**ASSESSMENT OF STUDENTS**

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**INTRODUCTION**

Although importance of practical work has a long been recognized but unfortunately in the past laboratory work has un-assessed in its true spirit. Science as knowledge and information has been favoured at the expense of science as skills and processes. Christofi (1988) argues” if it is important enough to teach, then we must also assess it, if practical work is not tested, it will undoubtedly be valued less by science students.

In this unit, two important uses of assessment i.e assessment for feedback and assessment for grading have been described in details. Various techniques of assessing the laboratory work have been discussed. Assessment of research projects is also described at the end of this unit.

**OBJECTIVES**

After reading this unit, you will be able to:

1. understand how assessment is used to take feedback of the work done in laboratories?
2. know why and how the assessment is helpful in grading the laboratory work of the students?
3. familiarize and use techniques for assessment
4. know and use the assessment techniques of research project.

**8.1 Assessment**

Assessment is collection of information, processing, analyzing and inferring conclusions from the communicating and informing the information to the students and parents. Teacher also uses assessment results for improvements of learning by giving feedback.

There are a number of assessment types like assessment for learning, assessment of learning and assessment as learning. Criterion referenced, norm referenced, summative assessment, formative assessment, ongoing assessment, diagnostic assessment, effective assessment and performance assessment.

These types of assessment are given the names on the basis of their function; e.g Criterion assessment is a type of assessment in which students have to meet a certain standard/ criterion. This type of assessment is valuable as its results are helpful for improvements, as it tells the gap between what is to be learnt and what has been learnt. If gap is significant then this assessment demands some improvement tips. In norm students achievement is compared with other students of the same group. Summative assessment is conducted at the end of session. Feedback chance becomes zero after summative assessment, as students are give grades and marks. On the basis of marks students are promoted to next classes.

Formative assessment is a type of assessment which is going on. This type of assessment is of worth because this assessment provides chances for improvements. Formative assessment is not only limited to classroom, but it can be done at the end of a topic, practical or unit. Discussions, short tests etc are assessment tasks. Assessment tasks are techniques used for formative purposes.

Diagnostic assessment or inquiry assessment is used to find problems of students for learning.

Ongoing assessment is also known as continuous assessment. It is also a kind of assessment which continues for ever.

Performance assessment is employed for performance tasks. Performance tasks are mostly related to actions, doing something with hands. Practical work is particularly assessed through performance assessment. Practical work aims at development of skills. Performance assessment is not only confined to practical work, but it also assesses higher order skills like drama, Dance and calibrations. Performance assessment and formative assesment where feedback is used, is beneficial for students as they get direct benefit to receive regular and personal information on strengths and weaknesses in performing various laboratory tasks.

In performance assessment by using “Observation” as data tool, a teacher can easily find out the missing skills when a student is performing a practical.

Other aspects to be considered apart from purposes of assessment are:

* What are the desirable characteristics of assessment procedures?
* What attributes can be assessed?
* What techniques are available?
* Are suitable test items available?

**8.1.1 Feedback**

Feedback as a task of formative assessment is supposed to be helpful in ensuring this quality. Feedback is also an important part of formative assessment. Until the results or weaknesses in learning are not reproduced and reported to the students and teachers, the element of improvement lacks. It can be said that without feedback the process of formative assessment is incomplete. Feedback is information a student receives after they have completed a piece of work and can be provided in a range of formats. The piece of work (assignment) can take a wide variety of forms, for example a lab report, essay etc. (Irons, A.(2008). Feedback is about giving information in a way that encourages the recipient to accept it, reflect on it, learn from it, and hopefully make changes for the better. Ramaprasad (1983, 4 cited in Walker, 2009) defines feedback as “information about the gap between the actual level and the reference level of a system parameter which is used to alter the gap in some way”.

