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Evidence-Based Practices in Special Education: A Reflection on the Philosophy, Research and Teaching

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Abstract

Some researchers have taken evidence-based practices (EBPs) as the main solution for enhancing the learning outcomes of students with disabilities. The manner in which the application of EBPs assumes teaching strategies to be aligned with students' learning problems or disability situations betrays a mechanical approach to dealing with issues of students with disabilities. Post/positivism and scientific methods are underpinning threads supporting these developments. Yet, the complexity of teaching practice tends to be overlooked and scientific methods overextended. In this background, this article reviews the philosophy of science so that a more complete and historical understanding of science is represented, which is helpful in facilitating the discipline to draw attention to the limitations of current discussions about EBPs. Subsequently, we raise three ways to elucidate the research and teaching practices. First, ontological, epistemological and methodological diversities should be practiced to interrogate issues related to EBPs. Second, alternative methodologies should be encouraged to counter the environmental and systematic barriers compromising students' learning difficulties. Last, a problem-solving approach should be used to compete with a mechanistic approach in responding to students' learning difficulties.

Keywords: evidence-based practices, scientific methods, philosophy of science

1. Introduction

From the 1970s onward, there was a concerted focus on best practices in the medical field to ensure good quality health care for patients, and later on, this was extended to the fields of nursing and psychotherapy (Spencer et al., 2012). A similar call was then taken in special education and was generally termed evidence-based practices (EBPs). EBPs aim to reconcile the gap between research and teaching practice and ensure effective and efficient teaching for students with disabilities (Cook, Tankersley, & Landrum, 2009; Cook & Odom, 2013; Odom et al., 2005). Unfortunately, unfulfilling EBPs has commonly been blamed for compromising the outcomes of students with disabilities (e.g., Cook et al., 2008).

EBPs were promulgated in the No Child Left Behind Act (NCLB, 2002) and Individuals with Disability Education Act (IDEA, 2004) in the United States of America. EBPs were further fuelled in 2013 when the Council for Exceptional Children vowed to commit to EBPs for the education of students with disabilities (Cook et al., 2014). Despite this, there is no mention of EBPs in the modified Special Education Act of 2020 in Taiwan. The government policy requires that special education teachers deliver scientifically sound pedagogies to ensure the learning quality of students with disabilities (TDE, 2008).

The proponents of EBPs tend to legitimise their arguments on scientific methods which are fundamentally based on post/positivism. It assumes that truth could be obtained or approached if researchers exercise neutral and scientific methods (Creswell & Creswell, 2017). In a sense, EBPs do exist in educational settings and could be captured through rigorous designs with empirical data (Cook & Cook, 2011). Nonetheless, limitations of science have not received adequate attention in research practice of EBPs. Actually, the philosophers of science, particularly in the last century (e.g., Popper, Khun, Felerband), intensively interrogated the concept of science and the limitations of empirical induction as well as deductive approach (Bird, 2018; Preston, 2016; Thornton, 2021). The limitations of scientific methods could be complicated with the statistical probability and the difficulty of

proceeding random sampling and assignment. In addition, a mass of concerns with the over-admiration on the evidence has been expressed in medical and psychotherapy fields, which may undermine practitioners' experiences and expertise. Yet, these are seldom looked at while researching EBPs.

This article aims to critique EBPs in terms of three aspects: the concept of science, scientific methods and the teacher's autonomy. The contents unfold in the following sequence. The article starts by presenting the discourse around science from a philosophical perspective. Subsequently, the credibility of scientific methods is examined. Finally, the content is centred on the compromise of teachers' practical judgment.

2. Variation of Science

EBPs proponents tend to legitimise their positions in the name of science; however, their meaning has been sparsely elaborated in relevant literature. Okasha (2002) indicated a common myth that science is a fixed and universal concept, but indeed, it is invariably evolving throughout history. This section focuses on the development of the philosophy of science in the 20th century. Two indispensable issues are interrogated: ontology and epistemology. Ontology concerns whether science serves as the exclusive means or one of many possible means to obtain knowledge, which receives massive attention in the contemporary science of philosophy. The latter centres on how to undertake an appropriate approach to obtain valid and reliable knowledge (Crotty, 1998).

