Educational Psychology

Educational Psychology

Modules in Social and Psychological Foundations of Education

REVA M. FISH, PH.D. AND GEHAN SENTHINATHAN, PH.D.

CHRISTOPHER HULSMAN, M.L.S.

BUFFALO STATE UNIVERSITY | SUNY OER SERVICES
BUFFALO, NY

Contents

Reva Fish, Ph.D.

Reva Fish is an educational psychologist and an associate professor in the Social and Psychological Foundations of Education Department in the School of Education at SUNY Buffalo State University. She completed her Ph.D. in Educational Psychology at the University at Buffalo and teaches educational psychology to undergraduate and graduate students, and research methods at the graduate level. Her research focuses on how the home and classroom environments affect development and learning in children.

Gehan Senthinathan, Ph.D.

Gehan Senthinathan is a behavioral neuroscientist and an assistant professor in the Social and Psychological Foundations of Education Department, and the Psychology Department, at SUNY Buffalo State University. He completed his education in Ontario, Canada, where he received a B.Sc. in Psychology from the University of Toronto, and M.Sc. followed by Ph.D. in Behavioral Neuroscience from Wilfrid Laurier University. His research explores how changes in the environment influence behavioral patterns and underlying neural mechanisms associated with motivated behavior. His research intersects with many areas in psychology, including age-development, learning, memory, and motivation.

CHAPTER 1: INTRODUCTION TO EDUCATIONAL PSYCHOLOGY

Ellis found a seat in the classroom just as the professor was introducing herself. The first week of the semester was always hectic, but so far everything had been going well. The class was Educational Psychology and was required for his teacher preparation program. Ellis was starting his junior year and was just one year away from student teaching. It felt like he was making good progress on his path to becoming a middle school science teacher. It had taken him some time to decide on a career, and now that graduation was in sight, he was excited about finishing his program and having a classroom of his own.

Preparing to be a Teacher

You are probably reading this textbook about Educational Psychology as you prepare for a career as a teacher. Most teacher preparation programs require an Educational Psychology course as part of the training to become a successful teacher.

Think About It

- Where are you in your teacher preparation program?
- How did you make the decision to be a teacher?
- What subject/grades are you hoping to teach when

you finish your program?

In this Educational Psychology course, we will study strategies to optimize your students' learning that will apply to students across all grades and in all subject areas. This will include information about planning effective lessons, setting up a classroom that supports learning, and building positive social-emotional connections with and among your students. We will discuss how students learn, including how the brain works and the best teaching strategies to use to maximize student learning. We will cover many ways to assess how well your students are learning and how to use the data from assessments to improve your teaching. You will also learn basic principles that will help you make the dozens of minute-to-minute decisions you face throughout the day as you keep your students engaged and motivated to learn.

The Personal and Professional Attribute of Successful Teachers

You may already have personal attributes that will help you become a successful teacher. Do you enjoy working with children? Do you have good communication skills and the ability to explain concepts clearly? Are you able to remain patient and calm in challenging situations? Are you compassionate when dealing with someone who is struggling to understand new information?

Think About It

List three personal attributes you have that may help you become an effective teacher. For each, describe a time that you used that personal attribute to help someone.

Professional attributes are also important for successful teaching. One current model of effective teachers, that is based on research, includes six professional qualities teachers should have to maximize student learning (Stronge, 2018)[1]:

1. Knowledge of the content of the subject you are teaching, how to best teach that subject, and general strategies for effective teaching of any subject.
2. Skills in designing and organizing instructional plans.
3. Strategies to deliver instruction that engage students with a range of ability levels.
4. Ability to design and carry out assessments to measure student progress and to guide your instruction.
5. Skills in Implementing classroom procedures and rules, and in designing a physical layout that supports learning and safety.
6. Appropriate use of compassion, respect, enthusiasm, and self-reflection to create a positive social-emotional classroom environment.

1. Stronge, J. H. (2018). *Qualities of effective teachers* (3rd ed.). ASCD

Think About It

- Which of the six professional qualities do you want to focus on developing as you complete your teacher preparation program, so you are prepared to be an effective teacher when you graduate?
- Which of the six qualities do you believe you will continue to develop in the future, through years of experience as a classroom teacher?

Think About It

Recall a class that you enjoyed as a student. List some of the personal characteristics of the teacher that helped make learning in that classroom enjoyable. List a few of the professional qualities the teacher had that supported student learning.

Importance of Evidence-Based Teaching Practices

Did you notice that the discussion of the six professional qualities of effective teachers, above, states that the qualities are based on research? This means that someone conducted a research study to determine which qualities of teachers make them effective. In this case, the study used a wide range of outcomes to measure a teacher's effectiveness, from students' grades to the likelihood that the students will eventually attend college.

The discussion of the research included a ***citation*** for the source of the information about the six qualities. The citation was "Stronge, 2018." This means that the last name of the author of the publication about the research was Stronge and it was published in 2018. In the ***reference list*** you can find more details about the source. The reference list entry says "Stronge, J. H. (2018). *Qualities of effective teachers* (3rd ed.). ASCD." This means that the results of the research about professional qualities of effective teachers was published in a book called *Qualities of Effective Teachers*, the third edition of the book was published in 2018, and the book was published by an organization called ASCD.

You will find citations for publications of research studies

throughout this textbook. Whenever we mention a research study, we will include a citation for the publication so that you can find and read the publication for more information if you would like. You can contact a campus librarian if you need help finding it.

You will find that some of the publications cited in this textbook were published a number of years ago. In most cases, these are classical studies still relevant today because they provided significant findings that influenced education, psychology, or neuroscience in fundamental ways. In other cases, older research may be cited because there are no more recent noteworthy publications about a topic.

We focus on using evidence-based practices in educational psychology because it is essential for effective teaching. There will be limited time to meet all of your teaching goals each school year, so relying on the most effective teaching practices, rather than simply personal beliefs or fads, will help maximize student learning in the time available. Descriptions of how to implement evidence-based practices in your classroom are included in every chapter of this book.

The Art of Teaching

Even though you should emphasize the use of evidence-based practices when you teach, we know there is an art to teaching well, an opportunity to teach creatively. Once you know the science of education – that is, what research has found are the best practices — you can then apply that science to the individual students in your classroom and the specific content you are teaching. As the teacher responsible for that classroom, you will know the optimal way to apply the best teaching practices in your unique classroom. For example, in this textbook we will discuss principles for using student groups to improve learning. As the teacher in your classroom, you will choose the most suitable approach to apply those principles to the content you teach and the specific students you have in your classroom at the time. In this way, it is clear effective teaching is both a science based on research and an art of applying that research.

In the next section, we will discuss types of educational research

and how the qualities of each influence the value of using the findings to guide your teaching. We will also talk about how you, as a teacher, can conduct research in your own classroom. You can collect and analyze data about your students to improve your teaching and improve their achievement.

Using Research to Guide Teaching Practices

Case Study

Maya listened as her colleagues discussed activities they were doing in their classrooms while they ate lunch together in the teacher's lounge. She was excited about starting her first year as a fourth-grade teacher. She was also very busy,

teaching during the day and attending classes in the evening to complete her master's degree.

Her colleagues discussed ways they differentiated instruction in their classrooms to support each student's learning. They mentioned using graphic organizers, giving students choices in learning activities, and pairing and grouping students to work together. Maya was familiar with these concepts from the courses in her teacher preparation program, and she listened carefully to her colleagues' conversation for ideas that she could implement in her own classroom.

However, she was surprised to hear one of her colleagues describe differentiating instruction by addressing students' learning styles and whether they are left-brain or right-brain learners. Maya had learned in her educational psychology course that both of those concepts are neuromyths – myths about how students learn based on misconceptions about neuroscience. She had learned that although the belief that students have learning styles may be widespread in education, there is no scientific research to support it. Similarly, she knew students should not be classified as left-brain learners who are better at logical thinking or right-brain learners who are more creative. Maya had learned that the hemispheres of the brain always work together to complete any task. She knew that labeling her students in ways that impose limitations on their skills would limit her expectations of them and affect their own self-concepts as learners.

One of Maya's goals as a teacher is to remain informed about evidence-based teaching practices using research that is relevant to her students and the subjects she is teaching.

She wants to be certain she is making the best use of the instruction time she has available.

Think About It

Are there any teaching practices that you believed were evidence-based but learned they were not during the courses in your teacher education program? Are there any teaching practices you want to investigate to determine if they will be effective strategies for teaching the students and subjects you plan to teach?

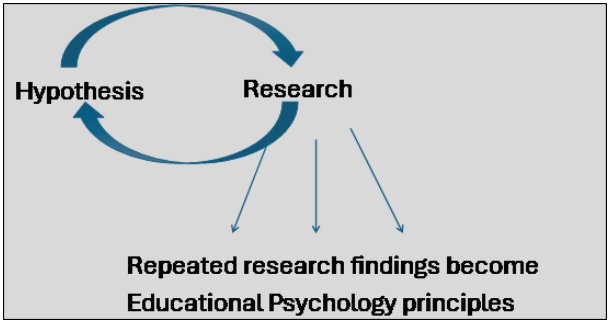
Using evidence-based teaching practices helps maximize student learning, so teachers must be aware of whether the instruction methods they use in their classrooms are supported by research. In this chapter we will describe how to find information about research studies that are relevant to your teaching. We will also discuss types of research studies and how you can conduct research in your own classroom.