Feedback is information that is shared between a teacher and student, in order to help the student to improve from their current level of achievement, and to achieve their learning goals. Feedback should be detailed and targeted towards the individual student. It has been shown that “descriptive feedback is the most powerful tool for improving student learning”.(Black, P., Harrison, C., Lee, C., Marshal, B., & Wilium, D.(2003)

Feedback allows teachers to give students advice on how to guide their learning, how to improve a skill, and how to close the gaps in their learning.

Feedback is the “most powerful single moderator that enhances achievement” (Hattie, J (1999). Therefore, in order for students to be successful, or increase their success level, feedback must be given. Beneficial feedback must be timely, specific, and descriptive. (Ontario Ministry of Education. (2010).

**8.1.2 Assessment for Feedback**

Feedback is crucial to students learning and progress. There are different types of feedback. Feedback is not done in vacuum. There should be some evidence on which feedback is conducted. Feedback is compatible with different types of assessment. For example, if we want to give feedback on performance feedback, it should be based on performance assessment. In performance assessment, oral presentation about any practical task, Science activity, practical tests and presentation of skills are includes in performance assessment.

Descriptive feedback is based on formative assessment, ongoing assessment or comprehensive assessment. Descriptive feedback includes feedback of diverse type, where focus is the improvement for learning, arousing love and motivation. Diverse type of sugessions is rendered in descriptive feedback. Evaluative feedback is given for summative assessment. Here summative is not only meant the end of session exams, but it also includes end of term exams. in evaluative feedback students are informed about grades and marks.

**Evaluative feedback**

Evaluative Feedback is a summary for the learner of how well he or she has performed on a particular task. This feedback is often in the form of letter grades, numbers, check marks, Symbols or general comments such as “good,” “excellent,” or “needs help.”

1) Is non-specific

2) Analyzes and grades student work

3) Relates to a score using letters, numbers, or other symbols.

**Evaluative feedback sheet in Science Practical**

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|  |  |  |  |
| --- | --- | --- | --- |
| **Name of Experiment** | **Task Description** | **Evaluation/marks Grades assigned** | **Sugessions** |
| To find the boiling Point of Water | Theorital back ground of the concept |  |  |
| Names of Chemicals and materials used in this practical |  |  |
| Procedure of the performance |  |  |
| Observational skill |  |  |
| Recording the reading |  |  |
| Calculations |  |  |
| Writing report regarding Practical work |  |  |

Descriptive feedback is specific information in the form of written comments or conversations that help the learner understand what he/she needs to do in order to improve the learning.

1. It is specific (Comments and suggestion for improvement are specific to topic/concept)

2. Analyzes and compare students work to standards, models, samples and exemplars.

3. Relates to performance and the improvement of performance.

Quality feedback Characteristics

* Timely
* Relevant
* Concise
* Specific

**Descriptive Feedback Sheet**

|  |  |  |
| --- | --- | --- |
| **Strengths** | **Area to Improve** | **Improvement Strategies** |
| This is quality work because…  Your thinking shows…  Two/three things you really did well are…  When explaining your topic  you…  Your writing tells me… | Your thinking shows…  One thing to improve on...  You need more…  You need less…  When explaining your topic you…  Your writing tells me… | Your next steps might be…  You might try… |

Other types of feedback may be discussions, lectures on feedback, students inputs for feedback, questioning, interviews, self regulated feedback etc. Researches show that feedback if it is carried in real sense brings a lot of improvement in learning and performance.

**Self Assessment Questions**

Q.1: What is the role of feedback in assessment of laboratory work?

Q.2: Prepare feedback sheets for practicals in your area of specialization.

**8.2 Assessment for Grading**

The process of allocating a grade is a shorthand method of summarizing the quality of student achievement

**8.2.1 Norm Referred Tests**

Norm referred tests are commonly used to discriminate students on the basis of their ability. Norm referred testing is a competitive situation, and may have no other goal than classification of the students. One of the major reason of riot allowing practical assessment to contribute significantly to overall student assessment (Thompson 1997; Downswell and Haris 1997) lies in the relatively poor ability of various tests used in laboratory classes to meet the expected criteria of a good grading examination. The stringer (1971) reported that total score given by teachers for practical courses have two predominant characteristics; first that the mean score is high relative to other forms of assessment, and secondly that the standard deviation and range of scores is low. This is undesirable in norm-referred testing because:

* The scheme will have a low discriminating ability, and hence will not distinguish between good and less good students.
* When the laboratory work counts significantly to the overall assessment of the course of study, the less good students will receive a significant bonus towards their achievement level, whilst the good students will have their achievement level reduced.

