



Guide To Developing High-Quality, Reliable, and Valid Multiple-Choice Assessments

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ABSTRACT: Chemistry faculty members are highly skilled in obtaining, analyzing, and interpreting physical measurements, but often they are less skilled in measuring student learning. This work provides guidance for chemistry faculty from the research literature on multiple-choice item development in chemistry. Areas covered include content, stem, and response construction; item analysis; item difficulty; and item discrimination. The goal is to help faculty construct high-quality, reliable, and valid multiple-choice items to evaluate students' ability to recet learning objectives and to demonstrate proficiency in the content domain under study. Using item-writing guidelines based upon the research literature allows faculty to create assessments that are reliable and valid, with greater ability to discriminate between high- and low-achieving students.



KEYWORDS: First-Year Undergraduate/General, Second-Year Undergraduate, Upper-Division Undergraduate, Curriculum, Testing/Assessment, Student-Centered Learning

INTRODUCTION

The design and interpretation of assessments of student learning is a responsibility of chemistry faculty. Developing familiarity and expertise about assessment—vocabulary, design, and interpretation—has been the topic of recent editorials and research articles in the Journal. ^{1–1} The aim of this work is to provide guidance for chemistry faculty in developing multiple-choice items leading to reliable and valid assessments. If exams are thought of as a tool for measurement of student learning, then the goal should be to develop the best tools possible.

The purpose of assessment is for faculty to learn what students know or can do. The purpose of a specific task is to provide formative (homework, quitzes, or exams given during the semester) or summative (exams or final projects at the end of the semester) feedback to faculty and students on the students' ability to achieve specific learning objectives. In this work it is assumed that faculty have specific, measurable learning objectives for each chapter, unit, module, and/or experiment in their course.

The terms reliability and validity are used to describe assessment tasks (and occasionally items) and frequently occur in the lexicon of assessment. Reliability refers to a task's reproducibility (or its precision). Validity refers to the degree to which the task measures what it purports to measure (or its accuracy). Thus, reliable and valid assessments allow faculty to measure in a precise and accurate way the students' ability to meet specific learning objectives.

There are many different ways to assess student learning and a wide literature base to peruse and use as resources. Faculty may be familiar with Blocon's Taxonomy and the revised taxonomy that uses a knowledge dimension and cognitive process dimension to generate 24 different types of possible assessment tasks of varying complexity.* ** Computer-based assessment, electronic

homework platforms, and technology platforms such as BeSocratic facilitate a wide variety of assessment tasks. Kathbeen Scalise's "Computer-Based Assessment: Intermediate Constraint" Questions and Tasks for Technology Platforms" is a rich resource for the development of questions linked to electronic delivery." These resources can help faculty consider what kind of knowledge they would like to assess (factual, conceptual, procedural, or metacognitive), at what level (recall, understanding, application, and analysis, etc.), and how they would like to do it (multiple-choice questions, essay questions, drawings, or projects, etc.). To determine if students have achieved a learning objective, faculty make decisions about what evidence they will accept predicated upon their own assessment proclinities, class size, level of the course, and time available for erading.

This work gleans from the research and practice literature guidelines for the development of multiple-choice items. Given that faculty may use such items in homeworks, quitzes, or exams to assess student learning, it is sensible to collect what is known about item writing into a work that is useful to chemistry faculty.

MULTIPLE-CHOICE QUESTIONS

Multiple-choice questions are a traditional type of assessment task for students that can be used on exams or quitnes. Such items have the advantage of ease of scoring, especially if scoring is automated. The item begins with a question or stree, and the correct answer is selected from a list of possible regresse options. There is one correct response and the other options are called distractors.

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Developing Assessments A Guide To Multiple Choice

Guillaume Favre

Developing Assessments A Guide To Multiple Choice:

