profile.

#### **KSA Background**

Historically, the KSA framework was associated with the U.S. federal government. Its agencies applied the Knowledge, Skills and Abilities model to its recruiting activities for many years, although the practice has lately been phased out in favor of resume-focused recruiting. That doesn't mean it has disappeared, however. If anything, the use of KSA is expanding to include assessments of training and coaching needs in an existing workforce.

#### **Defining Knowledge, Skills, and Abilities:**

One of the criticisms of KSA is that it's easy to see those three terms as interchangeable or at the very least overlapping. However, they are distinctly different dimensions of an individual's qualifications.

**Knowledge** focuses on the understanding of concepts. It is theoretical and not practical. An individual may have an understanding of a topic or tool or some textbook knowledge of it but have no experience applying it. For example, someone might have read hundreds of articles on health and nutrition, many of them in scientific journals, but that doesn't make that person qualified to dispense advice on nutrition.

**Skills** are the capabilities or proficiencies developed through training or hands-on experience. Skills are the practical application of theoretical knowledge. Someone can take a course on investing in financial futures, and therefore has knowledge of it. But getting experience in trading these instruments adds skills.

**Abilities** are often confused with skills, yet there is a subtle but important difference. Abilities are the innate traits or talents that a person brings to a task or situation. Many people can learn to negotiate competently by acquiring knowledge about it and practicing the skills it requires. A few are brilliant negotiators because they have the innate ability to persuade.

Strengthening KSA Knowledge and skills are best developed through training activities that incorporate theoretical learning and hands-on application of key concepts and tools. For instance, a person who wants to be a project manager must understand the key concepts of that role such as scope, work breakdown structure, and critical path, but must also gain experience incorporating elements of those concepts into a real project. Strengthening natural abilities is primarily a coaching challenge. Observation, feedback, and improvement can be applied to nurture abilities.

#### **Drawbacks of KSA**

The general criticisms of using a KSA framework for job applications or candidate evaluation tool include:

- Long and sometimes redundant job descriptions

# Course: Assessment in Science Education (697)

## Semester: Spring, 2022

- Complex and frustrating application processes
- Confusion over the differences between the terms, especially skills and abilities Some job applications include a request to describe your KSA, usually in the form of a brief essay. Keep those three terms straight and you'll be halfway

They are all “must-haves” in our career. Recruiters look for knowledge, skills, and abilities during the hiring process. Managers use KSAs when they are considering employees for transfers and promotions. KSAs are used as the company creates and updates their replacement and succession plans. As we talk more about the skills gap, it will be important to understand the difference because the way we obtain knowledge, skills, and abilities can vary. And if we’re an organization trying to figure out how to solve the skills gap that exists within our workforce, then we have to link the right solutions. For instance, if the issue is knowledge, then maybe we can create an in-house library that employees can check out books on the topics. But if the challenge is skills, the answer might be training. And if abilities need to be improved, is it possible to develop personal action plans that give employees the opportunity to refine their abilities.

### **Q.2 Discuss objectivity as an essential ingredient of assessment in order to explain how things work.**

Consider the differences between traditional instructor-led and competency-based education (CBE) programs in higher education. In the traditional instructor-led approach, students are awarded credit hours per “seat time” of instruction, and the transmission of knowledge is passed from teacher to student through some type of lecture or discourse . As participants in this system, all students are taught the same materials at the same point, resulting in inefficient use of students’ and teachers’ time. Students who do not learn quickly enough fail, rather than being allowed to succeed at their own pace, leading some to argue that student learning in higher education is one of the least sophisticated aspects of the teaching and learning process.

In contrast, CBE programs strive to balance a variety of learning approaches requiring students to master key concepts before graduating. Students learn at their own pace and earn their degree by demonstrating knowledge and skill in required subject areas through a series of carefully designed competency-based assessments. As the popularity of CBE programs continues to rise, the credibility of those programs will be scrutinized by students and employers alike, and the credibility of the CBE programs is largely dependent upon the quality of the assessments that are used.