If assessment of laboratory work is to occur for grading purpose, then the following criteria will apply:

* The grading scheme should consist of a number of specifically stated objectives with associated marks.
* The extent to which the students have achieved each individual objective should be capable of assessment.
* The total marks available for allocation should represent the full range of scores from 0-100%.
* Each activity should only assess a small number of objectives. If a laboratory test is designed with these characteristics, and administered to the student group, it is possible to do a simple calculation for the discrimination factor to check that the test procedure does have some discrimination ability. It is possible to calculate for any test an index of discrimination (D) which is defined as the difference in total scores achieved by the top (U) and bottom (L) groups (of equal number) divided by the total possible score (N) for a group of the given size:

U - L

D= ----------------------

N

If the calculated value is less than 0.2- 0.4 , then it is considered having less discrimination index. The D value more than 0.40 and fair and more than 0.70 is considered good.

**Activity**

Prepare a skills test for a practical in the subject of Chemistry or Biology and find its discrimination value, by using the above mentioned formula.

Producing an assessment with good discrimination value has several advantages:

* It is tail to students, and those who produce high quality work are commensurately rewarded.
* It enables the teaacher to identify early in the course students with poor practical ability who are in the need of remedial teaching.
* It gives the teacher reliable feedback information on the overall ability of students to cope with course aims/objectives.

The other requirement for assessment for grading is that students individual contribution to an activity must be capable of determination. This is relatively easy when students perform some individual test under examination conditions, and indeed is probably the strongest justification for formal examinations. Hence there is a strong resistance to the use of group activities, on the grounds that the individual contribution cannot be separated sufficiently from the others. It is possible , but very time consuming to overcome the problem to some extent by the use of a variety of probing activities such as verbal questioning and discussion on an individual basis to tease out the effort in terms of quality and quantity made by one person. What needs to be questioned, in view of the importance of team activities in the “real” professional world, is whether it is more important to give undergraduate experience of working in teams or to assess the work for grading purposes.

**8.2.2 Criterion –Referred Test and Mastery Learning**

A successful criterion- referred test is one in which the various participants would agree that the objective or content had been represented in the tasks, and that the score had meaning in their own right without reference to norm distributions. In Criterion –referenced testing, the examiner has to determine which students have met the various criteria.

The advantage of criterion referenced testing is that the testing procedure directs attention to the performance of students with respect to the tasks they undertake and that it rewards students on the basis of their attainment relative to set criteria rather than to their peers. In Science laboratory criterion referenced tests are very useful especially when coupled with mastery learning. It is obvious that some skills taught in laboratory sessions need to be developed to a high level of competence if students are to succeed in more complex operations. For example: ability to find the exact weight, to titrate accurately, to use instruments such as microscope, screw gauge, and using chemicals accurately in amount and kind. Mastery tests are criterion referenced tests on which very high performance level is set as pass grade.

**Process of CRT**

Since it is unlikely that all practical activities can be tested with the same degree of validity, reliability and discrimination, it follows that not all activities should be used for grading purpose. It is also apparent that different kinds of assessment techniques need to be applied, since it has very unlikely that one assessment procedure will cope with usually large variety of objectives associated with practical activities. In an ideal situation, the ssessment procedure, for grading, might consist of a small number of different techniques which have high validity, high reliability and high discriminating ability, and which adequately sample the range of objectives for the course.

