



## Single-Factor Fallacy

*A Commentary*

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### Abstract

*As editors and scholars, we have concerns with investigations that emphasize the contribution of one major factor to the development of a complex entity such as, for example, language or literacy. This phenomenon is known as the single-factor fallacy. Basically, this is asserting that there is one all-encompassing factor that causes or influences academic development even though there are certainly other factors that are critical contributors. Endorsing one factor, whether explicitly or implicitly, leads to oversimplification and overgeneralization as well as to other problems such as misleading conclusions and confirmation and citation biases. The single-factor approach results in the promotion of inappropriate educational decisions or implications regarding d/Deaf and hard of hearing (d/Dhh) children and adolescents. We discuss ways to minimize or avoid the single-factor fallacy.*

**Keywords:** *Deaf and Hard of Hearing; Single-Factor Fallacy; Types of Research Biases*

### Single-Factor Fallacy

Since the inception of the education of d/Deaf and hard of hearing (d/Dhh) children and adolescents, there have been a number of challenges for researchers and educators. These challenges include, at the least, proffering instructional practices that are effective for developing and enhancing language, literacy, and achievement in the other academic areas such as mathematics and science (Moores, 2001; Paul, 2022b). d/Dhh students, particularly those with moderate to profound hearing loss, may experience difficulty in school and often do not reach language, literacy, or academic achievement levels that are commensurate with their typical (hearing) peers. In fact, a number of d/Dhh students with moderately-severe to profound hearing loss

may read no higher than 4<sup>th</sup> or 5<sup>th</sup> grade (on a 12-grade scale) upon completion of compulsory education. These literacy levels have improved somewhat for students with cochlear implants; however, the findings are not unequivocal, and there is a need for further research to clarify the mixed results (Mayer & Trezek, 2018; Mayer et al., 2016; Qi & Mitchell, 2012).

Researchers and educators of d/Dhh children have argued that the degree of hearing loss should not be considered the only predominant factor in the development of speech, language, and literacy abilities. There are instances where a number of d/Dhh students are more successful in developing skills than are children with typical hearing. Such a situation may be attributed to factors such as stimulating early

intervention and educational environments, effective instructional strategies, well-written individual educational plans (IEPs), and d/Dhh students' ability to access the critical components of academic areas (e.g., see Jachova et al., 2018). Clearly, there is no panacea or all-encompassing factor that can solely account for overall achievement.

Nevertheless, the persistence of low levels of language, literacy, and academic achievements for some d/Dhh students has engendered a great deal of frustration for educators and parents/caregivers. This frustration can lead to questioning the value of educational and rehabilitative research, especially when there has been little overall improvement for the students after 12 to 16 years of schooling (Pring, 2004). It would not be surprising if researchers and scholars are pressured to provide a better understanding of achievement and to offer solutions that yield positive results. This pressure, among other factors, may lead to a misunderstanding of the types of investigations that need to be conducted or a neglect of addressing quality indicators such as adequate reviews of the literature, descriptions of the methodology, and the use of complex research designs (Paul & Wang, 2017).

As editors and scholars, we have concerns with investigations that seem to focus predominantly on the contribution of one factor to the development of a complex entity such as, for example, language or literacy. This phenomenon is known as the single-factor fallacy (Paul, 2021; Pettigrew & Hewstone, 2017). Basically, this is asserting that there is one all-encompassing or major factor that causes or influences such development even though there are certainly other factors that are salient contributors.

In this article, we argue that endorsing one factor, whether explicitly or implicitly, leads to an oversimplification of the findings as well as to other problems such as misleading conclusions and confirmation or citation biases. In essence, this single-factor approach can result in the promotion of inappropriate educational decisions or implications regarding d/Deaf and hard of hearing children and adolescents. We provide hypothetical examples and reasons for single-factor fallacies. We also propose various methods for researchers to assist them in minimizing or avoiding the single-factor fallacy.

## **Recognizing and Addressing Single-Factor Fallacies**

It is important to discuss possible steps for minimizing or avoiding single-factor fallacies. We begin by proffering possible steps related to the structure and content of a research manuscript. Specifically, it is critical to consider the technical merits or quality indicators for the review of the literature, methodology, and research design sections (Council of Exceptional Children, 2014; see also, various chapters in Cawthon & Garberoglio, 2017).

Whether researchers are conducting a primary empirical study or a narrative review, they should perform a comprehensive review of the available literature. Traditional aspects include a definition of the problem, summarizing previous research, identifying gaps or contradictions, and providing information to justify the research design of the investigation that is undertaken. Equally as important, researchers should critically analyze a range of pertinent studies, including those with contradictory findings—especially to avoid or minimize confirmation or citation bias (Galvan, 2012; Roig, 2011; Smart, 2005). Confirmation and citation biases refer to the inclusion of only studies (or specific researchers) that support the investigator's framework. In any case, a thorough review of existing relevant investigations should highlight the complexity of the phenomenon under study. That is, the readers should be aware of multiple factors that impact the phenomenon even if the researcher is only examining a few salient variables.