In educational psychology we rely on evidence from ***peer-reviewed*** published research studies to guide our decisions about teaching practices. Research is called peer-reviewed when experts on the research topic have reviewed a report of the research and recommended that the report be published in a scholarly journal. Research studies that are peer-reviewed use scientific methods to

test hypotheses systematically. The scientific research process typically involves first identifying a specific research question and a hypothesis, or expected answer, to the question. Then researchers collect and analyze data to answer the research question. Finally, they share the research findings with peers.

Sharing the research findings is an important step in the research process. After a study is published, the findings not only inform teachers about best practices, but they also provide other researchers with ideas for follow-up research studies. As additional research is conducted, researchers gradually build a ***body of literature*** about a topic, a collection of published research articles. In time, when multiple studies have similar findings about effective teaching practices, we can be confident we should apply those principles in our classrooms to support student learning (see Figure 1.1).

Figure 1.1



Cycle of Research. After identifying a research hypothesis, researchers conduct a study to test the hypothesis. Findings from studies result in new hypotheses and additional research. When we have repeated research findings that teaching practices are effective, we can use them in our classrooms.

Let's look at an example of how our understanding of best practices for teaching can develop through a series of research studies. Cooperative learning, where students work in small groups to complete learning tasks, has been used in classrooms for decades (Gillies, 2016)[1]. A series of studies helped build our understanding of how to best use small groups during classroom learning. Those studies include:

1. Gillies, R. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, 41(3), 39-54.

- A classic study about cooperative learning, published in 1981, in which a group of researchers found that students learned more when doing cooperative learning activities than when doing the work alone (Johnson, Maruyama, Johnson, Nelson, & Skon, 1981)[2]. The study also found cooperative learning activities improved achievement across subjects and grades.
- Further studies found that there were also social benefits to cooperative learning, including increased self-esteem and positive peer relationships (Johnson & Johnson, 2002[3]; Slavin, 1989[4]).
- Follow-up research by Roseth, Johnson and Johnson (2008)[5] looked at how these social benefits come about and learned that having shared goals helps build peer connections.
- Research by Johnson, Johnson, Roseth and Shin (2014)[6] explored ways teachers can make cooperative learning most

2. Johnson, D., Maruyama, G., Johnson, R., Nelson, D., & Skon, L. (1981). Effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis. *Psychological Bulletin*, 89(1), 47-6.
3. Johnson, D., & Johnson, R. (2002). Learning together and alone: Overview and meta-analysis. *Asia Pacific Journal of Education*, *22*(1), 95-105.
4. Slavin, R. (1989). Cooperative learning and student achievement. In R. Slavin (Ed.), *School and classroom organization* (pp. 129-156). Lawrence Erlbaum.
5. Roseth, C., Johnson, D., & Johnson, R. (2008). Promoting early adolescents' achievement and peer relationships: The effects of cooperative, competitive, and individualistic goal structures. *Psychological Bulletin*, 134(2), 223-246.
6. Johnson, D., Johnson, R., Roseth, C., & Shin, T. (2014). The relationship between motivation and achievement in interdependent situations. *Journal of Applied Social Psychology*. 44(9), 622–633.

effective and identified five factors necessary for successful cooperative learning, including teaching the students active listening skills to improve peer interactions.

As you can see, when one research study finds a way to improve student learning, this can lead to additional studies about related topics. The follow-up studies help educators develop and refine strategies for using the practices in their classrooms.

Finding Relevant Research

Although researchers found that cooperative learning activities improve student achievement in all subjects and grades, that is not the case with all evidence-based teaching practices. It is important to determine if research findings are relevant to your classroom. It makes sense that effective teaching practices in early childhood education would be different from those in later grades. Best practices for teaching mathematics may be different from those for teaching science. Therefore, as you read educational research, you should always consider its relevance to your teaching and your students.

As a student in higher education, you have access to peer-reviewed research articles about education through your campus library. You can meet with a librarian to learn how to search the database system available on your campus to find scholarly articles about specific teaching practices relevant to your classroom.

Google Scholar also provides a means to search for published research studies.

Websites for professional organizations for educators also have information about findings from peer-reviewed educational research. Two organizations that report information about educational psychology are the American Educational Research Association (AERA) and the American Psychological Association (APA). There are also professional organizations for teachers of each level of education and subject.

Another valuable internet resource is the What Works Clearinghouse website. It is a federal government website about scientific evidence for teaching practices. On the website you can find reports about educational research that rate the value of the research findings based on the quality of the research methods used.

In general, .gov, .edu, and .org websites are more likely to have science-based information about teaching practices than other websites. Use your skills in evaluating the quality of internet sources when you find information about teaching. You will need to discern whether information you find on the internet is based on facts rather than opinions before applying that information to your classroom practices. Avoid using newspaper or magazine articles for information about teaching because they are not peer-reviewed sources of research findings.

Some researchers publish trade books about the areas of education in which they are experts. These books provide an in-depth summary of their scholarly work in a format easily understood by the general public. To determine if the content of a book is evidence-based, check if the authors cite research articles from peer-reviewed journals to support the book content.

Think About It

Do an internet search to find the U.S. Government's Institute of Education Sciences' What Works Clearinghouse website. Use the site's search feature or menu to explore content relevant to the grade/subject you plan to teach. Note some of the information you found that might be helpful to you.

Types of Research Methods

When reading research studies, it is helpful to understand the types of research methods used by researchers because the method used influences the kind of data they collect, the way the data is analyzed, and the conclusions researchers can draw from their findings.

Research methods are divided into two main categories, ***quantitative*** and ***qualitative***. A third type, called ***mixed method***, includes elements of both quantitative and qualitative research studies.

Quantitative Research

In quantitative research studies, numeric data is collected and then analyzed using statistics. Quantitative studies of education practices might collect grades, test scores, or student socioeconomic status. A quantitative study could compare the student test scores of those who completed learning activities alone and those who worked with peers in small groups.

Qualitative research studies, on the other hand, collect and analyze text data such as interview transcriptions, observation notes, or historical documents. The data analysis in qualitative studies involves a process of coding the text to identify patterns and themes. For example, in a qualitative study a researcher might interview students about their experiences during small group learning activities. Then the researchers would look for themes in the interview transcripts to answer a research question about students' views of cooperative learning activities.

In a mixed-method research study both numeric and text data are collected and analyzed. For example, a teacher might survey students about their experiences in small group learning activities and include both questions that ask students to rank their

experiences on a scale, such as strongly agree to strongly disagree, and open-ended questions where students can respond in their own words. The answers that are on a scale would be recorded numerically and analyzed using statistics. The open-ended questions would be analyzed by identifying common themes in the text of the responses.

Within each of the two main categories, quantitative and qualitative research, there are several types of research. Four common types of quantitative research include:

- Experimental Research
- Causal Comparative Research
- Correlational Research
- Descriptive Research

Experimental Research: In an experimental study researchers look at the effects of a specific change in a teaching practice – called an intervention. To be a true experiment, the sample of students being studied must be randomly assigned to a group receiving the intervention or to a control group which does not experience the intervention.

Because of the random assignment, experimental research is the only research method where researchers can claim to "prove" any effect of the intervention. This is because when there is random assignment to the intervention and control groups, research protocols allow us to assume that the groups were essentially the same at the beginning of the study and to claim that any difference found between the groups was caused by the intervention and no other factor. For example, researchers could randomly assign first grade students to an intervention group that would experience a new method of reading instruction or a control group that would continue to receive the ongoing type of reading instruction. If it was found, through statistical analysis, that the new type of instruction improved reading skills more than the ongoing type of instruction,

it could be concluded that the new type of instruction was better than the ongoing type of instruction.

Causal Comparative Research: Causal comparative research also looks at an intervention but uses existing groups rather than random assignment to groups. This is a more practical research method in education where it can be difficult to randomly assign students to groups because students need to be assigned to classes based on individual needs. Even though we cannot make claims about "proving" the effect of interventions in causal comparative studies, this type of research is still valuable as it provides direction for additional research and reveals potential benefits of the teaching practices researched. For example, if a causal comparative study was used to compare two types of reading instruction, researchers would want to have the same finding from multiple studies before concluding that one type of instruction would benefit students more than another type.

Correlational Research: In correlational research studies, two numeric measures are compared to determine whether they vary in a similar way. That is, when one measure increases or decreases, does the other have a similar pattern of increasing or decreasing. An example of a correlational study would be comparing mathematics test scores and the number of hours of tutoring a student received. If it was found that, in general, students who had more hours of tutoring also had higher math test scores, it could be concluded that students may benefit from the tutoring. If additional studies had the same finding, educators could be confident there is a positive correlation and that tutoring improves math achievement.