1. A set of behavioural objectives or criteria describes what the student is expected to achieve; are given to the students.
2. The student carries out the activities several times in different context until the supervisor (or student) considers a mastery level has been achieved.
3. The students take the criterion-referenced test to demonstrate mastery.
4. If the defined mastery level is achieved, the students proceed to the next task. If the student fails the test, further practice and retesting is required until the test is passed. If this process were applied to a single common technique, such as using a burette, a set of criteria could be generated as follows, so that the end of the exercises the student should be able to:

* Fix the burette in the stand
* Read the level of liquid in burette to two decimal places.
* Record this value in tabular form in the laboratory book.
* Deliver a predetermined volume of liquid from the burette to a beaker with an accuracy of 0.02 mL.
* Record the final burette reading to two decimal places in the laboratory note book.
* Determine the volume of liquid actually delivered to .04 mL.

Listing what is expected, focuses attention on very specific aspects of techniques and at the same time prescribes the level of attainment. The use of mastery tests can save considerable time, and failure at later stages in the course, as it can be assumed with confidence that students have a firm foundation on which to build subsequent experimental skills.

It is not possible to test all laboratory objectives to mastery level, simply because of time constrains. Hence the objectives for mastery learning need to be identified and separated out from non- mastery learning objectives. The former must then be developed into criterion-referenced tests. Also, these two lists should be presented to the students, so that no confusion arises in their minds about the required levels of performance.

Once mastery tests have been established, they may be presented to the students as barrier or hurdles to further progress, implying that their topics are so crucial that the student is unlikely to succeed with subsequent activities unless they are passed. If students fail they are provided opportunities to practice the skills again before re-sitting .it is realized that the choosen topics are very important, and they are regarded as a prerequisite to further progress, they will be taken seriously.

**Self Assessment Questions 8.2**

Q.1: Describe criterion referenced tests. Discuss use of CRT in laboratory assessment.

Q.2: Describe norm referenced tests. Discuss use of NRT in laboratory assessment.

Q.3: Differentiate NRT and CRT.

**8.3 Assessment Techniques in Laboratory**

Having decided the purpose of the assessment, and what is to be assessed, the science teacher now needs to choose the most suitable assessment techniques for each assessable item. A number of the more commonly used techniques of assessment in laboratory are discussed as under:

**8.3.1 Assess by Direct Observation**

Structured mini-practicals are a simple, effective way to assess a wide range of skills. Students can undertake them as part of routine laboratory sessions. They are particularly effective in assessing students' manipulative, observational and interpretive skills.

When using observation assessment, follow a systematic plan or rubric. That way it's clear to both the assessor and the student what is to be observed and recorded. You can also use an oral assessment to supplement the observation, for example, to check a student's understanding of particular techniques. Students often perceive assessment of mini-practicals in the laboratory as contributing positively to their learning. Make sure your design of mini-practicals doesn't get in the way of students demonstrating their skills and capabilities. For example, don't impose significantly tighter time limits than students are used to in non-assessable lab sessions.

Mini-practicals are ideal for developing and assessing group and teamwork skills. If any laboratory demonstrators are involved in assessment, give them clear guidance and support, as well as explicit assessment criteria to guide their judgments of students' performance.

Additionally, you can use both peer assessment and self-assessment. The course might also offer the opportunity to involve others in assessing by observation. You might, for example, want to invite experts to come to campus or accompany your class in fieldwork, professional or industry placement, or other forms of work-integrated learning. You can assess practical skills using mastery approach rather than by grading. For example, where laboratory work consists of a linear sequence of activities, students may be assessed as having completed each activity on the basis of an observed outcome that must be completed, recorded and checked off by the tutor or demonstrator before moving to the next activity. Their achievement of each staged outcome indicates their competence in the related practical skills. Use this approach in the early stages of a course (or before a course has started) to ensure that students have foundational technical skills, which will enable them to fully participate in future laboratory classes. Require them to perform a number of essential laboratory activities that demonstrate their ability to operate within occupational health and safety regulations.

**8.3.2 Interviews**

Athough individual interviews with students are time-consuming and difficult to manage in a classroom setting; there are several reasons why they are worth trying.