In the West, the epistemological debate can be traced to as far back as ancient Greece. The deductive approach was the core pillar of rationality, whereas the inductive approach became the foundation of empiricism. Plato, an iconic figure of rationality, stressed that human beings can obtain valid knowledge through innate reasoning, whereas empiricism, advocated by Aristotle, proclaims that knowledge is formed through people's experiences. The method of the former relies on reasonable deduction in contrast to the latter which capitalises on empirical induction and becomes the main approach in doing scientific research (Okasha, 2002).

The research of EBPs is grounded profoundly on empiricist ontology which assumes that humans can obtain universal and objective truth through scientific methods, particularly experimental designs. Still, the inductive approach is applied to generalise a universal principle from an array of experimental findings. Yet, any conclusion inferring from empirical experiences cannot be applied to unexperienced events. For example, if a researcher attempts to prove 'all swans are white', the conclusion will always be deferred until all swans on earth are examined. Even if all swans on the planet are proven white, researchers will unable to guarantee that the swans delivered in the future will all be white.

In contrast, Popper claims that science should apply the deductive approach to obtain certain conclusions (Preston, 2016). The underlying principle is that if the predisposition is true, the conclusion must be true too. Furthermore, he argued that falsification was the critical feature to distinguish genuine science and pseudo-science. A real scientist is supposed to disprove a statement rather than prove it. Knowledge would progressively culminate until the pre-existing predisposition fails in falsification (Preston, 2020). Considering the aforementioned white swans, for example, the statement 'all swans are white' cannot be proved by presenting a white swan, but rather researchers need to deliberately spot a swan with any other colours and take the hypothesis as conjectural before it is disproved. It is worth noting that he does not say pseudo-science is worthless or is gaining credibility.

Popper's ideas regarding falsification and criticality, however, experience challenges. One remarkable critique is from Kuhn (1962), which asserts that a paradigm in any specific discipline must include a set of unproven assumptions regarding theory, research methodology and relevant perspectives taken for granted. Scientists just do normal research to address practical problems most of the time. The legitimacy of a paradigm is rarely questioned until anomalies pile up and a competing paradigm replaces it as a new dominant paradigm (Bird, 2018).

Pragmatically, EBPs tend to believe that any valid statement should be reduced to observable and measurable constructs (or variables) and then empirical evidence is collected to verify the statement. Researchers, then, may synthesise a set of relevant statements to form a theory to explain a general phenomenon, such as Darwin's evolution theory. The research contains pre-existing assumptions such as 'any existence can be measured or quantified' and 'scientific methods are a more appropriate approach to define an effective strategy'. This discourse is not nihilism, but logically any method per se just cannot prove itself. Therefore, any predisposition requires outside evidence to support it.

Contemporarily, the concept of science is subjective to the influence of postmodernism and relativism. Feyerabend (1975) opposes Popper's idea regarding the demarcation of real science and pseudo-science, and meanwhile, rejects Kuhn's concept of performing routine investigations. Rather, he argues that the value of scientific research hinges on revolutionary breakthroughs which require creative ideas and methods. None of the regular and valid methods could be defined in science history. Over time, breaking the rules may bring in insights. Moreover, it was

believed that the competing paradigms would benefit the development of knowledge. Feyerabend also values the idea of secular science because it might provide insights on formal science (Preston, 2016).

3. Overrating of Scientific Methods

The proponents of EBPs proposed a hierarchical framework to justify the legitimacy of scientific methods, randomly controlled trials (RCT), quasi-experimental design and single-subject which are credited as being able to draw a causality between independent and dependent variables. Then, the criteria for conducting each method are introduced to ensure the quality of applying these methods. On the other hand, this practice may draw little reflectivity on the restraint of scientific methods and unwittingly underestimate the contribution of qualitative research over the past decades in understanding and solving educational issues.

First, research questions are classified into differential levels, i.e., description, correlation, causation and prediction, and accordingly, specific methodologies are deliberately assigned to them (Cook & Cook, 2011; Horner et al., 2005). RCT, quasi-experimental design and single-subject are regarded as a priority in the sequence which is followed by multiple variable methods and is used to figure out significant factors among variables. On the other hand, the qualitative method, such as a structured interview, is only suitable to answer 'what' problems or serves as a preliminary quest on possible factors influencing an unexplored phenomenon.