Descriptive Research: Descriptive research provides summary information about the characteristics of the sample being studied. For example, a descriptive study in education might report the number of students in categories such as gender, race, age, or grade. Descriptive studies are not used to investigate the effect of teaching practices. They only provide summary information about the sample.

Qualitative Research

In qualitative research, textual data is collected and analyzed. There are four common methods of qualitative research:

- Observations Research
- Interviews and Focus Groups Research
- Ethnographic Research
- Historical Research

Observations Research: In this type of qualitative research, the researcher makes notes while observing a particular situation or setting being researched. The researcher may look for specific behaviors being studied or may document the incidents that happen to occur during the observation. For example, if a researcher is interested in exploring evidence of student engagement during different types of mathematics instruction, the researcher could sit in the classroom during mathematics instruction and use a checklist while looking for certain evidence of student engagement. The researcher could also simply note any evidence of student engagement that happens to occur.

Interviews and Focus Groups Research: In this type of study, researchers talk to people who have experienced the situation being researched. The conversations are generally transcribed, and the text is analyzed to find themes or patterns in the data. The researcher may have a list of questions to ask the participants or may instead use spontaneous conversations where there is a more informal discussion of the topic being researched. Interviews are generally conducted with one person at a time while focus groups involve talking with multiple people at the same time. For example, a researcher collecting data on teachers' opinions about a new social studies curriculum may interview individual teachers or hold a focus group of teachers to gather data.

Ethnographic Research: In ethnographic studies, a researcher immerses themselves in a situation to explore it from many perspectives, using multiple data collection methods. For example, to study the ways student misbehavior is handled in a school building, the researcher may take notes during observations as well as conduct interviews and focus groups to develop a comprehensive picture of the practices.

Historical Research: In historical research, past events are studied to construct an in-depth understanding of them. This would include examining documents and artifacts from the event as well as viewing video and conducting interviews, if possible. Historical studies allow researchers to develop new perspectives on past events. A researcher could look at how high school graduation ceremonies have evolved over the years by looking at materials such as program booklets and photos of past ceremonies.

Think About It

Identify whether each of the following describes a quantitative study or a qualitative study:

1. A researcher visits preschool classrooms to observe strategies the teachers use to help students develop self-regulation skills.
2. Students in middle school are asked to complete a survey with open-ended questions about their experiences in an after-school program.
3. Mathematics test scores of high school students who completed extra homework assignments are compared to the test scores of students who did not do the extra assignments.
4. Transcripts from student focus group discussions of the benefits of intramural sports are analyzed to provide a report for the school board budget committee.
5. At the beginning of the school year, kindergarten students are randomly assigned to a classroom where a new mathematics curriculum will be used or a classroom where the previous year's curriculum will be used.
6. A researcher reviews a school district's records of school suspensions over the previous thirty years to look for trends in biases.

Action Research

As teachers, we continually make small adjustments to improve our classroom practices. This is typically an informal process where we make mental notes as we track the effects of the day-to-day changes we implement. There is also a formal method for making changes in our classrooms and researching their effects. It is called **Action Research** and uses a systematic documented process that includes several steps:

1. Identify the specific situation in your classroom that you want to improve,
2. Find information from peer-reviewed research about the topic to guide your plan,
3. Decide a change to make to your instruction or other classroom practice to address the issue,
4. Implement that change over a sufficient period of time to determine its effects,

5. Collect data throughout that time,
6. Analyze the data to determine the success of the change, and
7. Based on the findings, determine whether the change you made has resolved the issue or if you should begin another cycle of action research to explore another strategy to address the situation.

As you can see, the cycle of action research can be repeated over time, allowing you to fine-tune the adjustments you make to your classroom practice, and to ultimately find the best solution to address any situation. Documenting the process provides a written record to guide your decisions and to share with your colleagues.

Let's Look at an Example of Action Research:

Louis noticed that during mathematics lessons in his fifth-grade classroom, a few of his students stopped paying attention after about 10 minutes of instruction. He believed some of the students found the new concepts he was teaching difficult to understand, while other students were distracted because they were bored. After reading a few research articles about student engagement, Louis wondered if student attention would improve if he had them work some examples of the concepts he was teaching during the lesson. He decided to apply this change in the lessons for the next mathematics unit, using action research, and he began making notes about how he would implement that change.

As he taught the next unit, he had the students do seatwork at more frequent intervals than he had in the past. At the end of each lesson, he recorded his observations about the level of student engagement, as well as which students became disengaged while he was teaching and at what point in the lesson it occurred. At the end of the unit, he reviewed his observation notes and concluded that, overall, the change in lesson design did improve student engagement during instruction. He also decided to make a couple of additional changes in the future to see if they would further improve student engagement. First, he wanted to try having the students do the seat work in pairs. After that he wanted to explore the effects of longer seatwork assignments on student engagement.

When conducting action research, it is important to avoid making multiple changes in the classroom at that time so you can isolate the effects of the change you are studying. Sometimes we cannot control the number of changes that take place in our classrooms. New students may be added to your class, building administrators may ask teachers to make classroom changes that could influence the findings of your action research, and so forth. If it is necessary to make multiple changes to the classroom during an action research study, make some effort to try to separate the effects of each of the changes, or start the action research process over if necessary.

We must keep in mind that any findings from action research apply only to the students who were in the classroom during the process. We cannot generalize our findings by assuming they will apply to all students in similar classrooms. However, the findings may be useful to your colleagues who teach the same students and as a guide for classroom practices for future groups of students in your classroom.

Think About It

Camille is a high school social studies teacher. She has noticed that if a student needs to talk to her before class starts, it sometimes takes several minutes to handle the matter and then the rest of the class has not settled down and is not ready to learn when the bell rings. It can take quite a bit of time until she has their attention and can begin instruction. She is looking for ways to prevent this by changing the routine when the students arrive in the classroom.

Describe an action research study the teacher could conduct to address it. Include:

- a statement of the issue that needs to be studied,
- a description of one change that could be implemented to address the issue,
- data that could be collected to determine if the change was effective, and
- a description of how the data could be analyzed to determine if the change was effective.

CHAPTER 5: ASSESSING LEARNING

Case Study

Mr. Moller paused after grading his students' exams to think about the results. He was surprised that several of his 6th grade students did not do well on the exam – including a few who generally did very well on assessments.

The exam assessed their knowledge of a social studies unit they had just completed about early river valley civilizations in the eastern hemisphere. The students had seemed engaged in the activities he designed for the unit. He had assigned groups of students to research each of the civilizations and used a jigsaw activity to have them share the information they found. He also had the students build dioramas to represent the civilizations they studied and even found an app they could use to video record their progress as they designed and built the scenes. The unit had taken more time than he had originally planned, but the students seemed to enjoy the activities.

While grading the exams, Mr. Moller found that most students did well on the multiple-choice questions. However, they seemed to struggle with the short essays, and only a few

of them did even adequate work on the long essay. Errors in the mechanics of their writing — such as spelling, sentence structure, and the logical flow of the sentences – made the grading more difficult. What he was able to decipher in their answers showed that the students were confused about some of the concepts they learned in the unit. Ultimately, he was not sure if they did not yet have the skills to compare and contrast the civilizations, an abstract task required for the long essay, or if they simply did not correctly recall the characteristics of each of the civilizations they studied.

This was Mr. Moller's first year with his own classroom, so he was eager to learn from this situation as he moved forward in his career. He jotted down some questions he wanted to consider as he thought through the best way to remedy the situation. He also planned to network with some of the more experienced teachers in his building to get their input.

These Are His Notes:

- Why did the students do poorly on the exam?
    - Did the learning activities fail to help them learn the concepts?
    - Did the students know how to study for the exam, and did they make enough effort to do that?
    - Did the students have the test-taking skills necessary to complete the types of items on the exam successfully?

- What could be done now to remedy the situation?
    - Are there sections of the unit that should be taught again? If so, how can the sections be identified and how can the instruction be improved?
    - Should students be given another assessment to provide them with an opportunity to show whether they have mastered the material?
- What should be done in future years to better prepare students for this end of unit exam?
    - What changes are needed to the learning activities to ensure the students understand the concepts before they take the assessment?
    - Are there study and/or test-taking skills students need to learn to prepare them for the types of items on the exam?
    - Are changes to the exam needed so it will better assess student understanding of the unit concepts?

Think About It

- What initial ideas do you have for strategies Mr. Moller can use to improve his instruction and/or the assessment? List a few ideas.

We will revisit this case study and Mr. Moller's concerns as we talk about best practices in classroom assessment in this chapter. We will discuss types of assessments and the characteristics of good assessments. We will also describe strategies for writing assessments and for evaluating students' work on them.