1. For those students who seem to be having trouble with a particular concept or skill as demonstrated on their tests, interviews may be a way of further assessing their functioning relative to the instructional objective. A series of probing questions can be developed that would be useful in deciding how to help students improve their performances.

2. If a new unit is being developed, interviewing a sample of students of different abilities about their prior knowledge on the topic should allow the teacher to assess students’ readiness to learn the new topic. Instruction could then be designed to target their entry level of knowledge.

3. Interviews can send a message to students that a teacher cares about what they think or understand. Rapport is encouraged, and student motivation may be increased.

4. Interviews allow students who have difficulty with written tests to express what they understand in a context that may be less threatening and anxiety producing. On the flip side, students who do well on written tests may have difficulty communicating their responses to questions verbally and may need practice.

5. Interviews provide teachers the opportunity to probe and ask follow-up questions in ways that challenge students to think beyond their current level of understanding and to organize their knowledge in more systematic ways. Thus, follow-up questions can be individualized such that students are pushed as far as their level of understanding permits.

Interviews can vary in their degree of structure. In unstructured interviews, the contents and order of the questions vary with the student and are responsive to each student’s answers. In semi-structured interviews, there may be some themes identified to structure the interviews, but questions within those themes may be phrased differently for different students. In structured interviews, teachers ask students to respond to the same set of questions.

**8.3.3 Using Information from Interviews**

Theway that information from interviews is used depends on the context or purpose of the interview. Some examples follow.

1. If a new unit is being developed, and the teacher is interviewing a small sample of students on their ability to explain and relate the concepts of adaptation and natural selection, tape recording the interviews might be helpful. The teacher could listen to the tape at a later time and look for misconceptions in student responses.

2. If the purpose of the interview is to assess students’ progress on an objective having to do with accurately communicating scientific principles, a series of rating scales could be developed to describe poor, average, and good performance on a variety of dimensions (e.g., organization).

Daily teacher/student dialogue which occurs during instruction can be seen as a series of unstructured interviews used by teachers to assess students’ competence relative to instructional objectives.

**8.3.4 Laboratory Notebook**

Use laboratory notebooks Laboratory notebooks are a form of authentic assessment, as they replicate what scientists actually do. Students use the notebook - possibly electronic, as reported by Quinnell et al. (2009) - to record details of all the experiments students complete in the laboratory. Requiring students to record their laboratory methods and results as a running record of their laboratory work is a vital part of the "doing" of science; asking students to present these records periodically as part of the assessment of a course reinforces the value of documenting laboratory work. You can assess the notebooks in different ways: demonstrators can assess them weekly in the laboratory they can be collected at random times to encourage students to complete them routinely or students can be set an open-book exam using their notebooks to respond to questions based on their experiments. Just as with other forms of assessment, make the assessment criteria explicit and teach students what constitutes a good notebook. Also make it clear what they should do if they miss an experiment, or if their experiment does not succeed. For example, if they use another student's data they must acknowledge this and explain the problem with their own experiment.

**8.3.5 Laboratory Reports**

Use laboratory reports unlike laboratory notebooks, which are written while experiments are being conducted, laboratory reports are prepared on completion of an experiment. They can demonstrate students' observation, interpretation and reflection abilities, and you can infer from them the knowledge and skills developed through lab-based learning. Laboratory reports can involve a lot of work for both students and staff, sometimes entailing long delays between the student's submission of the report and the return of feedback and grades. To reduce the workload, you might want to use report templates; students complete the templates during the laboratory session. You can have tutors mark some sections of the template to provide immediate feedback to the students, then leave time for students to complete interpretive and evaluative writing assessment tasks, in which they, for example, synthesise key findings from an experiment and relate them to published results. Teach lab report preparation skills explicitly, and provide opportunities for practice. Use available resources such as the WRISE (Write Reports in Science and Engineering) website, and incorporate the structured development of students' communication competence as an explicit component of assessment tasks and marking criteria. Give clear instructions about the assessment task, along with explicit assessment criteria and unambiguous guidelines so that students know where to focus their efforts. In laboratory reports, sometimes students report on methods they did not implement, or results they did not obtain. Address ethical issues as a central part of scientific enquiry, and ensure that assessment processes align with them. For example, an assessment exercise might require students to add a personal reflection on any ethical dilemmas they faced in carrying out their laboratory work and preparing their report. To develop this type of assessment beyond the straight lab report, require students to: pitch their reports for different (imagined or real) audiences, for example, a government body or a local newspaper. To do this, students need to think about that audience, and consider the best way to interpret and present their results. prepare a set of instructions and some guidelines for others to carry out the same experiment they have just completed.

