Research 101: Understanding

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Currently, the Montessori community is increasing its focus on the importance of research. You may have noticed that *Montessori Life* is featuring more research-related articles and that there are "How to conduct research" sessions at AMS conferences. The good news is that you don't have to have a PhD to be a discerning consumer of research! The purpose of this article is to provide you with some background to help you be a more critical reader of research related to Montessori education and to give you the tools to implement the findings in your own Montessori work.

Research articles are generally organized in a way that allows the reader to easily follow the logical flow of the research process. You will typically see an introduction followed by information on research methods. Research articles usually conclude with a discussion of results and practical implications. The sections that follow outline key considerations and questions you should ask yourself in each of these areas.

The Introduction

All research starts with a problem or a question the researcher will study. This should be stated in a clear and researchable way—in other words, the problem or question must be able to be investigated by gathering and analyzing data. The introduction to a research article usually includes background information and an overview of existing research on the topic to help the reader understand the context and significance of the research.

When thinking about research questions of interest in Montessori education, people often seek studies that demonstrate the effectiveness of Montessori education. And these studies are often the ones most frequently requested by legislators, school administrators, and prospective parents. However, a single research study should not suggest that it alone states Montessori education is unequivocally superior to other educational approaches. Academic researchers participate in the process of investigation to build a body of knowledge to support a hypothesis. A case can be made for Montessori education through assembling evidence from a variety of studies on student outcomes conducted over time. The AMS website contains resources on the Research page for locating this evidence.

When an article examines the effectiveness of Montessori education, the reader must understand how the researchers define effectiveness. Finding strong academic outcomes is obviously one definition of success, but there are many others. When a study focuses on academic outcomes or, even more narrowly, on results of standardized tests, you should realize that many other possible outcomes could be examined (e.g., social, emotional, behavioral, etc.) because Montessori education is focused on educating the *whole* child. Montessorians must participate in the nation's conversations about academic success as measured by standardized tests, but we must not be confined to this definition as the sole indicator of educational effectiveness. As you read the growing body of research literature on Montessori educational effectiveness, recognize that each study represents one piece of a much larger picture, including academic as well as other perspectives on student outcomes.

Methods

The research question at hand will dictate the methods employed by the authors. Educational research generally falls into one of two categories, quantitative or qualitative. Both play an important role in the field of education, but they address different types of research questions and use different types of data. Quantitative research, not surprisingly, involves the collection and analysis of numerical data to describe, explain, or predict phenomena. Techniques used in quantitative research include survey research, correlational studies, experimental or causal-comparative designs, and database analysis. Conversely, qualitative research involves the collection, analysis, and interpretation of narrative and visual (non-numerical) data through methods such as ethnography, case-study research, in-depth interviews, or focus groups (Gay, Mills & Airasian, 2009). Perhaps the best way to illustrate the difference between quantitative and qualitative research is through an example of two possible research questions approached from the two different perspectives:

- **QUANTITATIVE:** Are there differences in the number of times adolescent girls and boys ask/answer questions in a Montessori environment?

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- **QUALITATIVE:** What are the learning-related social experiences of adolescent girls and boys in a Montessori environment?

In addition to describing the research design, the description of the author's methods should also include information about the study participants, including the number of participants and their characteristics, as well as the procedures used to select the sample. In quantitative research, it is important to gauge if the number of participants in the sample is sufficient for statistical analysis and to understand any possible limitations or biases inherent in the sample. The minimum sample size varies depending on the statistical analyses conducted, but could be as small as 30. More robust studies include random samples with larger numbers of participants, typically numbering into the hundreds. In qualitative research, the number of participants will be much smaller, and could even be a single individual in a case study. The quality of participants in qualitative research can be assessed when the author provides enough information to determine if selected participants are appropriate for addressing the stated research questions (Gay, Mills & Airasian, 2009).

Well-designed research requires precision, so authors must articulate the definitions and measures they use. A key piece of information is how the authors define Montessori education. This can be difficult because the Montessori name is not legally protected. Any school can use the term in their name regardless of the degree to which they follow the principles of the Montessori philosophy. Researchers wishing to draw conclusions about any aspect of Montessori education must establish the authenticity of the environments they wish to study. Opportunities for describing the quality of Montessori environments include AMS school accreditation, AMI school recognition, or teacher certification by recognized training organizations. In addition to gathering information about the Montessori programs they study, researchers may collect other kinds of data as well, including established measures like standardized assessments, published instruments, or surveys designed by the researchers. The article should outline why these measures are valid and relevant for the study. Researchers often wish to design research to contrast Montessori education with other approaches, a design that requires the identification of a relevant basis for comparison. Because parents who seek a Montessori education may differ fundamentally from other parents, research design must take into account the potential confounding influence of parental selection on study findings. Selecting an appropriate "control group" can involve strategies such as comparing students in a Montessori magnet school to those enrolled in a magnet school with a different focus. Alternatively, students in a private Montessori school could be compared with students enrolled in a non-Montessori private school with similar demographic populations. A study by Angeline Lillard (2006) published in the journal *Science* addressed this issue by comparing students entering a public Montessori program based on a lottery selection process to those students who were also in the lottery but were not selected to attend.