Next, the standards are developed to guarantee the rigour of experimental designs. Four determinants are defined to ensure EBPs: appropriate research methods, high-quality research, more than one similar study, and statistical effect size (Cook & Cook, 2011; Cook et al., 2014). When researchers apply appropriate methods, RCT, quasi-experimental design or even single-subject design, they are required to abide by the procedures specified in a composite of indicators (Cook & Odom, 2013; Horner et al., 2005). In addition, more than one similar research result is mandated for assuring the validity of an EBP. Finally, the relevant studies are synthesised to examine the adequateness of effect size which could make sure that there are substantial changes on students' outcomes rather than merely exhibit a statistical significance (Gersten et al., 2005; Horner et al., 2005; What Works Clearinghouse, 2017).

In this practice, the promises of scientific designs might be exaggerated, while their limitations might be overlooked (Gallagher, 1998, 2001). Since data are calibrated within the acceptable probability of type-1 error (take truth as false; e.g., 5%), it is argued that an argument is validated. Although a researcher could ascribe misfit data to a probability and still argue for the validity of expected hypothesis, this separates educational research from natural science. For example, when scientists prove the existence of gravitational waves, they will always observe them with appropriate equipment considering the equipment functions properly. It is invalid to state that with 95% confidence level gravitational waves did exist, whereas the opposite result would be with 5% chance.

Furthermore, the difficulty is profoundly related to random sampling and random assignment on which the validity of RCT rests (Hosteller & Boruch, 2001). Both techniques are believed for researchers to exclude the interferences of irrelevant variables on the experimental effects (e.g., reading scores) and ascribe the effects to the manipulated variable, such as the disability category or instruction strategy. Nonetheless, random selection and assignment alike are extremely difficult if not impractical in educational settings. For example, speech pathological problems of children who experience communication problems occur prior to being recruited. In this case, a researcher is really unable to exclude the contextual interference, such as parenting and sibling interaction. In fact, the mere use of quasi-experimental or single-subject design somewhat reflects the difficulty to practice a RCT, and inevitably, researchers are urged to concede to less rigorous methods.

According to Foucault, all individuals' thinking and behaviours are normalised to accept and follow certain social rules. Through professional power, researchers are confined to a normalizing gaze which offers the ways to understand what phenomenon should be a question, how a question should be asked, how must it be sought, and how should it be interpreted (Gutting & Oksala, 2019). Researchers in special education are likely accustomed to seeing certain theories, paradigms, methodologies as superior or vice versa. One example is that evidence-based (EB) medical field does not include quasi-experiments or single-subject design (see Mullen & Streiner, 2004), but both methods are emphasised in special education. This is not to argue that all disciplinary knowledge and traditions are harmful or should be rooted out thoroughly, but rather, with being aware of it, people can act or respond to the world more autonomously and with an open mind (Gutting & Oksala, 2019).

Further, the contribution and updated development over the past decades have not been fairly discussed. It is not the intent of this article to argue for thoroughly relinquishing scientific methods or argue for nihilism, but rather, we do argue that researchers in the discipline of special education should acknowledge the advantages and restraints of scientific research. In the light of this, multiple or competing methods would benefit from the development of knowledge in special education. Russo-Campisi (2017) indicated that current research practice of

EBP somewhat underestimated the achievements of qualitative research. Wu, Salim and Chano (2019) advocated for embracing multiple methodologies, such as critical race theory, narrative study, and emancipatory research, to counter the dominance of conventional deficit-oriented research practices and the mainstreaming voices of abled individuals. As Braun and Clarke (2013) and Yin (2014) noted, qualitative research could transcend to figure out cause–effect explanations rather than merely being suitable for understanding 'what' questions.

4. Complexity of Practical Judgements

The research focus of EBP over the past years has shifted from figuring out effective educational strategies to exploring the barriers for practicing them. Also, it is established that teachers play a decisive role in the success of practicing EBPs (Russo-Campisi, 2017). The aim of these studies is to facilitate teachers to deliver EBPs with accuracy so that the educational outcomes of students with special educational needs (SEN) would be guaranteed. This orientation plays down teachers' expertise and exhibits differently in EBP medical or psychotherapy fields in which the focus is to reconcile practitioners' practical judgement and effective interventions (Berg, 2019, 2020; Mullen & Streiner, 2004).