Systematic Assessment of Learning Outcomes Mary McDonald, 2002 This book is designed to be the comprehensive reference which focuses on the development of the most commonly used type of classroom assessment the multiple choice Developing Assessments for the Next Generation Science Standards National Research Council, Division of Behavioral and Social Sciences and Education, Board on Science Education, Board on Testing and Assessment, Committee on Developing Assessments of Science Proficiency in K-12,2014-05-29 Assessments understood as tools for tracking what and how well students have learned play a critical role in the classroom Developing Assessments for the Next Generation Science Standards develops an approach to science assessment to meet the vision of science education for the future as it has been elaborated in A Framework for K 12 Science Education Framework and Next Generation Science Standards NGSS These documents are brand new and the changes they call for are barely under way but the new assessments will be needed as soon as states and districts begin the process of implementing the NGSS and changing their approach to science education The new Framework and the NGSS are designed to guide educators in significantly altering the way K 12 science is taught The Framework is aimed at making science education more closely resemble the way scientists actually work and think and making instruction reflect research on learning that demonstrates the importance of building coherent understandings over time It structures science education around three dimensions the practices through which scientists and engineers do their work the key crosscutting concepts that cut across disciplines and the core ideas of the disciplines and argues that they should be interwoven in every aspect of science education building in sophistication as students progress through grades K 12 Developing Assessments for the Next Generation Science Standards recommends strategies for developing assessments that vield valid measures of student proficiency in science as described in the new Framework This report reviews recent and current work in science assessment to determine which aspects of the Framework's vision can be assessed with available techniques and what additional research and development will be needed to support an assessment system that fully meets that vision The report offers a systems approach to science assessment in which a range of assessment strategies are designed to answer different kinds of questions with appropriate degrees of specificity and provide results that complement one another Developing Assessments for the Next Generation Science Standards makes the case that a science assessment system that meets the Framework's vision should consist of assessments designed to support classroom instruction assessments designed to monitor science learning on a broader scale and indicators designed to track opportunity to learn New standards for science education make clear that new modes of assessment designed to measure the integrated learning they promote are essential The recommendations of this report will be key to making sure that the dramatic changes in curriculum and instruction signaled by Framework and the NGSS reduce inequities in science education and raise the level of science education for all students Resources in education ,1983-06 **Assessment Handbook** Judith A.

Dawson, 1995 Assessment for Effective Teaching Gerald S. Hanna, Peggy Dettmer, 2004 Written in a straightforward and conversational manner this book integrates assessment and instruction to provide educators with an understanding of when and why to use different assessment techniques to optimize student learning Emphasis is on realistic applications taken from the author's experiences using mainstream assessment principles. The subject matter in each chapter is frequently expanded with examples from a broad range of educational settings ranging from classroom teaching to school administration school counseling special education and related special services for students with special needs Features Discussion of individual differences among students helps readers understand the reality of individual differences so as to employ assessment to influence learning for all students Separate chapters on product assessment with rubrics and performance assessment methods present balanced and contemporary treatment of authentic assessment in Chapters 8 and 9 Simple easily managed data sets and computation exercises for developing concepts throughout the text eliminate intricate calculations that often get in the way of important principles An entire chapter 13 on assessment issues in special education helps readers address the thicket of special education issues and mandates in which assessment plays a vital role Learning aids such as Discussion Questions Thinking Cap Exercises and computational problems are embedded throughout the book to provide assistance in identifying key issues checking comprehension and review Instructor's Manual Test Bank developed by the authors is available to adopters Companion website for students and instructors is available at www ablongman com hannadettmer Related Titles Program Evaluation Alternative Approaches and Practical Guidelines 3 e Jody L Fitzpatrick James R Sanders Blaine R Worthen Order No 0 321 07706 7 Designing and Using Tools for Educational Assessment 1 e Madhabi Chatterji Order No 0 205 29928 8 Consultation Collaboration and Teamwork for Students with Special Needs 4 e Peggy Dettmer Norma Dyck Linda P Thurston Order No 0 205 34073 3 Developing and Validating Multiple-choice Test <u>Items</u> Thomas M. Haladyna, 2004-04-21 This book is intended for anyone who is seriously interested in designing and validating multiple choice test items that measure understanding and the application of knowledge and skills to complex situations such as critical thinking and problem solving The most comprehensive and authoritative book in its field this edition has been extensively **Developing and Validating Multiple-choice Test Items** Thomas M. Haladyna, 1994 This is the most current and comprehensive book devoted to item writing It addresses the related topics of multiple choice test item development and validation of responses to these test items two critical steps in the development of any cognitive test In so doing the volume provides a conceptual basis for item writing reviews the issue of constructed versus selected response testing presents a variety of formats provides guidance in developing items as well as a basis for reviewing evaluating and improving items and speculates about the future of item development and validation This book helps readers better understand the concepts principles and procedures available to build better test items that will lead to more reliable tests of ability and achievement The Development and Evaluation of an Introductory Biology Study Guide at the College Level