Despite these differences, many of the principles of assessment development in the competency-based education arena can be applied to the higher education assessment community. Several of these principles that will be discussed more thoroughly in the remainder of this paper include the creation of a value chain of development, the use of subject matter experts in the workplace to guide the nature of assessments, the flexibility and timely use of objective assessments to assess more basic levels of cognitive reasoning, and the need to include real-world relevance and practical applications throughout the assessment experience.

# Course: Assessment in Science Education (697)

## Semester: Spring, 2022

The value chain represents the activities and products necessary to execute a full assessment solution – from the creation of assessment content to the delivery of remediation services, and ultimately graduating competent students. These activities include; assessment design, measurement activities, assessment libraries, score analysis, and prescriptive remediation. This article focuses on the first of these activities (assessment design), and articulates 12 steps for building a best-in-class competency-based assessment program. This process is supervised by professional subject matter experts (SMEs), content developers, and psychometricians, and adheres to professional and technical standards ensuring assessment reliability, validity, and fairness; notably, guidelines covered by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education.

In the remaining sections of this paper, we briefly explore the history of objective assessment in higher education, studying its historical antecedents, and define next steps toward building a standards-based community of practice. We operationally define competency-based education, paying particular attention to the term “competence” and what it means in the context of maintaining standards for assessment validity. We then offer 12 steps for building a best-in-class objective assessment program. We conclude with case study metrics from Western Governors University's assessment portfolio, which describes four key assessment performance indicators and documents a commitment to continuous quality improvement through quarterly assessment reviews.

Scant literature exists concerning sound assessment development principles in higher education, especially as it relates to ensuring student competence in critical academic and professional domains. One of the first efforts in this area was the work of Robert F. Mager in **1962**, with the publication of “Preparing Instructional Objectives,” where the author highlights the three components needed for learning objectives: a performance that will be measured in some way, conditions that identify what is to be allowed in the performance (as well as what is not), and criteria that explain how the performance will be measured. Mager's work served as a unique bridge between academic and professional demonstration of student/learner demonstration of ability.

In another early report entitled “A Nation at Risk,” published by the U.S. Department of Education (**1983**), governors and legislators recognized that postsecondary education was a powerful engine for economic and workforce readiness. Institutions of higher learning were going to be faced with raising standards and expectations by, among other things, advancing standardized achievement tests at major transition points from one level of education to another, and particularly from high school to college and work.

Then in the fall of 1985, the First National Conference on Assessment in Higher Education was held in Columbia, South Carolina, where three major recommendations were identified: (a) that high expectations be established for students; (b) that students be involved in active learning environments; and (c) that students be provided with prompt and useful feedback (Banta, **2002**). Of particular note, conference organizers recognized the need to redefine the term “assessment” in higher education, as it meant different things to different people.

# **Course: Assessment in Science Education (697)**

## **Semester: Spring, 2022**

The most established definition had its roots in learning mastery (Bloom, 1968), where assessment referred to the process of determining an individual's mastery of complex abilities. Mastery learning maintains that students must achieve a level of competence (e.g., 70%) in required knowledge before moving forward to learn subsequent information. If a student does not achieve mastery, they are given additional instructional support and then tested again. This cycle continues until the learner accomplishes mastery, and they may then move on to the next stage. Yet, despite its popularity among researchers and assessment designers of the time, few, if any within higher education operationalized mastery-learning into practice.

A far different meaning emerged from K-12 practice, where the term assessment described large-scale testing programs like the federally funded National Assessment of Educational Progress (NAEP). The primary objective of NAEP was not to examine individual mastery, but rather to benchmark school and district performance in the name of accountability. Finally, a third tradition of use defined assessment as a special kind of program evaluation, whose purpose was to gather evidence to improve curricula and pedagogy. Again, the focus was on aggregate, not individual performance mastery.

Which begs the question: Why have institutions of higher learning been so hesitant to adopt the learning-mastery approach? Perhaps, as Boud (2000) explains, assessment in higher education is confronted with challenges that represent multiple and sometimes contradictory responsibilities: assessment is meant to inform student learning even as it sorts students into those who pass and those who fail; assessment measures learning outcomes but also compares students with one another; assessment should be objective and individually accountable but must evaluate the attainment of dispositions such as creativity, leadership, and imagination. These contradictory views have led some to criticize the current state of assessment in higher education, arguing that it has little effect on educational quality and that accrediting agencies require institutions to invest time and resources into collecting evidence on student learning even though it does not improve academic quality (Gilbert, 2015).