Categories of Assessments

First, Let's Discuss Three Ways We Categorize Assessments in Educational Psychology:

1. ***Formative*** Versus ***Summative***
2. ***Classroom*** Versus ***Standardized***
3. ***Criterion-Referenced*** Versus ***Norm-Referenced***

Formative Versus Summative Assessments

The most common way to categorize assessments is as formative or summative. **Formative assessments** are those that take place before or during instruction to check student knowledge. These assessments are not graded in a formal way. That is, they are used to give students feedback about their learning and to give teachers feedback about their teaching, not to record grades. For example, we can use formative assessments to help us determine whether we need to reteach material because some of the students have not mastered it. Similarly, formative assessment helps students find out if they understand the material while they are still learning it.

Think of all the ways a teacher might check on student learning informally as they are teaching. You might give the students an ungraded pretest before you start a unit to determine what they already know so you can focus instruction on new material. Then, to check whether students are understanding instruction at it occurs, you can ask questions while you are teaching. Also, giving brief ungraded assessments helps the students, and you, identify gaps in learning. For example, using a tool such as a "ticket out" that asks your students to write about something they learned that day gives you an opportunity to determine whether there is any content you need to reteach during the next lesson.

Formative assessment helps students establish and strengthen neural pathways when we frequently check in with them to make sure they understand new concepts as we are teaching them, and by asking them to use that new knowledge in a variety of ways in classroom activities. [add link here to discussion of this concept in neuroscience chapter]

Think About It

What are some of the ways your teachers have used formative assessments? Based on the information in the case study, did Mr. Moller use any formative assessments when teaching the unit about early river valley civilizations?

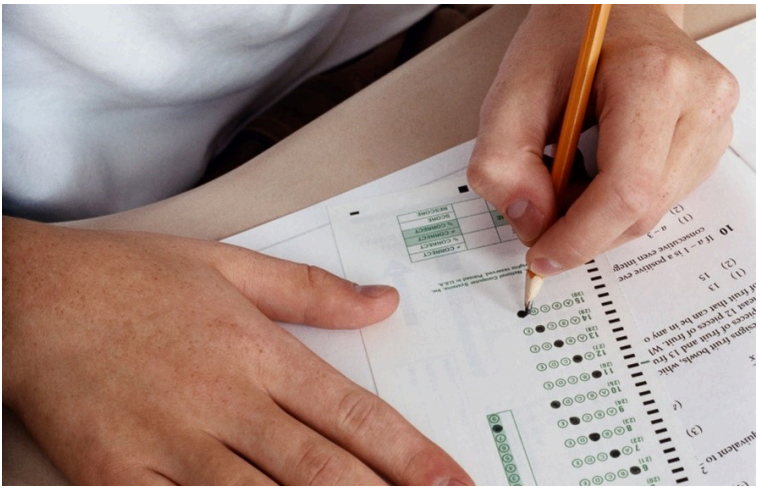
Summative assessments are those you use at the end of a unit of instruction to evaluate student mastery of the material. Summative assessments include quizzes, tests, exams, portfolios, and performances. Summative assessments are graded, and those grades are used to determine students' cumulative course grades for formal reports of students' progress such as school district report cards and transcripts.

As with formative assessments, summative assessments can be viewed as another opportunity for students to learn. As students study for an assessment, they are recalling the material they already learned, strengthening those neural pathways that connect the bits of related knowledge. And then while they are completing the assessment, they will need to retrieve that knowledge from long term memory again, giving them another opportunity to strengthen those pathways and reinforce their knowledge. In this way, assessments not only measure learning, but they also improve it.

Think About It

What are some of the common summative assessments used for the subject(s) you plan to teach?

Classroom Versus Standardized Assessments



Classroom assessments include any formative and summative assessments you create for your students, as well as assessments teams of teachers in your building/district might develop to be

used with all students in a specific grade or subject. These are used to determine if students have mastered certain knowledge or skills.

Standardized assessments are usually developed by test construction experts and are available for use with a broad population. They are generally used to measure certain aptitudes. For example, the SAT is a standardized test used nationwide to predict whether the test taker has the reading, writing, and math skills needed to be successful in college.

These assessments are called standardized because they must be administered, scored, and interpreted using standard methods. Because of this standardization, a student's score on the test can be compared to others in their age group to determine where they rank in the specific skills or knowledge the test was designed to measure.

Criterion-Referenced Versus Norm-Referenced Assessments

Criterion-referenced assessments are used to determine how much a specific student has learned. Classroom assessments used by teachers to test whether the students in a class have mastered certain knowledge after classroom instruction are criterion-referenced assessments. This is the most common type of assessment and the one you are probably most familiar with taking as a student yourself.

Scores from **norm-referenced assessments** do not provide information about how much a certain student has learned. Instead, they tell us how well each student performed on the assessment compared to other students of their grade/age. They are called norm-referenced assessments because each student's score is compared to the "norm," the average score of all those of the same grade/age who took the test, to determine a rank for the individual student. That norm might be the average of all the students in a

school district, a state, a national group, or even an international group of that grade/age. The comparison group can vary.

When you read in the news that educators are concerned about how students in the United States are performing in comparison to students in other countries, they are using results of international norm-referenced assessments to compare the groups.

Summary

While we have three ways to categorize assessments, **formative** versus ***summative,***

classroom versus ***standardized,*** and***criterion-referenced*** versus ***norm-referenced***, you have probably noticed these are not distinct ways to describe assessments. For example, the classroom assessments you create for your students are likely to be formative and summative, and they will be criterion-referenced assessments as well. Another way these categories overlap is that standardized tests are typically also norm-referenced assessments.

Think About It

Can you recall any assessments you took that were standardized and/or norm-referenced?

Learning how to categorize assessments will help you participate in professional discussions of assessments. It will also help you know whether to interpret scores from them as measuring a certain student's mastery or as a measure of how their level of knowledge compares to other students of their grade/age.

The most important distinction for classroom teachers is formative versus summative assessments. When you design a unit of instruction, you will need to consider when you should simply check in with your students to see the progress they are making in a unit of study and when will you want to administer a more formal assessment to measure student progress and report grades.

Think About It

How would you categorize the assessment Mr. Moller gave his class at the end of the unit?

1. ***Formative* or *summative***
2. ***Classroom* or *standardized***
3. ***Criterion-referenced* or *norm-referenced***

Determining the Quality of Assessments

In this section, we will discuss characteristics of assessments that are used to measure their quality — **validity, reliability, practicality,** and **fairness**. These characteristics apply to all the categories of assessments we discussed in the previous section.

Validity may be the easiest quality of an assessment to evaluate. An assessment is valid if it measures what you expect it to measure. For example, if you want to determine if your students have mastered the information from a history unit, that assessment should only include questions about the material in that unit, and it should assess all the important knowledge you expected them to have gained from your instruction of that unit. In that way it is a valid measure of whether students learned the information in that unit.

While it is obvious that an assessment of mastery of a history unit is not valid if it includes questions about material in an unrelated mathematics lesson, there are less obvious ways an assessment might not be valid. For example, if students need to have certain test-taking skills to complete an assessment, the assessment is not valid if they do not have those skills. In that case, the assessment

is measuring their ability to complete the test as well as their knowledge of the unit content. Teachers should check that students know how to complete the types of items on a test before giving them an assessment that includes those types of items. For example, if you are going to have the students write an essay for a summative assessment, consider first giving them a formative assessment that is an essay. This will allow you to determine if they are ready to complete an essay for a graded assessment.

In general, a valid assessment would include only information students have been taught and would not require reading skills, writing skills, test-taking skills, or any other skills which students may not yet have.

An assessment is **reliable** if the results are generally consistent each time it is given to students. There are several ways you can ensure the reliability of an assessment. First, it is important to use consistent instruction across groups of students you teach. When instruction is consistent, each group is equally prepared to complete the assessment and the results should be similar. This does not mean you would never make changes to improve your instruction or your assessments, but you should be able to attribute differences in students' performance on an assessment to those improvements you made.

You can also ensure the reliability of assessments by providing each group of students who take the assessment with clear and precise directions for completing it. They also should have specific information about how you will evaluate their work on the assessment. For example, you could give them a checklist or a rubric that describes the criteria you will use for grading the assessment.

If an assessment is reliable, you should also find that individual students perform similarly on each section of the assessment. That is, for example, they should show a similar understanding of the material being tested whether they are answering multiple-choice questions or writing an essay.

Finally, the conditions under which the students take the assessment could affect their performance and, therefore, the

reliability of the assessment. If your students typically take the assessment in a quiet classroom, but one year the class had to complete it while loud construction was taking place outside the building, the difference in setting may affect the reliability of that assessment that year. In general, if there are any conditions that would affect student ability to complete the assessment successfully, other than their knowledge of the material being assessed, it will affect the reliability of the assessment.

A **practical** assessment is one that requires a reasonable amount of time for you to write, for students to complete, and for you to grade. It is an assessment that is not expensive to administer and one that does not require more adults to administer it than are available in the classroom.

As you design assessments for your students, consider the amount of time that will be available for them to complete the assessment and write an assessment that can be completed in that amount of time.