An underlying mechanical viewpoint on teaching and learning is obvious in EBPs. That is, it attempts to standardise teaching practice as equivalent to an algebra formula: 'if x, then y'. (Mullen & Streine, 2004). First, a bunch of efficient strategies suitable for students experiencing specific difficulties under a given disability category are sought. Then, students' difficulties are identified in terms of academic, behavioural or social emotional performances. Accordingly, the plausible strategies are prescribed and implemented for each student. Finally, the learning outcomes are monitored or evaluated. Nonetheless, the standardised process underestimates the complexity and variation of teaching practice (Russo-Campisi, 2017).

A call for practitioners to simultaneously consider the tripartite factors, context, clients and evidence has been made extensively across literature in the fields of medicine (Haynes, 2002) and psychotherapy (Berg, 2020; Berg & Slaattelid, 2017; Mullen & Streiner, 2004). Their discussions are instructive in special educational enterprise. For example, Haynes asserted that a medical practitioner invariably relies on practical expertise by which comprehensive evaluation was made before mapping out a treatment programme. It is impractical to expect practitioners to follow the so-called best practices without any compromise (e.g., ignoring a patient's preference or resources). Likewise, Berg proclaimed that tripartite factors, plausible interventions and patients' expectations, preferences and personalities should be taken into account altogether while practising a psychotherapeutic intervention (Berg, 2019, 2020).

On the other hand, the ambiguous boundary between fidelity and flexibility could lead EBPs' arguments to be self-evident. On the one hand, teachers are required to deliver an effective strategy with fidelity, while on the other hand, teachers are supposed to adjust students' individual needs as '[n]o practice will work for every single student' (Cook & Odom, 2013, p. 135). In a sense, fidelity or inflexibility could always be blamed for failing to live up to expected outcomes. Consequently, several questions are still unclear: When should a teacher adjust the EBP or try another one; what criteria justify those decisions; how and why should a teacher adjust to the EBP while still conforming to the fidelity (Russo-Campisi, 2017).

5. Illuminating Research and Teaching Practices

The previous discussions shed light on the directions for doing research and implementing instruction of students with disabilities. First, social science should transcend post/positivism and the method of reductionism as well as statistics, and then further recognise potential contributions from alternative methodologies (Indick, 2002). Nowadays, even hard science (e.g., physics) is more open to alternative ontological, epistemological and methodological diversities. Given scientific research in education is further complicated with its subjectiveness to contextual variations and statistical probability, potential variations and inclusiveness of study results are supposed to be natural. Therefore, engaging various philosophies (e.g., critical theory or postmodernism) into researching EBPs could contribute to adding them with new elements on the aims, scopes, threads and methodologies.

Moreover, alternative methods may be beneficial to investigate factors beyond learners' and instructors' levels (Haug, 2010); unravel the complex relationships amongst race, sex and disability (Annamma et al., 2018) and counter sociocultural issues (Smith-Chandler & Swart, 2014) to enhance the welfare of people with disabilities. Therefore, researchers need to recognise the limitations of RCT, quasi-experimental design and single-subject design so that the research aim, scope and methods could be broadened.

Finally, in dealing with students' learning needs, the problem-solving approach is more appropriate instead of mechanising instruction because it may largely compromise students' individuality and teachers' creativity. Ideally, teachers are supposed to resort to a variety of sources, such as teachers' self-reflection, students'

self-reports, and other teachers' experiences to gain insights into solving or leveraging it with a consideration of contextual factors and a learner's characteristics. This must take into account the students' motivation, preferences, schools' policies, resources, class routines and even educational regulations rather than strictly following EBPs.

6. Conclusion

This article challenges the intention of EBPs' advocates to resort to scientific methods and standardize the educational process to ensure the quality of special education. Arguably, it is difficult to establish an educational formula as in natural science: if x, then y, that is, if 'specific disability category, severity, or features', then 'certain teaching strategies'. Wittingly or unwittingly, this utopian belief may neglect the diversity of science concepts and, meanwhile, show supremacy over alternative research—generally qualitative methods. Actually, science has never been a singular idea in terms of ontology, epistemology and methodology, rather it can be debatable (e.g., falsification vs. verification) or contradictory (e.g., deduction or reduction), thereby seeking a hierarchic framework and privileging particular methods (e.g., RTC or quasi-experimental design). Therefore, a decision model taking into learner's factors (e.g., preference or motivation), contextual reality and professional expertise could be more feasible to satisfy the learning of students with disabilities.

Competing Interests Statement

The authors have read and approved the manuscript and take full responsibility for its contents. The authors have declared that no competing interest exists.

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