**8.3.6 Learning Logs**

Ask your students to keep a learning log as a way of reflecting on their own learning and progress. These logs can constitute a part of the assessment regimen. Students can record "critical incidents" at the time of their experiments, then reflect on and discuss these. Make sure all tutors are clear as to which learning outcomes the journal-keeping is aligned with. Learning logs should not be just a record of routine activities, but should help students develop communication and critical skills.

**8.3.7 Learner as Teacher**

Sometimes the deepest formative learning happens when learners try to teach what they have learnt to a real novice, or someone acting as a novice. This is particularly true in relation to practical skills. The new learner gains immediate feedback on their own understanding and capacity to explain, based on how quickly the novice picks up the skill being taught. Summative assessment tasks can be developed from this principle. For example, a task requiring students to provide explanations and guidance about scientific concepts and/or practical skills for the next student group helps them revise their laboratory learning, and consolidate their understanding about the relationships between theory and practice. They can deliver learning products as, for example, written instructions or guidelines, or audio or video recordings of laboratory demonstrations and other presentations. Assessment tasks like these are also ideal settings for reciprocal peer assessment and self-assessment, supported by assessment rubrics.

**8.3.8 Conduct Tests and Quizzes**

When you integrate "mini-tests" with laboratory work, students receive feedback on how well they understand the conceptual basis of their practical work. The results can inform subsequent teaching activities, for example by highlighting areas of common conceptual misunderstanding.

**8.3.9 Hold Poster Sessions**

Students can develop posters based on their experiments carried out; these allow you to assess their observational, analytical and communication skills, and encourage students to be creative and reflective. You can require that their poster production be a group project and/or link it to a presentation. Tutors and/or peers can assess the posters, giving the students fast, and formative feedback. When you set a poster task, give students clear instruction about the objectives, presentation formats and so on. Don't reduce poster session assessment simply to a competition with awards for the top few. Be prepared to give feedback that rewards students for the work they do and contributes to their learning. An event where students present their posters can be an especially engaging assessment forum, offering students the opportunity to experience a mini-science conference.

**8.3.10 Have the Students Give Presentations**

Students (in groups) can present an experiment or set of experiments to their peers and report findings, challenges and implications. If you can, incorporate these presentations into lab sessions, so that students learn about experiments from their peers. As with posters, you can use either peer or tutor assessment, or a combination of these. Presentations can be pre-recorded by students, using basic available technologies such as mobile telephones, then uploaded to a shared online space. As an example, Pearce (2010) describes an assessment task that entailed students making a video recording of themselves narrating what they did in their last laboratory experiment.

**8.3.11 Get Students to Complete Projects**

A project is a time-intensive task for students to complete and for teachers to assess. However, the use of projects for assessment can encourage deep learning and scientific enquiry. Projects can integrate a range of practical skills and motivate students to explore new ideas and areas. The method reported by Ketpichainarong et al. (2010) outlines a staged approach: beginning with a given experiment for practice, then moving on to students designing and conducting their own experiment, with oral and written presentation of processes and outcomes supported by peer assessment and class discussion.

