THE INTERRELATIONSHIP OF LANGUAGE AND THE BRAIN AND LANGUAGE DISORDERS IN AUGMENTATIVE AND ALTERNATIVE COMMUNICATION (AAC): FINDINGS FROM A SYSTEMATIC REVIEW OF THE LITERATURE

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Abstract

This study presents a systematic literature review focusing on the Interrelationship of Language and the Brain and Language Disorders in Augmentative and Alternative Communication (AAC) based on a number of published researches in several refereed international journals available in various online databases. A repertory grid was utilized to plot the responses to the research questions posted. The data on the grid were analyzed to be able to identify the various gaps in the researches conducted. Consequently, this study yields the following concepts: the Role of Assistive Technology and Mediation, Interventions in AAC, and Focus on AAC Outcomes. It is concluded that these concepts should form part of the compendia to be used by language teachers, especially those specializing in psycholinguistics and AAC. Finally, the paper presents suggestions for further research into AAC and psycholinguistics per se.

Keywords

Augmentative and Alternative Communication, Assistive Technology, psycholinguistics, language, communication, mediation, interventions, learning outcomes

1. Introduction

Psycholinguistics is a cross-disciplinary field which links psychology and linguistics. It focuses on the core processes and skills concerning the production, comprehension, and acquisition of language. Simply put, psycholinguistics or psychology of language is the study of the interrelation between linguistic factors and psychological aspects (Jackendoff, 2002; Aitchison, 2007; Jodai, 2011). Jodai (2011) cited Harely (2005) stating that the main subject of research in psycholinguistics is the study of cognitive processes that underlie the comprehension and production of language, and the way the cultural environment interact with these two. Bates, et al. (1995) added that the other significance of studying psycholinguistics is that it uncovers universal processes that govern the development, use, and breakdowns of language. Hence, psycholinguistics is where experts try to design theories and models to describe and envisage particular linguistic behavior.

Treiman, et al. (2003) explained that psychologists have long been interested in language, but psycholinguistics as a field of study did not emerge until the 1960s. It was Chomsky who spearheaded it when he focused on the productivity aspect of language. Chomsky claimed that the special properties of language require special mechanisms to handle it (Treiman, et al., 2003).

The occurrence of language disorders among learners brings into light a challenge in language education. The study of Tesink, et al. (2011) shows that in individuals with Autism Spectrum Disorders (ASD), difficulties with language comprehension are most evident when higher-level semantic-pragmatic language processing is required, for instance when context has to be used to interpret the meaning of an utterance. Until now, it is unclear at what level of processing and for what type of context these difficulties in language comprehension occur. Meanwhile, Dugan (2014) underscored that schizophrenia is a complex mental disorder that results in language-related symptoms at various discourse levels, ranging from semantics (e.g. inventing words and producing nonsensical strands of similar-sounding words) to pragmatics and higher-level functioning (e.g. too little or too much information given to interlocutors, and tangential discourse). Dugan (2014) added that most of the literature concerning people with schizophrenia who acquire a second or foreign language suggests that these linguistic deficits are not as prominent (in some instances, altogether absent) when patients use their non-dominant language, a phenomenon that has been used to support different claims posited by psychologists

and linguists about schizophrenia and second language learning alike. These research findings just prove that the brain and language function inseparably.

Meanwhile, the American Speech-Language-Hearing Association (ASHA) defines Augmentative and Alternative Communication (AAC) as a term that encompasses all forms of verbal and non-verbal communication that are used to express thoughts, needs, wants, and ideas. However, people with language problems rely on AAC to enhance existing speech, or replace speech that is not functional. Special augmentative aids, such as picture and symbol communication boards and electronic devices, are available to help people express themselves. These may increase social interaction, school performance, and feelings of self-worth. The AAC aids and devices are used to enhance their communication (Millar, 2006).

In this literature review, the researcher presents the different interrelated concepts on language and the brain and language disorders in AAC based on a number of published online refereed journals in online databases.

Considering the productivity of researches conducted on Language and the Brain, Language Disorders and Augmentative and Alternative Communication, none of these were conducted with the aim to present a holistic view on the concepts that cover all these three topics. Hence, this study is aimed at conducting systematic literature review to be able to identify any gaps in current researches on Language and the Brain and Language Disorders in Augmentative and AAC in order to suggest areas for further investigation and to provide a framework in order to appropriately position new research activities about it.

2. Method

This study employed a systematic review of the literature method. A systematic literature review, often referred to as a systematic review, is a means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest. Individual studies contributing to a systematic review are called *primary* studies; a systematic review is a form of *secondary* study (Kitchenham, 2007).