It is also instructive for researchers to delineate any theoretical framework that might provide a perspective for the complexity and multifaceted nature of a phenomenon being examined such as language or literacy development. This framework not only should guide the researcher's design, but also provide readers with an understanding of the researcher's approach—or in this case, the researcher's bias in exploring the entity. It is also helpful to mention that there are other theoretical frameworks that have been used, and the selected one for the study is the researcher's choice. That is, the researcher has argued that the selected framework supports the design and will yield the most productive outcomes for the phenomenon being

investigated (e.g., see Paul & Wang, 2017).

In the methodology section of the manuscript, critical considerations involve the sociodemographics of the participants, the construct validity of the measuring instrument, and the data-analysis design of the study. Although sociodemography is not directly related to the single-factor fallacy, this variable does affect the validity of the selected instruments used to measure performance of the participants. For empirical studies, the sociodemographics of the participants in the researcher's investigation should be compared to the sociodemographics of the participants in the analyzed studies in the literature review. Adequate sociodemography also minimizes overgeneralizations of findings (Council for Exceptional Children, 2014).

The heterogeneity of d/Deaf and hard of hearing individuals should definitely be highlighted. The variety of hearing loss levels affects our understanding of communication and language and even the culture of these individuals. For example, communication is influenced by factors such as the individual's hearing history, length of the hearing loss, age at implantation of assistive hearing devices, and the involvement of parents/caregivers (Hasanbegovic & Kovacevic, 2019). Heterogeneity presents challenges for generalization of research results.

In essence, ignoring critical factors such as degree of hearing loss, age at onset of the loss, and socioeconomic status that can affect achievement outcomes is misleading or is a misinterpretation of the findings. Indeed, without adequate sociodemographics, we are limited in our ability to understand the merits of instructional or assessment practices as well as the applications of our research findings.

Another major factor associated with the single-factor fallacy is inadequate construct validity of the measuring instrument used in the investigation. There are several types of validity—for example, face, concurrent, predictive, content—and the one that we will focus on—construct. In general, validity addresses the question: Does a test measure what it was designed to measure? Construct validity is influenced by an individual's theoretical persuasion. Nevertheless, a test is considered to possess construct validity if it adheres to an extant

theoretical construct (Gall et al., 2007; 2015). We recognize that describing an extent theoretical construct is controversial and debatable. However, this is necessary, in part, to justify the construct validity of assessments.

Whether a researcher is interested in a language domain such as syntax or in a general domain such as reading, it is not feasible, or even possible, to develop a detailed test that assesses *all* components of a domain in one investigation. For example, it is clearly unrealistic to assess all of the major structures of syntax (e.g., negation, relative clauses, etc.) with one test. Even if one uses a screening format, it will still be necessary to develop a more elaborate version of one syntactic structure to pinpoint a student's specific area of difficulty with that structure. Additional test versions are necessary to develop a comprehensive profile of syntactic knowledge. Of course, if the scores on the screening test correlate with levels of reading proficiency, it might be permissible to state that reading proficiency is affected by the syntactic structures on the screening form. Additional research is needed to delineate a student's specific problem with syntax and to ascertain the overall effects of syntactic structure on reading performance.

It is important to provide a few remarks about the formats of tests, which can also contribute to the single-factor fallacy. Let's use reading comprehension as an example. There is no best method for assessing comprehension; researchers have used formats such as multiple-choice, retell, and answering essay questions. Each method assesses a "view" of comprehension—not a "complete" view, and it is recommended that several formats be used to obtain an adequate picture of reading comprehension (e.g., National Reading Panel, 2000). In addition, it is recommended that investigators assess participants' understanding of ecologically valid reading passages, rather than isolated sentences. Reading involves more than just comprehension of sentences. In any case, if a researcher employs one type of test format in their studies, then the results need to be contextualized with respect to that format.

The final area to discuss in this section is research design. There is a need to develop or employ complex designs that acknowledges the existence of multiple factors on the development of a specific

content areas or construct. The design should be guided by a robust theoretical framework as much as possible. It is good research practice to control or at least discuss the effects of possible confounding factors. It is recommended that the following designs be considered (for further accessible details, see Creswell, 2008, 2014; Gall et al., 2007).