**8.3.12 Make Pre-laboratory Work an Assessment Task**

To help students prepare for, and make the most of, their laboratory learning experiences, have them undertake assessed pre-laboratory activities. These can also help you assess their experiment planning skills. You might set students the task, in groups, of designing an experiment before going into the laboratory. Instruct them to use discussion forums or wikis so that you can track how their ideas develop and how each student contributes. Ask them to present their plan for experiment as a flowchart or graphic. Then again, you could require students to carry out written pre-laboratory work, answering questions about the upcoming laboratory procedure. Over time, reduce the number of explicit, directed questions and indicate that students are expected to take greater responsibility for researching and writing up key aspects of the procedure. You can use video recordings of laboratory activities or descriptions of experiments as resources for online quizzes that students must complete before laboratory session. Pre-laboratory work is also a way of addressing risk and safety issues.

**8.3.13 Ensure Fairness**

Ensure that you accommodate students with disabilities, in any lab work. For example, you might engage an education support worker for a student with reduced mobility or colour-blindness. Work with the student to identify the best approach. In planning for learning and assessment, accommodate any significant differences in the laboratory experience levels of students entering courses with laboratory-based components, to minimize the chance of unfairly disadvantaging them.

**8.3.14 Use Technology**

Use virtual laboratories as part of pre-laboratory assessment, to familiarize students with laboratory safety. Or use them to replace real laboratory experiences, having students undertake experiments and analyze results. Remember, though, that certain aspects of learning can't be assessed in simulated environments, particularly tasks requiring touching, smelling, motor skills and so on. Online laboratories or iLabs, such as those at the iLab Central website, are experimental facilities that allow students and educators to carry out experiments from anywhere at any time. You can design a range of formative assessment activities based on the simulations available in these laboratories, and both students and teachers can monitor student understanding and progress. Use technology to support the administration of assessment and reduce workload. For example, use smart phones to record students' laboratory assessment results in a central database during the laboratory session, and allow students to access their results and receive prompt feedback during or immediately after their laboratory session.

**Self assessment Question 8.3**

Q.1: Describe different Laboratory assessment techniques.

**8.4 Assessment of Science Projects**

In higher classes project activity is considered to be the most significant practical activity. A student may occupy a major proportion of a term, a semester or whole years. This activity is significant not only because of the time involved, but also because it seeks to integrate all practical skills developed in previous sessions of the secondary /higher secondary courses and may extend into new areas.

A problem is presented to a student, student then plan the investigation program, build necessary equipment, make the measurements, analyze the data, infer results and prepare the report. If all of these skills are to be assessed, the task is very large and exhibits all of the challenges of the weekly labs, combined into one total experience.

Project work challenges students to think beyond the boundaries of the classroom, helping them develop the skills, behaviors, and confidence necessary for success in the 21st-century. Designing learning environments that help students question, analyze, evaluate, and extrapolate their plans, conclusions, and ideas, leading them to higher–order thinking, requires feedback and evaluation that goes beyond a letter or number grade. The term “authentic assessment” is used to describe assessment that evaluates content knowledge as well as additional skills like creativity, collaboration, problem-solving, and innovation.

Authentic assessment documents the learning that occurs during the project-building process and considers the real-world skills of collaboration, problem solving, decision making, and communication. Since project work requires students to apply knowledge and skills throughout the project-building process, you will have many opportunities to assess work quality, understanding, and participation from the moment students begin working.

For example, your evaluation can include tangible documents like the project vision, storyboard, and rough draft, verbal behaviors such as participation in group discussions and sharing of resources and ideas, and non-verbal cognitive tasks such as risk taking and evaluation of information. You can also capture snapshots of learning throughout the process by having students complete a project journal, a self-assessment, or by making a discussion of the process one component of the final presentation.

**8.4.1 Developing Assessment**

As you design the project, it is helpful to begin with the end in mind. What performances do you want to see? Then, determine exactly how students will demonstrate each performance as they build a product or solve a problem to complete the task.

Most of our assessment focuses on content mastery. Techniques we are all familiar with include the evaluation of the final product and having students complete quizzes or tests. Other benchmarks for content mastery you can use include the number of citations a student references, amount and quality of research, use of experts, validity and effectiveness of arguments, meeting the topic, and answering the essential question.