Use assessments that will take a reasonable amount of time for you to grade and to review with the class after grading. You should give feedback to the students soon after they complete any assessment, so try to administer it when you know you will have time to grade it and return feedback to the students soon after they take it. Do not, for example, give the students a test just before a holiday break. It is unlikely they would benefit from feedback given to them long after they have completed the assessment.

Further, when designing an assessment that requires individual administration, such as a performance assessment, ensure there will be both enough time to do the individual assessments as well as a way to keep the other students occupied during that time. This may require assistance from other teachers in your building, so you will need to check their availability and prepare a plan with them.

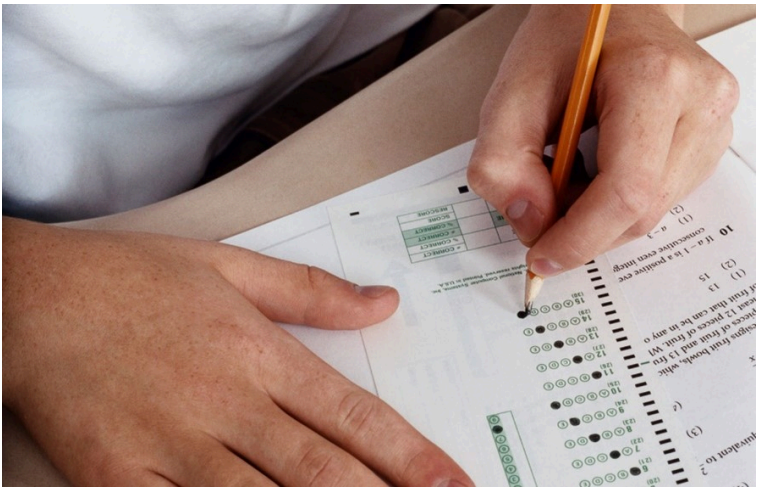
The fourth characteristic of a good assessment is **fairness**. A fair assessment is one that asks students straightforward questions about only the information they have learned in your class and does

not use complex wording that may lead them to answer questions incorrectly.

A fair assessment does not include cultural knowledge that some students do not understand. Even simply mentioning popular musicians or sports teams in an attempt to make the assessment engaging could put some students at an advantage because they are more familiar with these topics in popular culture than other students.

Fair tests are administered in a manner that gives all students an equal chance to complete them successfully. For some students, this means providing the accommodations they are permitted to have such as more time for the test or someone to read the test to them. Teachers must take care that limited test-taking skills or a disability does not put any student at a disadvantage.

A fair assessment is also one that you will have adequate time to grade, giving each student's work equal attention and providing sufficient feedback to each student.



Think About It

For each of the following characteristics, describe a way Mr. Moller can ensure the quality of his exam.

1. **Validity**
2. **Reliability**
3. **Practicality**
4. **Fairness**

Designing Assessments

In order to accurately measure students' learning, it is important to spend sufficient time developing an effective assessment. One of the tools we use to design a new assessment is a **table of specifications** (see Table 5.1) A table of specifications includes information about the learning objectives or topics covered in the unit being assessed, the percentage of total instruction time spent on each topic, and the level of cognitive challenge we want to use to check students' knowledge of each of the topics.

Table 5.1

Learning Objective/ Topic	Percent of Time	Level of Bloom's Taxonomy					
		Remember	Understand	Apply	Analyze	Evaluate	Create
		Lower-Level Cognitive Process			Higher-Level Cognitive Process		

To Complete a Tables of Specifications:

First, list all the learning objectives or topics from the unit of study and indicate the percentage of total instruction time that was spent addressing each. For example, if there were a total of 12 lessons for the unit, and three lessons were spent on the first learning objective, you will state the learning objective in the first column and indicate 25% in the second column.

Note that because the table of specifications identifies the specific learning objectives from the unit, it helps ensure the **validity** of that assessment for that unit. You can be certain you are checking students' knowledge of the material you intended for them to learn during your instruction of the unit because the assessment design is tied directly to the unit's learning objectives.

Next, Indicate the level of cognitive challenge you wish to use on the assessment items for each of the learning objectives, using the levels of Bloom's Taxonomy **[note this will eventually link to the section in chapter 4 about the taxonomy – to be written]** (see Figure 5.1).

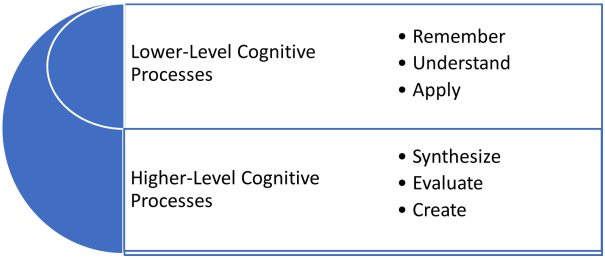
Decide if it is sufficient for the students to demonstrate lower-level cognition for that learning objective, such as remembering, understanding, or applying their knowledge and indicate that in the table.

On the other hand, you may want students to

demonstrate more complex and abstract knowledge of the learning objective, such as analyzing, evaluating, or creating information. Those are higher-level cognitive processes in Bloom's Taxonomy.

Your choice of the lower-level or higher-level cognitive processes should reflect the learning activities students experienced during instruction for that learning objective. That is, if students were required to demonstrate only simple and concrete knowledge related to that learning objective in class activities, the items on the assessment should then require only lower-level cognitive processing. If students completed more complex and abstract tasks when learning the material, the assessment items should also require higher-level cognitive processing. See Figure 5.2 for examples of the types of tasks that use lower-level and higher-level cognitive processing.

Figure 5.1: Bloom's Taxonomy



Bloom's level verbs: Lower-level Cognitive Processes are listed first and above. These include: Remember, Understand, and Apply. The Higher-Level Cognitive Processes are listed below and they are: Synthesize, Evaluate, and Create.

Figure 5.2

Example Student Tasks at Each Level of Bloom's Taxonomy

Lower-Level Cognitive Processes

- **Remember:** recall information, list facts

- **Understand:** define concepts, explain information
- **Apply:** use knowledge to solve a problem, demonstrate a skill

Higher-Level Cognitive Processes

- **Analyze:** compare and contrast information, develop a graphic organizer
- **Evaluate:** judge a product using specific criteria, check use of standards in a process
- **Create:** write an original story or poem, construct a portfolio

Sometimes it is sufficient for students to only remember the information they learned. Other times, we want them to be able to process the information at a higher level of cognitive challenge. You may be able to use the words of the learning objectives to guide this decision. The words used to write learning objectives often indicate the level of cognitive processing expected and will be helpful when completing the Table of Specifications.

In our case study, Mr. Moller's exam for the social studies unit about early river valley civilizations addressed the learning objectives listed below. There were 20 lessons of instruction in the unit, and the number of lessons for each objective is indicated.

1. Identify the characteristics of a civilization. (2 lessons)
2. Explain how geographic factors predicted the location of early River Valley Civilizations. (1 lesson)
3. Discuss the role of religion and government in the early civilizations and their interaction in developing cultures. (5 lessons)
4. Describe at least one technological achievement from each civilization and how it improved the lives of the people. (4 lessons)
5. Analyze the effects of wealth, power, and gender on job specialization in the early River Valley Civilizations. (8 lessons)

Using this information, Mr. Moller constructed a Table of Specifications to guide his writing of the assessment:

Learning Objective/ Topic	Percent of Time	Level of Bloom's Taxonomy					
		Remember	Understand	Apply	Analyze	Evaluate	Create
		Lower-Level Cognitive Process			Higher-Level Cognitive Process		
1	10%	X					
2	5%	X					
3	25%				X		
4	20%	X					
5	40%				X		

Think About It

Identify a unit of study in the subject area you are planning to teach. Construct a Table of Specifications for an assessment for that unit. Include at least three learning objectives for the unit, estimate the percentage of instruction time needed for instruction of each objective, and indicate whether, in your opinion, assessment items for the learning objective should require lower-level or higher-level cognitive processes.

Writing Assessments

Types of Assessments

The first step in writing an assessment is to decide whether you need a traditional assessment or an alternative assessment, or both.

1. **Traditional assessments** are conventional paper-pencil tests that include true-false, matching, multiple-choice, sentence-completion, and essay items.
2. **Alternative assessments** include performance and portfolio assessments.

The type of assessment you choose should reflect the type of activities the students completed during instruction as they learned the material. If students have been reading, writing, and discussing the material, a traditional assessment may be the right choice. If

students have been performing, constructing, or creating material, an alternative assessment may be needed.

Also consider the skills of your students when choosing the type of assessment and assessment items. Assessments should accommodate students' developmental level across grades. Children in early childhood education will need assessments that require limited reading and writing skills. Students in elementary and middle school grades will need assessments that allow for mostly concrete thinking, and older students can typically handle more abstract assessments. Recall the general development of cognitive skills across childhood described in Piaget's Theory of Cognitive Development as you write the assessment. **[Link to information about Piaget's Theory of Cognitive Development in the Effective Instruction chapter will be added here.]**

Also, check that your students have the necessary test-taking and language skills to complete an assessment successfully before you administer it. When an assessment requires students to have skills beyond just the knowledge intended to be assessed, and students do not yet have those skills, it is not a valid assessment for those students.