Finally, faculty's attitudes toward and expertise in what constitutes valid assessment design has produced sizable discord in higher education. Faculty have been shown to have mixed opinions on the purposes of assessment based on their attitudes about teaching and learning (McLellan, 2004; Murray & MacDonald, 1997). According to Fletcher, Meyer, Anderson, Johnston, and Rees (2012), those who view teaching and learning as the transmission of knowledge from teacher to student are likely to view assessment as a method to test students' ability to reproduce information. In contrast, those who see teaching and learning as facilitating critical thinking and knowledge transfer view assessment as an integral part of the learning process. As Hattie (2009) argues, in higher education "we implicitly trust our academics to know what they value in their subjects, to set examinations and assignments, to mark reliably and validly, and then to record these marks...and the students move on, upwards, and/or out" (p. 1). As a result, assessment activities within traditional higher education continue to be implemented as additions to the curriculum, designed for purposes of program evaluation rather than being integral to student mastery. "Good assessments are not once-and-done affairs," says

# **Course: Assessment in Science Education (697)**

## **Semester: Spring, 2022**

education consultant Linda Suskie. “They are part of an ongoing, organized, and systematized effort to understand and improve teaching and learning”

### **Q.3 Explain “Analysis of Organisational Principles” with relevant examples from the science subjects.**

Organizational analysis is the process of appraising the growth, personnel, operations, and work environment of an entity. Undertaking an organizational analysis is beneficial, as it enables management to identify areas of weakness and then find approaches for eliminating the problems. Important aspects of organizational analysis include the assessment of external elements that can influence the performance of an organization. An organizational analysis also includes strategically evaluating an organization’s potential and resource base.

Internal weaknesses and strengths, together with external threats and opportunities, determine the success of an entity. For this reason, SWOT analysis is an important part of organizational analysis. It is used by businesses to assess their performance and establish goals or objectives.

#### **1. Strengths**

The competitive edge that an organization enjoys over its competitors is an advantage that defines its success. Assessing the strengths of an organization involves evaluating management, workforce, resources, as well as current marketing goals. In general, an internal analysis looks at an entity’s core competencies and resources.

Defining the capability of an organization helps the management team to make sound decisions as they formulate long-term objectives. Other important aspects of an internal analysis include looking at financial objectives, strategic planning, and operational structure.

#### **2. Weaknesses**

Weaknesses are obviously an aspect of an organization that can affect its performance. Recognizing weaknesses is important, as it enables the organization to locate problems and implement beneficial changes. In addition, the organization is able to develop appropriate choices in its strategic planning process, especially when results are not satisfactory.

Potential weaknesses include low morale, poor leadership, poor financials, obsolete technology, and inefficient functions. An example of a turnaround would be an organization, which previously experienced poor cost control, working hard to manage costs.

#### **3. Opportunities**

Generally, an external analysis weighs the threats and opportunities that are present outside of an organization. An external assessment includes sizing up the competition, analyzing market trends, and evaluating the impact of technology on the performance of an organization. When looking at external opportunities, an organization needs to identify current trends in the market, as well as weaknesses and gaps in the market that it can come in and fill.

An entity also needs to consider technological changes as an opportunity. Innovation helps to create opportunities for business. Therefore, organizations that set themselves apart in terms of their efficient use of available technology are capable of becoming leaders in their respective industries.

#### **4. Threats**

Not all threats are detrimental to the success of a business. For instance, labor can be a threat or an opportunity, depending on the prevailing economic conditions. Legislation and regulations set by the government also exert an effect on how well an organization performs in its industry.

To succeed in a competitive environment, an organization needs to learn to cope and embrace change as it happens.

#### **Models of Organizational Analysis**

Organizational analysis helps businesses succeed in a dynamic business environment. For that reason, an entity needs to understand its model. Business modeling is a key parameter in the process of organizational analysis. Models explain how a business functions and the changes they experience, so that they can reach their desired level of performance.