To be able to meet the aims of this study, the search of multiple databases to locate every study on Language and the Brain and Language Disorders in AAC was the first step done. The search process was based on the eligibility criteria that were established before the process of identifying, locating, and retrieving the research needed to address the problem of evidence-

based practice started. The eligibility criteria specified which studies will be included and which will be excluded from the systematic review— though the criteria were subjected to possible changes as the systematic review progressed through the early stages of the process, some of the criteria were fundamental to collecting a rigorous and defensible set of data for the review (Meline, 2006). At the outset, studies were excluded if they clearly meet one or more of the exclusion criteria.

Using critical evaluation approach that aims to include studies that meet some high methodological standard of quality (Slavins, 1987 cited by Meline, 2006), the inclusion criteria were not too broad and not to strict. Lam and Kennedy (2005) stated that if the inclusion criteria are too broad, poor quality studies may be included, lowering the confidence in the final result. If the criteria are too strict, the results are based on fewer studies and may not be generalizable. Hence, the specific inclusion and exclusion criteria were identified by the researcher in the process of retrieving the available data from the databases.

Using available databases, 8 scientific papers which met the following initial inclusion and exclusion criteria were used by the researcher in this study:

Table 2.1: *Inclusion-Exclusion Criteria*

Parameters	Inclusion Criteria	Exclusion Criteria
Type of research	Primary research published in peer reviewed journals and scientific papers	Book reviews, opinion pieces, literary reviews, policy documents
Results of the study	Research articles or scientific papers that dealt with language and the brain and augmentative and alternative communication in language education	Research articles or scientific papers that did not have augmentative and alternative communication in language education as the research area
Language	Research articles or scientific papers that made use of English as a medium of writing	Research articles or scientific papers that did not make use of English as a medium of writing
Database	Google scholar, EBSCO, ERIC, Proquest, DOAJ, Scopus and other databases accessible to the researcher	Databases not accessible to the researcher
Time frame	Research articles or scientific papers on Language and the Brain and Augmentative and Alternative Communication (AAC) published from 2000 to 2015	Research articles or scientific papers on Language and the Brain and Augmentative and Alternative Communication (AAC) not published from 2000 to 2015

After ensuring that the research articles meet the above cited criteria, the quality of the papers were further evaluated for the selection of the final papers to be included in the review identified. At this phase, the criteria used in evaluating a scientific paper were considered.

3. Research Questions

To be able to achieve the aim of this study, research questions were crafted as one of the most important parts of the systematic review. The questions that were targeted in the study are: What is the paper all about? What was wrong with the current state of knowledge that rationalized the conduct of the study? Why? What was/were the objective/s of the study? What did the study do to address the current state of knowledge/problem? How was the study conducted? What were the findings of the study? What do the findings mean? What were the conclusions drawn from the study?

4. Treatment of the data

A repertory grid was utilized to plot the responses to the research questions posted. The data on the grid were analyzed to be able to identify the gaps in the researches that were conducted. Eventually, these gaps were thematically analyzed and were coded according to areas of concerns.

5. Findings

Recent studies that were subjected to analysis in this paper found various concepts interrelating Language and the Brain and Language Disorders in AAC. The qualitative analysis gave rise to three (3) trends in the interrelationship of language and the brain and language disorders in AAC, namely: (1) The Role of Assistive Technology and Mediation, (2) Interventions in AAC, and (3) Focus on AAC Outcomes.

5.1 The Role of Assistive Technology and Mediation

Technology has advanced that it becomes impossible for learners not to be engrossed with it. Since it has a great influence on the young people's minds in their acquisition for knowledge at the tip of their fingers, it already found its place in pedagogical aspect.

With today's technological trends, teachers must have sufficient computer skills to guide students in the use of computers and other technologies in their classrooms (Fain, 2013). Liton (2012) recommends that classes should be facilitated with the use of technological instruments as

a part of practical exposure to reduce the learners' lack of motivation and to heighten their interest and latent desire to immerse in language learning. Furthermore, the study of Prameswari, et al. (2017) revealed that equating parent's perception with children's hobby, due to the children's interest to the application as a new media in learning, can provide learning motivation and self-development for children.