Completing complex authentic projects that require collaboration, creativity, problem-solving, and innovation helps prepare students for increasingly complex life and work environments. Effective communication in the 21st-century requires that students can effectively express themselves in writing, verbally, and visually. Be sure to assess the quality of writing, including ideas, vocabulary, fluency, organization, and conventions, as well as the use of media and overall design. Since a project is a collaborative effort that occurs over time, include evaluation components that consider teamwork, organization, planning, and behavior.

**Self Assessment Questions for Students of Project.**

**Content Knowledge**

* What new knowledge did you learn while working on this project?
* Did you learn more or less than you expected?
* What surprised you?
* What else would you like to know about the topic**?**

**Collaboration and Team Work**

* How did your work and actions contributed to your team’s success?
* What was the hardest part of project about working in a Team?
* What was the best part?

**Technology and Communication**

* What new skill did you learn?
* What else do you want to learn how to do?
  + 1. **Creating Rubrics**

Because many performances cannot easily be quantified, you want to be as specific about your expectations as possible. [**Creating a rubric**](http://www.rubric-maker.com/?utm_campaign=ce_rubmkr_ref&utm_source=ce&utm_medium=ce_body) for the final product and various components of project work can ensure a more accurate, specific, and useful assessment.

A rubric is an authentic assessment tool that:

* Provides clear expectations for a project.
* Examines the product as well as the entire project-building process.
* Enumerates the performances on which students will be evaluated.
* Explains what constitutes excellence during the project process.
* Helps students understand what they need to do to excel.
* Helps remove subjectivity and bias from the evaluation process.

Sharing and clarifying the performances that will be assessed during a project removes mystery from the evaluation process, helping students focus on specific actions they can take to improve their performance.

**8.4.3 Involving Students in Assessment**

Involving students in project assessment boosts motivation, improves meta-cognition, and promotes self-directed learning. Students who are asked to reflect on their own performance learn to evaluate their strengths and weaknesses and are able to pinpoint where to focus their efforts to see the greatest results.

You might have students provide feedback and critiques by asking them to keep a project journal or work log, evaluate themselves using the project rubric, and answer additional self-assessment questions. An open-ended self-assessment allows students to share learning that occurred during the process that was not included in the rubric. As they reflect and evaluate, students should describe their learning and contemplate decisions they have made individually and as a team.

You may also want to have students complete a peer evaluation for components of the project, such as the project presentation. Students can also evaluate the writing, design, and effective communication during the creation and presentation of the final product. Combining your assessment of the process and the end product with student reflections and evaluations will help you create a more accurate assessment of student performance.

**8.4.4 Audience Assessment**

Authentic project work should reflect the questions, problems, and needs of the world beyond the classroom. If the work is something that has real value, make sure there is a wider audience for the final product presentation. Having students create web pages to display their ideas and findings enables their products to easily reach a wider audience. If the project deliverable involves an oral presentation, invite peers, family, or community members to attend.

You may also want to invite subject matter experts in the area of project work to participate in the final product’s assessment. Developing public-service announcements? Invite employees from a local advertising agency. Designing a new school? One of your classroom parents may just be an architect.

If students know that other people will be relying on and judging the information and ideas they propose, their motivation to work hard and take risks increases. If you involve the audience in the assessment process, be sure to provide a rubric or other guide to ensure the feedback they provide is pertinent to project goals.

**Conclusion**

The complexity of student projects makes assessment that captures both the final product and the learning that occurs along the way an intricate and sometimes difficult task. Summative assessment can be an effective component of an overall assessment strategy. Authentic assessment can be used during the project-building process. Rubrics, ideally developed with the help of the students, can help to evaluate how successfully students address specific goals and performances. Self-reflection gives students a means to determine what they think they have learned and how well they have learned it. Crafting assessment strategies that combine all of these methods helps us gain a much better understanding of the learning that takes place during the entire process.

**Self Assessment Questions 8.6**

Q.1: Create your own Rubric for the assessment of your project work.

Q.2: How will you involve your laboratory students in assessment? Give your own arguments.