The methods we have been discussing all relate to establishing the validity of a particular research study. *Validity* simply means the degree to which a study's results should be trusted. The research field further identifies many different types of validity, including external validity, which reflects the generalizability of the findings, and construct validity, which reflects the appropriateness of the instruments to measure the intended concepts. However, these distinctions are not crucial in this discussion. Suffice it to say that an author has demonstrated a study's validity when s/he makes a convincing case for the reader to believe the study's conclusions (Cook and Campbell, 1979).

Another term that you may hear linked with validity in discussions of research is *reliability.* Generally speaking, reliability just means the consistency of the results of an assessment (Miller, Linn & Gronlund, 2009). In other words, would the researcher's efforts yield similar results again under similar circumstances? Statistical measures exist to quantify the degree of reliability in quantitative research, such as *inter-rater reliability* (when multiple observers provide ratings of a subject) and *split-half reliability* (when an instrument demonstrates internal reliability).

In qualitative research, the term *credibility* is used to refer to the quantitative concept of validity (Creswell, 2007). Credibility in qualitative research

may be established through triangulation, construct validation, face validation, and catalyst validation (Creswell, 2007). Each of these terms involves a dialogue with the participants, multiple sources of data, and member checks to ensure that the story told by the researcher matches the story perceived by the participants. Establishing validity relies on extensive field notes and a paper trail authenticating the research, both of which also influence the reliability of a qualitative study. A thorough paper trail and member checks ensure the reliability of a study by eliminating differences between the reality of the subject studied and the researcher's interpretation of that reality (Bogdan & Biklen, 2007).

You can probably see that it would be difficult to argue that a study is valid if the results are not reliable. Consider this example. A math assessment could be reliable if it yields consistent results for students. But it is not a valid measure of their math ability if the test involves so much reading that it is more a reflection of reading skills than math ability.

Results and Discussion

A major portion of the results of a quantitative research study will include reporting summaries of the data. The author must provide enough information about the data collected for you to gauge the validity of his/her conclusions. In presenting their results, quantitative researchers often use the term "statistical significance." Since authors make inferences about a larger group based on information gathered from a sample of individuals in the population, they say that the findings are "statistically significant" when they are unlikely to have occurred by chance (Gay, Mills & Airasian, 2009). Many different statistical procedures exist with a variety of assumptions required for their appropriate use. When an author finds results to be statistically significant, this simply means that you can be fairly confident (typically 95% confident) that his/her results represent a true difference in the population. For example, if a study finds that first-grade girls volunteer to read aloud in class more often than boys by a statistically significant margin, this means that the difference in volunteer rates between boys and girls is large enough that you can be fairly confident that you would see this difference if you were able to observe all first-grade boys and first-grade girls in the population from which the sample was drawn.

While issues of statistical significance are not relevant in qualitative research, such articles should report enough data for you to follow the path of logic to the author's conclusions. Data in qualitative research are often detailed descriptions and direct quotes from participants. Often data that support the author's conclusions are provided from a variety of sources. The technique of using a variety of sources to confirm each other is called "triangulation" (Lodico, Spaulding & Voegtle, 2010). A qualitative researcher examining the impact of an anti-bullying program in a school setting would likely interview a variety of students, faculty, and parents looking for corroborating data. In discussing results, the author must address possible arguments that could poke holes in the findings.

In quantitative research, these questions often include:

- Are other explanations possible? (Confounding Variables)
- Do findings apply outside this study? (External Validity)
- Is the researcher measuring what s/he purports to measure? (Construct Validity)
- Are these results repeatable? (Reliability)
- Has the author dealt with possible sources of bias? (Sampling, Content Validity)

(McMillan and Schumacher, 2006)

In qualitative research, the author must still address questions that could make you doubt the results. However, the questions are different in qualitative research. Enough information should be provided for you to assess:

- Has the researcher acknowledged the role of his/her theories, preconceptions, or values to understand how they influenced conduct and conclusions of study?
- Has the author explained the possible influence of the researcher on participants in order to understand it and use it productively? (Kirk and Miller, 1986)

If an author is effective in establishing the validity of a study, whether it is quantitative or qualitative, the discussion of practical implications of the results is often easy to make. If you are convinced of a study's quality, you can use your professional knowledge and experience to gauge the relevance of implications for the field suggested by the author.

Research articles usually follow a similar design, even if the method of research differs. Most articles will begin with a question/problem and background literature, followed by a discussion of the sample and data collection procedures, and then end with a discussion of the findings. By becoming informed consumers of research, we as Montessorians may find new ideas to apply in the classroom and evidence supporting our practice. However, to become an informed consumer, one must understand the language and design of the research process. Once a basic understanding of research is developed, numerous resources are available to address questions that arise within a classroom setting. As discussed above, the question drives the research method and as consumers of research, our questions should direct the search for answers among the multitude of available articles. As discerning consumers, we should be able to choose the best of available research to inform our practice.

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