Writing Traditional Assessments

The types of items on traditional assessments can be categorized as:

- Selected-response items or
- Constructed-response items.

Selected-response items are those where the answer is provided. The students only need to recognize the answer to complete the item. These include true-false, matching, and multiple-choice items.

Constructed-response assessment items, on the other hand, require students to provide the answer. These include sentence-completion items and essays.

Next, we will describe each type of selected-response and constructed-response assessment item and provide guidelines for writing them.

Selected-Response Assessment Items

True-false assessment items are statements that students identify as either true or false. The items should be written carefully to ensure that every part of the statement is clearly either true or false. True-false items do not generally require higher-level cognitive processing skills because students are only required to recognize whether facts are true or false.

While true-false items are generally easy to write, a disadvantage of them is that there is a 50% chance of students choosing the correct answer by simply guessing. Therefore, they may not actually assess students' knowledge. A way to improve true-false items is to have students rewrite all false statements to make them true.

Examples of True-False Items:

Directions: Indicate whether each of the following statements is true or false. If it is false, rewrite the statement to make it true.

1. The hieroglyphic system of writing was developed in the Indus Valley civilization.
2. The Mandate of Heaven was used to justify the selection of rulers in ancient Chinese government.
3. Hammurabi's Code established guidelines for farming practices in Mesopotamia.

Matching assessment items ask students to identify two pieces of information that are related. Usually, two columns of words or phrases about information in the unit of study are presented to students and they choose one from each column to make pairs that are associated. Matching items do not generally require higher-level cognitive processing skills because students are required to only remember related pieces of information.

Pictures are often used for matching items in early childhood classrooms where some students may not yet be able to read words and phrases. In later grades, matching items can be made more challenging by having a different number of items in the columns and using some words/phrases in multiple matches or not at all. It is important that the directions state whether each word/phrase in a column can be matched to more than one in the other column and

if there are words/phrases that do not match to any in the other column.

Example of a Matching Item

Directions: Match each invention from the ancient river civilizations in the right column to the group that developed it in the left column by writing the letter for the invention next to the correct civilization. Each invention applies to one civilization.

1.) Ancient Egypt	a.) Wheel
2.) Mesopotamia	b.) Grid Plan for Streets
3.) Indus Valley	c.) Silk Cloth
4.) Ancient China	d.) Catapult

Multiple-choice assessment items include a question or an incomplete statement followed by a list of response options for students to choose from to answer the question or complete the sentence. The question/statement is called the **stem**. The response options in the list that are not the correct answer are called **distractors** because they distract the student from choosing the correct option in the list. Effective multiple-choice assessment items use distractors that are plausible answers, so that students need detailed knowledge of the material being assessed to choose the correct response.

The stem portion of a multiple-choice item should be as brief and

clear as possible so that the meaning is understood by students. When using a stem that is an incomplete statement, check that each response choice makes sense grammatically to complete the statement. Also, the distractors should be a similar length to the correct response so the length of the response choices is not a clue to the correct answer.

Think About It

Using learning objectives from the Table of Specifications you constructed, write at least one true-false, one matching, and one multiple-choice item suitable for the students you will teach. Include directions to the students for answering each type of item.

Constructed-Response Assessment Items

Sentence-completion assessment items ask students to supply missing words or phrases in sentences. Each sentence has underscored spaces to indicate the missing word or phrase. Sentence-completion items can be more challenging for students than the selected-response assessment items, like matching and multiple choice, because students need to recall the information from the unit needed to construct their response. Possible answers are not provided. Note that if a word bank of answers is provided, it would then be considered a matching type of selected-response

assessment item rather than a constructed-response assessment item.

When you write sentence-completion assessment items, make all the underscored spaces in all of the sentences the same length, so the length of the spaces is not a clue to the correct answer. Avoid asking students to provide more than one word/phrase in a sentence because without the context of an almost full sentence, it may be difficult for the students to figure out the information needed to complete the sentence.

Examples of Sentence-Completion Assessment Items

Directions: Provide the words or phrases to complete each sentence.

1. _____ was an early river civilization located between the Tigris and Euphrates Rivers.
2. The Sumerians developed a system of writing called _____.
3. _____ _____ _____ is a set of ancient legal codes that regulated trade and social behavior, including punishments for crime.

Essay assessment items ask students to write about specific content from a unit of study. They can be used to give students a higher-level of cognitive challenge – to synthesize, evaluate, and create information.

Because essay assessment items typically ask students to write about specific information, you may need to include several essay questions to assess knowledge of a broad range of unit content. To manage the amount of time needed to complete the assessment you can specify a required limit for the length of the responses. For example, students can be given a maximum number of sentences or paragraphs they should write in their response to each essay item.

It is important to give the students specific directions about the topics they should address. Giving general directions, like simply asking them to "discuss" a topic, may cause confusion about the information they should include in their answer. Provide as many details as possible to guide their work.

It can be helpful to write an example response yourself to ensure your directions are specific enough and to determine the approximate amount of time it may take students to write an answer to the essay question. Your example response can then be used as a guide to your evaluation of students' work as your grade the essays and provide specific feedback to each student.

Keep in mind if you choose to use essay items that, in general, they may take less time to write than other assessment items, but they typically require substantially more time for students to complete and for you to read and grade.

Example of an Essay Assessment Item

Directions: Describe the similarities and differences in the government and social hierarchy of Ancient Egypt,

Mesopotamia, Indus Valley, and Ancient China civilizations. Limit your response to 4-5 paragraphs.

Writing Alternative Assessments

Alternative assessments are considered to be more authentic assessments because they ask students to demonstrate their knowledge in realistic contexts. For example, an authentic assessment of oral language proficiency would have students speak the language. An authentic assessment of science laboratory skills would have students demonstrate those skills using laboratory equipment in the laboratory setting. Two types of alternative assessment include performances and portfolios.

Performance assessments give students the opportunity to demonstrate a range of complex skills and knowledge. They are especially useful in demonstrating skills in subjects such as oral language, voice and instrumental music, dance, art, and debate where performance is a natural component of learning the material. Performance assessments can be used in other subject areas as well. Reading skills in early childhood are best assessed by observing a child read text of interest to them. Similarly, observations of individual students as they solve mathematics problems or conduct science experiments can be effective assessments.

Students should be given detailed guidance as they prepare for performance assessments, including the expected components of their performance and the criteria on which they will be evaluated. A **rubric** is a common tool used for providing students with the criteria for evaluation and grading. Rubrics list the skills and knowledge to be assessed, and the points students can earn based on the level of proficiency they demonstrate during the

performance. The rubric should be given to the students before the assessment to help them prepare for the performance, and then used by the instructor during the performance to evaluate and grade each student's work.

Example of a Performance Assessment Item

Directions: For this laboratory assessment, you will:

1. Measure 5ml of each of three provided liquids,
2. determine whether each of the three liquids provided is acidic or basic using litmus paper,
3. use a digital pH sensor to determine the pH value of each of the three liquids,
4. report your findings.

Your performance in the laboratory will be evaluated using the following rubric. Each skill will be assessed as:

- Meets expectations: performance was satisfactory.
- Need improvement: some minor errors in performance.
- Unacceptable: unsafe actions in the laboratory.

Skill Assessed	Meets Expectations (5 Points)	Needs Improvement (3 Points)	Unacceptable (0 Points)
All required safety equipment was used			
Correct processes were used to measure liquids			
Correct rinsing and cleaning of equipment was used to avoid contamination			
Correct procedure was used, and accurate results found in determining acid/base			
Correct procedure was used, and accurate results found in determining pH			
Findings recorded accurately using correct laboratory report format			

Think About It

Describe a performance assessment that might be used in the grade/subject you plan to teach. Write the directions you will give to the students and create a rubric you can use to evaluate their performance.

Portfolio assessments are alternative assessments that ask students to compile a collection of their work across a period of time to illustrate their learning. For example, students in an English composition class or an art class would include the major assignments from a school year in their portfolio. Students are typically required to reflect on the improvement in their skills across that time and write a description of the specific ways the work included in the portfolio documents their progress in learning.

Beginning when the first assignments are completed, you should periodically discuss with the class the purpose for developing the portfolio and the process they will use to build it. This will help them keep track of the work they intend to include in the portfolio, remind them to note their progress in the class, and help them prepare to write about it. Consider providing a rubric to guide the students' work and your grading of the portfolio assessment.

Writing portfolio assessment items is similar to writing essay assessment items. It is important to provide specific and clear instructions so students can complete the assessment successfully. In addition to asking students to reflect on the progress they have made over the time represented by the work examples they

gathered for the portfolio, you can customize the assessment by asking them to explain which assignment they found most challenging, most engaging, and so forth.