- **Multivariate analysis**—This type of analysis permits the examination of several factors simultaneously. Examples include multiple regression, path analysis, and structural equation modeling. Although correlation analyses are a good first step, in-depth understanding requires the use of analyses that can provide some information on causation, the strengths of specific variables, the level of variances of factors, and so on. It might also be critical to perform a sensitivity analysis; that is, evaluating the impact of the results in light of the inclusion of additional variables
- **Mixed-methods approach**—Technically, this is a combination of qualitative and quantitative methods, which can provide a more comprehensive or holistic perspective of the entity under study. However, this should not be merely a juxtaposition of the two techniques. The rationale of the approach needs to be demonstrated as well as the relationship between the two methods of analysis
- **Longitudinal studies**—Although longitudinal studies are time-consuming and a challenge for young researchers in tenure-track university positions, these studies have enormous value in that they permit an understanding of the manner in which different factors interact and influence the various outcomes over a set period of time.

In addition to the above suggestions, it is also recommended that specific researchers collaborate with other researchers from other disciplines or even from other countries. This can engender diverse perspectives on the constructs under investigation, highlighting the contributions of multiple factors and even provide a cross-cultural perspective. To minimize or avoid confirmation or citation biases, it might be feasible to collaborate with investigators who ascribe to a theoretical or philosophical framework that is outside one's silo.

As editors and scholars, we understand the challenges of conducting research on a low-incidence population such as d/Deaf and hard of hearing individuals, especially d/Dhh individuals with additional disabilities (e.g., learning disabilities, cognitive disabilities, autism spectrum disorders, etc.). We also submit that there is certainly value in employing designs such as single-case, correlational, and even the various types of qualitative methods such as case study, ethnographic, grounded theory, historical, and phenomenological (e.g., see various discussions in Cawthon & Garberoglio, 2017). Whatever design is used, we maintain that investigators should be cognizant of the limits of such designs and should also be aware of the complexity of the theory that underlines their constructs (e.g., language, literacy, mathematics). At the least, this should minimize or avoid the single-factor fallacy.

### **Hypothetical Examples**

There are hypothetical single-factor examples that can be highlighted here. For example, researchers should avoid attributing performance solely to hearing loss as the predominant factor, as mentioned previously. Investigators need to mitigate remarks that seem to tout all-encompassing factors such as visual phonics, cued speech/language, cochlear implants, Sign Language, and so on. There is no doubt that the above variables can contribute to the positive performance of d/Dhh children and adolescents; however, it is critical not to ignore other factors that also play a role in that performance.

### ***The Example of Reading***

Understanding reading is extremely complicated (Alvermann et al., 2013; National Early Literacy Panel, 2008; National Reading Panel, 2000; Paul et al., 2013; Paul, 2024). Macro models of reading might include components such as word identification, comprehension, and sociocultural variables such as teacher competency and teacher-student relations. There are even micro models that focus only on one component such as word identification or vocabulary. Researchers may explore the role of phonics or morphology—which are necessary, but clearly not sufficient for the development of reading in a language such as English. The crux of the matter here is

that neither phonics, morphology, or even vocabulary can account for or explain all of reading comprehension. There are other critical variables (e.g., prior knowledge, metacognition) that need to be examined, and this should be highlighted to minimize or avoid the single-factor fallacy. Thus, it is possible that a number of investigators are ascribing to a narrow or constrained paradigm of language or literacy and do not inform their readers that they are only examining a part of these constructs. Again, this can lead to overgeneralizations or misinterpretations of their findings.

Researchers and educators need to remember that “reading” is a non-unitary construct. Non-unitary refers to the notion that there is no one all-encompassing factor that can account for the development of literacy. This complex structure has components related to cognition, linguistics, and culture—in essence, reading can be stated as a cognitive-social phenomenon. In addition, there are interactive factors such as the home environment (e.g., involvement of parents/caretakers), the teaching-learning situations (e.g., teacher competencies), and the affective domains (e.g., interest, motivation of students) (Alvermann et al., 2013; National Early Literacy Panel, 2008; National Reading Panel, 2000; Paul et al., 2013; Paul, 2024).

It is also necessary to understand the way in which the practice of literacy works both in society and in the classroom. This cognitive-social perspective of literacy implies that reading and writing involve different types of texts in different modalities in different practices established by different social groups. Learning to read and write is understood as a process of participation in different social flows (practices) (Alvermann et al., 2013; Lipson & Wixson, 2013). A cognitive-social model should attempt to include cultural differences between groups, which also applies to Deaf people including those who are members of the Deaf culture, DEAF-WORLD, or have a Deaf identity.

From a predominate cognitive perspective, learning to read and write involves not only proficiency in the foundational skills such as accessing words, but also with using prior knowledge and metacognition to comprehend and interpret the printed information.