There are four different models that organizations commonly work with. The first model is the **rational model**. Its philosophy is that there is only one logical way to perform tasks. An alternative model is the **natural model**, which believes that a business not only wants to achieve its own goals, but also positively influence its external environment.

**Socio-technical** is the third model. According to the socio-technical model, businesses are evolving on a continuous basis. Change is made each time employee expectations are altered because of collaborating with fellow employees.

The last one is the **cognitive model**. This model places great emphasis on tasks done by the business team. A lot of attention goes toward the division and coordination of tasks among employees.

#### **Benefits of Organizational Analysis**

Organizational analysis offers many benefits to a business. For one, it helps businesses improve on their weaknesses. Understanding how a business functions helps to shed light on areas of weakness that may only require simple changes to spur growth. An organizational analysis helps businesses find innovative ideas, such as new ways to structure objectives so that employees are more productive.

#### **Q.4 Scientific attitude among science students is rare, how can we develop this attitude among the secondary school science students? Give a practicable solution.**

Some experts are of the view that direct teaching does not produce considerable kind of changes in attitudes of the students, while in accordance with some experts, for developing such kind of attitudes, out of school and uncontrolled experiences play an important role. Various studies have shown the fact that direct teaching plays an important role in modifying the attitudes of young students to considerable extent.

For planning learning experiences to inculcate scientific attitudes, some experts have put forwarded their views. In accordance with an expert's view, this can be done by increasing the degree of consistency of the environment in which students get education.

# **Course: Assessment in Science Education (697)**

## **Semester: Spring, 2022**

In simple terms the measures through which scientific attitudes can be developed among the students include those through which their curiosity gets satisfied, they get rid of their superstitions, they begin to participate in co-curricular activities, they begin to think in a practical way, they play an important role in developing a desirable kind of environment in the classroom, they get inspired to get involved in the habit of studying various scientific literatures and they get opportunities to get involved in practicing or practical works.

An important tendency which is found among all human beings and especially in children is curiosity. Children are found to be more curious to know about various things they observe around themselves in their daily life. Teacher should make such kind of arrangements in the classroom and in school that they can get maximum opportunities to get their curiosity satisfied to considerable extent.

However, this tendency should be nourished by the teacher by encouraging them to ask questions and teacher should try to provide satisfactory responses to their queries and curiosities. Opportunities for close observations should be provided to the students and they should be provided equal opportunities to get involved in the experimental functions carried out in the school. Thus, through such practice, teacher will find it possible to nourish feature of curiosity found in the students.

Generally it is found that whatever a child or person learns during his childhood, they become permanent qualities of his personality for life long time. Not only this, generally children begin to believe the things or stories they hear from the others.

During this age, probability of developing the habit of relying on the superstitions is found to be maximum. Such kind of thinking prove to be an important blocker in developing the scientific attitudes among the students, for which teacher should stress on the removal of such impressions of these false beliefs and superstitions through the proper and well-arranged study of science.

For this purpose, teacher should provide the task of collecting evidences and beliefs based on their self-observations, experiences and experimentation with the aim to test the validity of such baseless beliefs and superstitions. Proper encouragement should be provided to the students to carry out various test and experimental functions independently. Spirit of self exploration and investigation should be developed among them. This can only be done with the help of scientific methods.

Teacher should encourage the students in every possible respect to find out the evidences on which they base their beliefs. They should be led to the unknown by making use of their own previous knowledge for finding and exploring the further aspects of relevant field of knowledge.

Some opportunities should be provided to the students by which they can experience complete freedom in their thoughts. Teacher should never indulge in such practice by which students can get ready-made responses. All those facilities should be provided in the schools through practices of free thought and active participation can get developed among the students.

As said earlier that science is a practical subject, for which, provision of educational trips and tours should be made from time to time. All the students should be encouraged to get participate in such tours. At uniform

# **Course: Assessment in Science Education (697)**

## **Semester: Spring, 2022**

intervals, provision of science exhibitions should be made in the schools and the responsibility of making all arrangements of such functions should be laid on the shoulders of students.

Through this, quality of performing various functions independently will get developed in the students. Experts and teachers from other schools or institutions should be invited and science conferences should be organised in the schools by which scientific attitudes can get developed among them easily and quickly.