Example of a Portfolio Assessment

Directions: Gather your creative writing assignments from each unit we completed this year. Review each assignment and the feedback you received on it.

For this assessment, write a final document to add to your portfolio that describes the progress you have made in this class. Include information about the specific skills that improved, and identify examples from the assignments that illustrate that improvement.

Preparing to Administer the Assessment

After you have written a class assessment, guided by a table of specifications, review it carefully to check that each item is written clearly. Every section of the assessment should begin with brief and complete directions to the students about how to complete the items in the section.

Make a key for all selected-response and sentence-completion items on the assessment so you are prepared to grade them. Write

a model answer for each constructed-response item and develop a rubric for any essay, performance, and portfolio items.

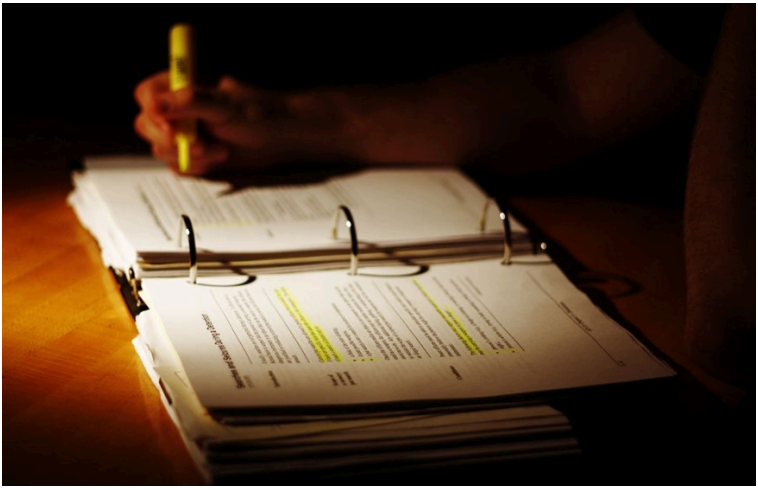
Plan to share information from the table of specifications and any rubrics with your students to guide their preparation for the assessment. If possible, schedule a class period to review the material that will be assessed and to answer any questions the students have about the assessment.

The types of assessment items students expect on the assessment will guide the way they study for the assessment. When assessments use selected-response items, students will need to recognize the correct response, so familiarity with the material will be sufficient. When assessments include constructed-response items the students will need to be prepared to recall information without any cues. Keep this in mind as you design assessments and prepare students to complete them.

Textbook Test Banks

Some textbook publishers provide collections of assessment items. These are often selected-response items — true-false, matching, and multiple-choice questions — but other assessment item types may be provided as well, depending on the subject material in the textbook. If a test bank is available from the publisher of the textbook you are using, and you are considering adopting some of the items, check that those you are going to use are well-written and fit the needs of your class. Generally, you can edit them for clarity and to match the learning objectives and topics that were the focus of your instruction. It is important to use a table of specifications to design the assessment even when you are using a publisher's test bank.

Grading Assessments



It is good practice to grade assessments and return them to students as soon as possible after they take the assessment. Students benefit most from feedback that is received while they can still recall why they chose their responses to the assessment items. Whenever possible, schedule assessments when you will be able to complete grading and share the results with students soon after they take it.

As you grade, refer to the keys and rubrics you developed when you wrote the assessment. Grading selected-response items — true-false, matching, and multiple-choice – can generally be done quickly because there is one correct response. Grading constructed response items — sentence-completion and essays — requires more time because there may be a range of correct responses. Use your key for these items, but also be open to other correct responses you may not have considered when you wrote the key.

When reviewing the constructed-response items, it is important

to use a grading process that will ensure you are applying the same standards to all students. Along with using keys and rubrics, there are a few other strategies you can use to maintain consistent grading:

- If possible, grade the assessment without knowing students' names to prevent expectations about any student's performance from biasing your grading. To accomplish this, you can ask them to write their names on the back of a page in the assessment or on a blank cover sheet. You can also have them write a numeric code instead of their name on the assessment, and then match that assessment to the student only after you complete grading.
- Grade one section of the assessment at a time for the entire class before moving to the next section. This is especially helpful for maintaining consistent grading for a long assessment or for a large class.
- Try to keep the same level of alertness while grading. If you find you are getting distracted or growing tired, take a break from grading until you can focus on the task consistently.

Conducting Item Analysis

As you grade an assessment, you may notice patterns in the items students completed successfully and those which multiple students had incorrect. There may also be a pattern in the type of errors they made. In addition to taking note of these patterns, there are **psychometric analyses** of the student responses you can conduct after grading to determine the effectiveness of the items on the assessment. Psychometric analyses provide a means to interpret the quantitative results of tests. Three types of analysis that are useful with items from a classroom assessment are **item difficulty, item discrimination,** and **distractor analysis**.

Item difficulty is the proportion of students who answered an assessment item correctly. It is calculated as:

Item Difficulty

Item Difficulty = Number of Students with Correct Response/Total Number Students

- The answer will be in the range 0.0-1.0.
- An item difficulty of 0.0 means that none of the students had the correct response.
- An Item difficulty of 1.0 means that 100% of the students answered it correctly.
- Your goal should be for items to fall within a minimum range of difficulty of 0.7-0.9. That is, 70-90% of the students answered the item correctly, so most of the students learned the information.

Item discrimination provides information about whether assessment items were more likely to be answered correctly by the students with the highest overall grades or by those with the lowest grades on the assessment. Items that are more likely to be answered correctly by the students with the highest grades are said to discriminate well.

To determine the discrimination of items, gather the assessments of the 20-25% of the class who had the highest overall grades and the 20-25% of the class who had the lowest grades. To analyze the discrimination of an item, first record whether each of those

students had the item correct or incorrect. Then use the following formula to calculate the item's ability to discriminate:

Item Discrimination

Item Discrimination = (Number of Higher Scoring Students with Correct Response/Total Number of Higher-Scoring Students) – (Number of Lower Scoring Students with Correct Response/Total Number of Lower-Scoring Students)

The result is the difference between the proportion of students with higher test grades who had the item correct and the proportion of students with lower grades who had it correct. Item discrimination values range from -1.0 to +1.0. A positive value indicates that more of the students with high test scores than those with low test scores answered the item correctly. This is what one would expect to find. If there is a negative value for an item's discrimination, this indicates that students who had lower grades on the assessment were more likely to answer the item correctly. Because this would be unusual, if this occurs you should check the item and your grading key to determine why it may have occurred. If you find you graded the item correctly, consider whether the way the item is worded may have confused the higher-scoring students even though they know the material well. You may need to rewrite the item to improve its discrimination when you use the assessment in the future.

Distractor analysis allows you to evaluate the quality of the distractors in multiple-choice assessment items. Recall that the

distractors are the response choices that are not the correct answer. Their purpose is to distract students who do not have a thorough understanding of the material from selecting the correct response choice. You conduct distractor analysis by determining the percentage of students who selected each of the distractors as well as the correct response. Optimally, at least 70-90% of the students should have selected the correct response. If there are any distractors that were not chosen by any student, it may be that the distractor is too obviously not the correct answer. In that case, you can improve that item by rewriting the distractor. If most of the students chose a distractor instead of the correct response, consider whether you need to improve instruction about that material or if the item needs to be rewritten.

Using Assessment Results

Once you have completed the grading and item analysis for an assessment, think about the assessment results overall and consider the possible reasons for common student errors. These may include:

- instruction was insufficient for some students to learn the material,
- study strategies used by some students were ineffective,
- students did not understand some of the directions on the assessment,
- some assessment items were not written clearly,
- there was noise or other distractions in the classroom where the assessment was completed, or
- some students performed poorly due to illness or another personal reason.

There are actions you can take based on the most likely reasons

for the errors. If you suspect that some of the common errors were made because students did not learn the material sufficiently well, plan to reteach that material. If it is a small number of students, you can conduct small group instruction or give them an assignment that allows for relearning of the material. If a substantial number of the students had errors on certain items, conduct instruction about that material again for the whole class. In all cases, it is good practice to have students write corrections to their errors on an assessment or take the assessment a second time. In this way, relearning and reassessment allow students to master the course content from a particular unit of study before moving on, better preparing them for successful learning of future course content. This is particularly important if the material on the assessment is prerequisite knowledge for material they will learn in the future.

Students may also need instruction about effective study strategies. It is not uncommon for students to underestimate the time they need to spend studying for an assessment or to use ineffective study strategies. Taking the time to instruct students about strategies for studying for an assessment will benefit them throughout their years of education. **[this will link to the section of the neuroscience chapter about strategies for learning and recalling information from memory]**

If common errors were due to confusion about the assessment directions or the wording of items, consider excluding those items or sections from the calculation of final grades. Plan to rewrite them before you use the assessment again in the future.

If disruptions in the classroom setting or personal issues prevented any students from doing their best work on the assessment, a follow-up assignment or assessment to improve their grade should be considered.

Giving Feedback to Students

When you meet with students to review the assessment, start with a positive message about their effort. Then focus discussion on the items which were most often answered incorrectly.