At the least, scholars need to address the relationship between the through-the-air (i.e., speech, sign) form and the representation of that form in written language. This relationship is part of all major frameworks on the development of adequate literacy (reading and writing) skills.

For a number of d/Dhh students, as well as for other students who might be struggling literacy learners, it will be necessary to differentiate instruction (Jachova et al., 2018; Paul et al., 2013). In some cases, it might be necessary to proffer alternative approaches to print literacy (e.g., sign literacy, oral literacy) in order to prevent cognitive impoverishment and facilitate the acquisition of knowledge in academic content areas (Paul, 2022a; Paul & Wang, 2012).

The majority of educators and researchers believe that it is extremely important for citizens to possess appropriate literacy skills (reading and writing), especially for academic and post-school success in societies that are predominantly dependent on technology and print. Of course, print literacy is extremely important, but the simple definition of this construct is debatable, and a broad literacy view indicates that it does not represent only the possession of functional print literacy skills (Paul, 2022a; Paul & Wang, 2012). What is important is to ensure that d/Deaf and hard of hearing students and others can experience a meaningful participation in social, economic and political engagements through the institutions of society. This broad view of literacy requires a commitment to its complexity to avoid the single-factor fallacy.

### ***The Evolving Cohort of d/Deaf and Hard of Hearing Students***

The single-factor fallacy cannot be avoided if researchers and educators do not understand the evolving cohort of d/Dhh students (e.g., Mayer & Leigh, 2010). This simply cannot be overemphasized. Research results need to be contextualized with respect to the specific demography of the students. As mentioned previously, without this contextualization, there may be an overgeneralization of findings on a sample from a population to a dissimilar sample of the same population (e.g., Paul & Wang, 2017).

It is challenging, for example, to generalize findings on hard of hearing students (hearing losses up to the moderately-severe level) who might use the oral communication mode predominantly to d/Deaf students (mostly with severe to profound losses) who might use a signed communication mode predominantly. d/Deaf students, who are predominantly dependent on the use of a signed language or the use of signing (e.g., Arabic signs, English signs, Flemish signs, etc.) and who have limited or nonfunctional hearing, represent a group that might be distinct from the cohort with adequate access to functional hearing with or without amplification.

Demography is important also for implementing evidence-based practices for specific cohorts of students. It is possible and even desirable to use an assessment for d/Dhh students and students who have typical hearing or are typical literacy learners as long as scholars consider individual/demographic factors that may affect the construction and use of assessments as well as the comparisons of performances of the groups. In short, demography is considered one of the quality indicators of good research and effective instruction.

What constitutes an adequate rendition of demography for research on d/Deaf and hard of hearing students is certainly open to considerable debate. It is difficult to ignore factors such as hearing level, gender, age, additional disabilities, and socioeconomic status. Even if these variables are not applicable or part of the research questions, it is still important to provide this background for generalization and replication purposes. Even if generalization and replication are not applicable issues—as in qualitative research—it is still critical to contextualize the nature of the participants; that is, provide an adequate sociodemographic background.

In essence, investigators will not make progress with research on cochlear implants, bilingualism, or other areas if they do not consider the heterogeneity of the population of d/Deaf and hard of hearing students.

In fact, using labels such as “Deaf”, “deaf”, or “hard of hearing” is ambiguous and not helpful for research or instruction without accompanying sociodemographics such as hearing level, speech intelligibility, communication/language background, age at onset of hearing loss, or use of assistive hearing devices. Again, demography is critical to avoid single-factor fallacies.

### Conclusion

In this article, we described the concept, single-factor fallacy, and provided suggestions for minimizing or avoiding this type of fallacy. Our suggestions were associated with the sections of a research manuscript such as review of the literature, methodology, and data analysis. There were also recommendations for utilizing more complex research designs based on the extensive non-unitary nature of entities such as language, literacy, and other academic areas. Because of our interest in d/Deaf and hard of hearing individuals, there was a focus on sociodemography due to its effects on the development and use of appropriate measurements and instruments and the need to avoid overgeneralization of findings. Sociodemography is also important for proffering evidence-based practices and is critical, given the diverse and evolving characteristics of d/Dhh individuals.

Last, but not least, we argued that researchers need to be cognizant of and continue to grow in their understanding of extant theoretical frameworks associated with various academic areas of interest. This recommendation undergirds the complexity of constructs such as language and literacy developments and emphasizes the need to contextualize research findings to minimize misconceptions and misunderstandings. This recommendation will also serve to counter other “fallacies” such as confirmation and citation biases. In our view, if investigators are conscious of single-factor fallacies, then they should be able to document results that lead to evidence-based practices and, ultimately, to contribute to the improvement of academic achievement for d/Deaf and hard of hearing individuals.

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