

HOMI BHABHA CENTRE FOR SCIENCE EDUCATION

Tata Institute of Fundamental Research

(Elective Course)

Date: November 23, 2022

Course Title: Assessment for Enhancing Science and Mathematics Learning

Course Code: SCE319.2

Credits: Two

Duration: January 2023

Time and location: (Monday, 11.00-1.00)

Contact hours: 26 hrs, 13 sessions,

Instructors: Narendra D. Deshmukh and Kalpana Kharade

Guest Session: KK Mashood/Shirish Pathare

Mode- Blended mode (Online & Room 217, Main building.

Field work locations will be intimated later.

About the course

Introduction: For several decades now, assessment has become an important educational priority. The school accountability is very often based on analysis of, standardized summative assessments. As a consequence, assessment now dominates most debates about educational reform, particularly as a means of school accountability for learner performance. Behind this debate is a genuine challenge to address gaps in achievement between different demographic groups of students. There is an urgent need to provide a helping hand to the communities and cohorts of students out of cycles of underachievement.

This course is an overview of current debates about testing, and analysing the strengths and weaknesses of a variety of approaches to assessment. The course also explores recent advancement in the use of ICT in assessment. It also generates conversation on the need for assessment for equitable learning for the diverse learners prevalent in today's classrooms.

Learning outcome

After learning this course the learner will be able to -

- understand the concept and philosophy of Assessment
- understand Taxonomy of Educational objectives

- design various tools and techniques of Assessment for enhancing learning
- develop insight in to basic skills and competencies in the use of various types of assessment tools and techniques, their administration, analysis, interpretation, reporting and feedback

Course Modules

Module 1: Basics of Assessment

- a. Contexts and perspectives of assessment
- b. Types of Assessment- Placement, Formative, Diagnostic and Summative
- c. Essentials of Assessment
 - I. Aims and Objectives
 - II. Learning Outcomes
 - III. Assessment of Cognitive, Affective and Psychomotor Domains of Learning
 - IV. Practice of assessment: Challenges and Tensions

Module 2: Tools and techniques of Assessment

- a. Criterion Referenced Tests and Norm Referenced Tests
- b. Self-Assessment, Peer Assessment and Teacher Assessment
- c. Assessment in digital age: Quiz, Polls, Crossword, Survey, Blog, Wiki, Assignment, Discussion forum, Rubrics, e-Portfolios, Reflective Journals
- d. Design of tools-Concept inventory, two/three/four-tier diagnostic test, Concept based Objective tests, drawings, etc.
- e. Assessment for equitable learning

Essential learning activities

- A. Formulate an Assessment plan for any unit from Science/ Mathematics
- B. Create a structure for e-portfolio for a learner at secondary/ higher education level
- C. Make a rubric for students' presentations
- D. Create a Feedback policy for your class

Essential Readings

Demosthenous, E., Christou, C., & Pitta-Pantazi, D. (2021). Mathematics Classroom Assessment: A Framework for Designing Assessment Tasks and Interpreting Students' Responses. *European journal of investigation in health, psychology and education*, 11(3), 1088–1106. <https://doi.org/10.3390/ejihpe11030081>

Hestenes, D., & Halloun, I. (1995). Interpreting the FCI. *The Physics Teacher*, 33, 502–506.

Klymkowsky, M.W., Garvin-Doxas, K. (2020). Concept Inventories: Design, Application, Uses, Limitations, and Next Steps. In: Mintzes, J., Walter, E. (eds) *Active Learning in College Science*. Springer, Cham. https://doi.org/10.1007/978-3-030-33600-4_48

Klymkowsky, M. W., Gheen, R., Doxas, I., & Garvin-Doxas, K. (2006). Mapping student misconceptions using Ed's tools, an on-line analysis system. *Developmental Biology*, 295, 349–350.

Miles, J. (2022). The 3 Different Types of Assessment in Education.

<https://www.hmhco.com/blog/different-types-of-assessment-in-education>

Mutlua, A. and Sesenb, B.A. (2015). Development of a two-tier diagnostic test to assess undergraduates' understanding of some chemistry concepts. *Procedia - Social and Behavioural Sciences* 174, 629 – 635.

Norman, Patricia J.; Nordine, Jeffrey. (2016). Improving Elementary Mathematics and Science Teaching and Learning: Lessons from a School-University Partnership. *School-University Partnerships*, v9 n1 p30-44. <https://files.eric.ed.gov/fulltext/EJ1107094.pdf>

Reynolds, C.R, Livingston, R.B and Wilson V, (2011), *Measurement and Assessment in Education*

Rustaman, NY. (2017). *Journal of Physics: Conf. Series*. 895 012141, doi: 10.1088/1742-6596/895/1/012141

Smith, M. K., Wood, W. B., & Knight, J. K. (2008). The genetics concept assessment: A new concept inventory for gauging student understanding of genetics. *CBE Life Sciences Education*, 7, 422–430.

Taiwo, Adediran A. (2004), *Fundamentals of Classroom Testing*, Vikas Publishing House Pvt Ltd, New Delhi. <https://www.reading.ac.uk/engageinassessment>

Tanujaya, B. (2017). Application assessment as learning in mathematics instruction. *Advances in Social Science, Education, and Humanities Research*, 100, 140- 145. <https://doi.org/10.2991/seadric17.2017.30>

Treagust, D. F. (1988). Development and use of diagnostic tests to evaluate students' misconceptions in science. *International Journal of Science Education*, 10, 159–169.

Treagust, D. (1986). Evaluating students' misconceptions by means of diagnostic multiple choice items. *Research in Science education*, 16, 199–207.

Additional Reading Resources

[Assessment in Mathematics](https://www.learnalberta.ca/content/mewa/html/assessment/index.html) <https://www.learnalberta.ca/content/mewa/html/assessment/index.html>

[Using Classroom Assessment Techniques](https://www.cmu.edu/teaching/assessment/assesslearning/CATs.html)

<https://www.cmu.edu/teaching/assessment/assesslearning/CATs.html>

[Understanding the Role of Assessment in Learning](https://www.queensu.ca/teachingandlearning/modules/assessments/04_s1_01_intro_section.html)

https://www.queensu.ca/teachingandlearning/modules/assessments/04_s1_01_intro_section.html

[Assessment Tools and Instruments](https://serc.carleton.edu/NAGTWorkshops/assess/tools.html)

<https://serc.carleton.edu/NAGTWorkshops/assess/tools.html>

[Science assessment tools](https://assessment.tki.org.nz/Assessment-tools-resources/Commonly-used-assessments/Science-assessment-tools)

<https://assessment.tki.org.nz/Assessment-tools-resources/Commonly-used-assessments/Science-assessment-tools>

List of Concept Inventories-

<https://cgi.tu-harburg.de/~zllwww/fachdidaktik/ci/?lang=en>

CERI-OEDC. (2008). *Assessment for Learning Formative Assessment*, Available at:

<http://www.oecd.org/site/educeri21st/40600533.pdf>.