For developing scientific attitudes among the students, it is necessary that classroom in which science information is imparted, laboratories where various kinds of experiments are being conducted and other places where scientific activities are being conducted be equipped with a sense and spirit of scientific environment.

Students should be provided with complete freedom to carry out their own devised experiments in the well-equipped laboratory. In permitting the extent of freedom, teacher must make use of his discrimination, as in absence of this; chances of occurrence of various kinds of accidents will get increased.

### **Q.5 What is Pupil Peer Evaluation? How can it help improve our science subject assessment practice?**

Peer assessment is a process by which learners rate their peers, and is, as such, of great relevance to teacher development. It signifies the joint collaboration by those involved in the learning process in the appraisal of their own learning. In a peer-assessment arrangement, the learners consider “the amount, level, value, worth, quality or success of learning of peers of similar status” (Topping, 1998). Peer assessment is not only a direct appraisal of what has been learned (outcomes) but also of the how of learning (process). The supposed beneficial effects of peer assessment are not only diverse, but also inconclusive (Falchikov, 2005). Peer assessment (and its related format: co-assessment, that is, mentor/assessee) is said to help learners develop meta-cognitive skills, for example, communication skills, self-evaluation skills, observation skills, and self-criticism (Havner and McDowell, 2007); and this may lead more readily to acceptance of feedback. However, supposed effects of peer assessment for learning vary considerably. The findings range from better attendance, learning gains, impact on the ability to self-assess, developing critical thinking, to no effects at all (Topping, 1998). Peer assessment in essence is a social appraisal process where feedback is given to and received by others, aimed at enhancing the performance of the learner'. Therefore, interpersonal and interactional processes play an important role, such as psychological safety, value diversity between peers, interdependence in social relations, and trust in the other as an assessor. Framing features in the arrangement of peer assessment might condition how peers step into the process of appraising each others' learning results. A first set of framing features has to do with specifying the contextual arrangement of the assessment, that is:

- the why, that is, reasons for utilizing peer assessment;
- the what, that is, objectives, teaching areas, and products/outcomes;
- when, that is, time;
- where, that is, place; and
- how, that is, is it supplementary to grading or required; compulsory or voluntary?



## **Course: Assessment in Science Education (697)**

### **Semester: Spring, 2022**

A second set of framing features considers the interaction among peers in the appraisal; because of the interpersonal factors mentioned, the assessment might vary with respect to who assesses whom. This directionality in peer assessment can be one way (from assessor to assessed), reciprocal (peers assess each other, e.g., in pairs), and mutual (all peers assess all peers). In addition, peer assessment may differ in level of privacy (anonymous, confidential, and public) and nature of contact between assessor and assessee (at a distance or face to face).

A third set of framing features refers to the composition of the peer group that provides feedback – it can differ in ability or not; its constellation can vary or not.

In teacher education, student teachers often work and practice together during practice teaching/mentoring. Also in professional development programs, teachers work together as colleagues and share learning experiences. This setting provides a platform for peer assessment in which the ‘learners’ appraise each other as critical friends

Assessment during the tooth morphology course included both formative and summative assessment. Formative assessment included tests performed during learning opportunity, self-assessment and peer assessment. The facts and details expected in the tests that students had to complete during learning opportunities required A- and B-quadrant thinking. Students also had to synthesise their knowledge into answers that indicated the relevance of tooth morphology in the clinical setting, which required D-quadrant thinking.

Summative assessment included a project and a final test at the end of the series of learning opportunities. The project required students to produce, manufacture or create something that would show what they had learned about tooth morphology in a Whole Brain® Thinking manner. They were free to do it in any way they chose. The freedom of choice, and the requirement to create an artefact to illustrate their knowledge, addressed D-quadrant thinking preferences. The content of these artefacts – the facts and application of these facts – required students to use A-quadrant abilities. The details of the content required B-quadrant competencies, while the physical activities necessary to complete the assignment involved C-quadrant skills.

The students created extremely creative artefacts that illustrated their mastery of the subject and ability to construct new knowledge in a meaningful way. The different products were evidence of the students’ diversity, commitment and willingness to be different.