Carol Hardy McFadden, 1981 Smart Tests Catherine M. Walker, Edgar Schmidt, Kat Mototsune, 2004 High stakes accountability and the growing move towards standardized testing are placing teacher knowledge and assessment skills under ever increasing scrutiny Teachers know what is going on in their classrooms and have first hand reliable evidence of what their students can accomplish They can be the major factor in student assessment and help their students better demonstrate what they have learned Smart Tests shows educators how to create well structured evaluation tools that match assessment tasks to the purpose and content of instruction Teachers learn how to relate testing directly to classroom goals and activities and make assessment an integral part of learning and teaching not just the end result They will find the information they need to build assessment tasks that give students in grades K 8 the opportunity to succeed These tasks encourage students to apply new knowledge reflect and defend their thoughts and opinions and connect what they learn the world beyond the classroom Developing and Using Tests Effectively Lucy Cheser Jacobs, Clinton I. Chase, 1992-11-05 It is estimated that up to 20 percent of a professor s time is spent evaluating the impact of instruction Yet most faculty receive little formal training in classroom testing or other means of determining which students have attained course objectives and which have not Developing and Using Tests Effectively offers practical guidelines that faculty members can use to improve their skills in the development administration and grading of classroom tests This book offers specific how to advice on every stage of the testing process including planning the test and classifying objectives to be measured ensuring the validity and reliability of the test and grading to arrive at fair grades based on relevant data Lucy Jacobs and Clinton Chase examine the strengths and weaknesses of many types of tests including both traditional multiple choice true false matching completion and essays and alternative take home open book and oral assessment procedures For every testing procedure they show how faculty members can write tests that are fairer and more valid and that do a better job of measuring what students learn thereby improving faculty members ability to assess learning outcomes The authors reveal for example how essay tests may often measure only the skill of the grader in assessing what the writer has said and offer suggestions for improving the instructor's skill in reading essays and scoring them reliably They discuss the problem of cheating and suggest ways to deal with it They examine the advantages and limitations of using computers for classroom testing And they describe such alternative assessment procedures as portfolios journals and peer testing Developing and Using Classroom Assessments Albert Oosterhof, 2003 This brief inexpensive book focuses on how to write construct and use assessments in the classroom It continues to take a balanced approach to assessment involving both traditional and innovative techniques It includes the development and use of written tests informal assessments portfolios and performance assessments This balanced approach to assessment is what prospective teachers need when they get into the classroom Coverage includes integrating assessments into the learning process showing the implications of research in cognitive psychology and showing how classroom assessments can facilitate transfer of learning and development of problem solving skills For professionals in the

field of Educational Psychology or anyone interested in teaching methods **Educational Assessment** Thomas P. Hogan, 2007 Following a practical approach this book focuses on educational assessment as it is practiced today in the actual world of classrooms school systems state departments and national organizations It first covers the basic concepts applicable to all types of assessment statistical concepts reliability validity and interpretive frameworks. Then it explores the preparation of teacher made tests standardized tests and other important areas such as grading legal issues and evaluating one s own The Praxis Series Official Guide with CD-ROM, Second Edition Educational Testing Service, 2009-12 Coming straight from the creators of the Praxis test this study guide includes a complete Praxis 1 PPST review six full length A Guide for Developing Interdisciplinary Thematic Units Patricia Roberts, Richard tests and an interactive CD ROM Dean Kellough, 2008 Looks at the development of interdisciplinary thematic units covering such topics as content diversity technology and classroom management An Introduction to Developing Wisconsin State Civil Service Examinations and Assessment Procedures ,1994 Otto E. Miller, Plaintiff-Respondent, Against Fred W. Smythe, Defendant-Appellant, Wings Gr 3/1 Signatures 1999 Harcourt Brace, 1998-04 Exploring Lifespan Development Laura E. Berk, 2008 EXPLORING Lifespan Development provides students with an efficient read of the most important theories research findings and applications in the field of lifespan development Berk's clear engaging writing signature storytelling style exceptional cross cultural focus rich examples and long standing commitment to presenting the most up to date scholarship while also offering students research based practical implications that they can relate to their personal and professional lives remain the Resources in Education ,1997 cornerstone of this essential text **Designing and Using Tools for Educational Assessment** Madhabi Chatterji, 2003 This text is intended for the large group of non measurement professionals who need to know about creating assessment tools and using them for decision making Teachers administrators and instructional support personnel will find that this book provides a balanced treatment of design validation and use of assessment tools for varied learning outcomes and needs This treatment includes traditional and alternative assessments The book is straightforward and applied with minimal statistical content Numerous examples case studies tables figures and a Web site with chapter highlights and exercises support the applied focus of this book Psychologists or those involved with educational psychology

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