If you plan to allow the students to complete the same assessment again to show mastery of the material and to improve their grade, discuss the material on the assessment in general terms rather than giving the class the answer to specific assessment items.

It is not necessary to give students specific information about class grades or the overall range of grades on an assessment. It can encourage competition among students, foster a performance rather than mastery orientation, and discourage those who performed poorly. **[this will link to section from motivation chapter about this topic]**

As you give the class feedback about the assessment, note students' reactions to their performance. Encourage them to view their successes and failures with favorable attributions: [this will link to the discussion of attributions in the motivation chapter]

- Internal: a result of their actions
- Unstable: changeable over time
- Controllable: they can bring about the change

Meet separately with students who seem particularly discouraged or who need individual support to improve their learning, study strategies, or test-taking skills. Help them plan goals for improvement and specific steps they can take to reach them. Afterwards, check in with them periodically to help them evaluate the progress they are making toward their goals.

Some students who perform poorly on an assessment may be experiencing test anxiety. **Test anxiety** is an uneasiness some students experience around assessments that affects their ability to recall information, preventing the student from demonstrating their true ability. It may have started before they were a student in your class and depending on the severity of the anxiety, you may need to seek help from a professional who has been trained to support students with test anxiety.

In general, students who experience test anxiety can benefit from having the opportunity to complete assessments successfully, increasing their confidence. Consider, for example, giving a student a series of brief assessments of gradually increasing difficulty, starting from the point in their zone of proximal development where they can do the work independently – material they know well. Assessments that allow them to practice test-taking skills can be helpful too, especially in early grades when they may have little experience taking assessments. Another strategy is to help the student master the material during instruction and then study until they are over-prepared for the assessment, leading to better performance.

In order to prevent anxiety from developing in students, do not try to motivate students to prepare for an assessment by over-emphasizing its importance. Also, fully explain the components of each assessment to students before they study so they know what to expect. Students should know the types and number of items

on the test. Finally, consider permitting some students to use alternative methods of assessment to show you what they have learned if they would benefit from doing that. For example, a student may be better able to discuss the content learned in your class with you than complete a traditional exam.

Think About It

1. After grading the assessment described in the case study, Mr. Moller completed item analysis of the results. The analysis revealed three issues he needed to address. Explain the meaning of each issue of concern listed below and describe at least one way Mr. Moller can address each:
    1. The item difficulty of a multiple-choice item was 0.2.
    2. The item discrimination of a true-false item was -0.4.
    3. Distractor analysis of a multiple-choice item showed more students chose a certain distractor more often than the correct answer.
2. Why is it important for students to have the opportunity to show mastery of the material after they had errors on an assessment?
3. What can teachers do to prevent test anxiety in their students?

Think About It

If you were a colleague of Mr. Moller, what advice would you give him about each of the following. Answer each question with 4-6 sentences or bullet points.

1. How can Mr. Moller use the assessment results to identify the unit content that students have not yet mastered and now need to relearn?
2. What steps can Mr. Moller take to make sure his students who did poorly on the assessment can now relearn the material before they move onto the next unit?
3. In the future, how can Mr. Moller check if his students know how to study for an assessment and have the test-taking skills needed to complete an assessment before they take it?

Glossary Terms

Action Research

Action research is a process that educators use to systematically evaluate and improve teaching practices.

Alternative assessments

Alternative assessments are non-traditional assessments. They include performances and portfolios

body of literature

The body of literature about a research topic is the collection of published peer-reviewed journal articles about the topic.

Causal Comparative Research

Causal comparative research studies an intervention using existing groups of students as the intervention and control groups.

citation

Identifies the source of information; includes the authors' names and the publication date.

Classroom assessments

Assessments designed by teachers.

Constructed-response assessment items

Constructed-response assessment items require students to provide the answer. These include sentence-completion items, and essays

Correlational Research

In correlational research studies, two numeric measures are compared to determine whether they vary in a similar way. That is, when one measure increases or decreases, does the other have a similar pattern of increasing or decreasing.

Criterion-referenced assessments

Assessments that determine whether students have certain knowledge, based on specific criteria or standards.

Descriptive Research

Descriptive research provides summary information about the characteristics of the sample being studied.

distractor analysis

Distractor analysis allows you to evaluate the quality of the distractors in any multiple-choice assessment items by determining the percentage of students who selected each distractor as well as the correct response

distractors

Distractors are the answer options in a multiple-choice question that are not the correct answers. They are called distractors because they may distract the student from choosing the correct answer from the list of response options

Essay assessment items

Essay assessment items ask students to write about specific content from a unit of study

Ethnographic Research

In ethnographic research, a researcher immerses themselves in

a situation to explore it from many perspectives, using multiple data collection methods.

Experimental Research

In experimental research, researchers look at the effects of a specific change called an intervention. Students in the sample studied must be randomly assigned to a group receiving the intervention or to a control group which does not experience the intervention.

fairness

Fair assessments are those administered in a manner that gives all students an equal chance to complete them successfully

Formative assessments

Methods teachers use to check student understanding during instruction.

Historical Research

Historical research looks at past events to construct an in-depth understanding of them.

Interviews and Focus Groups Research

In interviews and focus groups, researchers talk to people who have experienced a situation being researched. The conversations are generally transcribed, and the text is analyzed to find themes or patterns in the data.

item difficulty

Item difficulty is the proportion of students who answered an assessment item correctly. It is calculated as: Item difficulty = number of students with correct response/total number students

item discrimination

Item discrimination provides information about whether assessment items were more likely to be answered correctly by the students with the highest grades or those with the lowest grades overall on the assessment. Items more likely to be answered correctly by the students with the highest grades are said to discriminate well. The formula for item discrimination is:
Item discrimination =
(number of higher scoring students with correct response/ total number of higher-scoring students) –
(number of lower scoring students with correct response/total number of lower-scoring students)

Matching assessment items

Matching assessment items ask students to match two pieces of information that are related. Usually, two columns of words or phrases about information in the unit of study are presented to students and they choose one from each column to make pairs that are associated

mixed method

Mixed method research studies include elements of both quantitative and qualitative research studies. Both numeric and text data are collected and analyzed.

Multiple-choice assessment items

Multiple-choice assessment items include a question or an incomplete statement followed by a list of options for students to choose to answer the question or complete the sentence

norm-referenced assessments

Assessments that rank individuals who take the assessment in comparison to others of the same age/grade who have taken it.

Observations Research

In observation research, the researcher makes notes while observing the situation or setting being researched. The notes are then analyzed to find themes or patterns.

peer-reviewed

Peer-reviewed research has been reviewed by experts in the relevant field to ensure that the research is of a level of quality worthy of publication in scholarly journals.

Performance assessments

Performance assessments give students the opportunity to demonstrate a range of complex skills and knowledge

Portfolio assessments

Portfolio assessments are alternative assessments that ask students to compile a collection of their work across a period of time to illustrate their learning. Students are typically required to reflect on the improvement in their skills across that time and write a description of the specific ways the work included in the portfolio documents their progress in learning

practicality

A practical assessment is one that requires a reasonable amount of time to write, for students to complete, and to grade

psychometric analyses

Psychometric analyses provide a means to interpret the quantitative results of assessments

qualitative

Qualitative research is used to collect and analyze text data

such as interview transcriptions, observation notes, or historical documents. The data analysis in qualitative studies involves a process of coding the text to identify patterns and themes.

quantitative

In quantitative research, numeric data is collected and then analyzed using statistics.

reference list

A list of all the sources of information used to write a document.

reliability

A reliable assessment is one that measures student knowledge consistently, across time and groups of students

rubric

A rubric is a common tool used for providing students with the criteria for evaluation and grading. Rubrics list the skills and knowledge to be assessed, and the points students can earn based on the level of proficiency they demonstrate during the performance

Selected-response items

Selected-response assessment items are those where the answer is provided. The students only need to recognize the answer. These include true-false, matching, and multiple-choice items.

Sentence-completion assessment items

Sentence-completion assessment items ask students to supply missing words or phrases in sentences. Each sentence has underscored spaces to indicate the missing word or phrase

Standardized assessments

Assessments that must be administered and scored in a standardized manner.

stem

A stem the question or incomplete statement given at the beginning of a multiple-choice assessment item

Summative assessments

Methods teachers use to check student understanding at the end of a unit of study.

table of specifications

A table of specifications is used to design an assessment. It includes information about the learning objectives or topics covered in the unit being assessed, the percentage of total instruction time spent on each topic, and the level of cognitive challenge to use to check students' knowledge of each of the topics

Test anxiety

Test anxiety is an uneasiness some students experience around assessments that affects their ability to recall information, preventing the student from demonstrating their true ability

Traditional assessments

Traditional assessments are conventional paper-pencil tests that include true-false, matching, multiple-choice, sentence-completion, and essay items

True-false assessment items

True-false assessment items are statements that students identify as either true or false

validity

A valid assessment is one that measures all the concepts it is intended to measure, and only those concepts