In particular, the study of Ferreira, et al. (2013) showed that the three digital games that were developed for the children enabled the occurrence of communication among children with Cerebral Palsy. These digital games favored non-speaking children with Cerebral Palsy with the use of different forms of communication such as, body and facial expressions, vocalizations and gestures. The movement of hands and feet, the spark in the eyes and the smiles of the children expressed their curiosity, enthusiasm, and motivation about the possibility of using the device and the games installed on it, hence, a proof that AT can contribute to the education and increase of communication of nonspeaking children. The results also suggested the importance of assistive technology for communicative, social inclusion and improved quality of life, enabling people with Cerebral Palsy access to computer and other devices that promote their interaction with people, and the possibility of using such resources as educational procedures and promoting the development of those children (Ferreira, et al., 2013). In connection, Rasid and Nonis (2015) found out that the use of Information Communication Technology (ICT) helped the participants with Cerebral Palsy in their learning and socialization. It also suggested that navigating through the various social media sites and mobile applications establishes a high ability to communicate online. This coupled with the desire to communicate ensures that the participant can independently communicate with others.

Akpan and Beard (2013) posit that AT helps students with special needs develop independent thinking skills, maintain self-reliance, increase autonomy, develop problem-solving skills, facilitate a sense of continuity in living conditions as much as possible, and become more actively involved in their educational activities at home, schools and communities. Moreover, AT allows teachers to reach out to all children at home, in the classroom, workplace, and community through outreach programs. AT, both high and light provide enormous potential for students with special needs to capitalize on their strengths and by bypassing, or compensate for loss of function, making the most out of their educational experiences. Furthermore, Akpan & Beard (2013) believe that AT is a means of empowerment, hope and encouragement since it

relies on hands-on minds-on active knowledge construction that provides students with special needs with "real-world" experiences. Providing all students with AT programs may be their best chance for success both inside and outside the classroom. Consequently, denying them these options may exacerbate their special needs effects. Thus, educators, parents and the community as a whole must continue to protect the welfare of students with special needs and persist to act as strong advocates for equitable distribution of AT resources to people with special needs.

According to the Cultivation Analysis, most people get much of their information in a mediated fashion rather than through direct experience. Thus, mediated sources can shape people's sense of reality (McGraw-Hill Companies, Inc., 2001). Ferreira, et al. (2013) highlighted mediation as an important aspect in the development of activities with games and in the use of digital equipment, stating that the use of mediation enabled the child to express the various forms of communication. In their study, children with Cerebral Palsy showed the greatest frequency of communication with the Food Safety game, which is part of the children's daily routine. The same study showed that the communication category that was most frequently utilized (vocal and non-verbal) suggests that treatments in this area of Alternative Communication should explore the various ways a child can express himself with their environment. Another study shows that students with disabilities can be taught to use Computer-Based Video Instruction (CBVI) to independently order at fast food restaurants with an AAC device. Prior to intervention, the participants appeared to be aware of their lack of communicative competence and relied on adult partners to verbally communicate their food requests and to answer cashier questions. The authors discuss their results as support for this approach, which would be one solution for providing instruction in a simulated environment when community-based instruction is limited (Mechling & Cronin, 2006). Indeed, technological resources can provide recreational opportunities and can help in mediating between the child and the real world.

5.2 Interventions in Augmentative and Alternative Communication

The study of Pinto, et al. (2009) demonstrates the link between current research-based intervention strategies and practice that increase communication skills for students with severe disabilities. In this study, it was found out that children with severe disabilities can learn to communicate by engaging in a variety of communication methods. The current trend to include students with severe disabilities in general education classrooms with their peers has shown

positive affect to all students.   In contrast, the same study also identified several general gaps in building AAC skills in beginning communicator with severe disabilities such as: little reporting of generalization and maintenance of outcomes, infrequent involvement of teachers and parents, infrequent measurement of partner behavior, poor reporting of treatment integrity, and contexts that less often included general education and non-disabled peers.   Another gap is because researchers typically have combined intervention strategies, the effectiveness of isolated procedures is less clear (Pinto, et al., 2009).

Hence, Taibo, et al. (2009) stressed that when attending people with complex and special communication needs, working memory span should be trained, and phonological skills should also be programmed in the intervention or educational programs. Memory has been involved in the recognition of a much greater amount of orthographic patterns and in the reading of a greater amount of visual vocabulary. Besides, conventional orthography allows communication without any restriction. If we want people with complex communication needs to communicate using AAC devices based on traditional orthography, we should plan the practice of phonological skills in order to teach spelling skills later.

In connection, Malik and Manaf (2015) pointed out that the special education curriculum may play very vital role in the adjustment of physically handicapped children in society but there is still lack of resources, infrastructure, and teacher trainings that involve parents in education and rehabilitation program. There is also some lack in the awareness about the importance of social adjustment of physically handicapped children in the society. Given this, the academic sector should also be able to bravely adjust and adapt to the changing needs of all kinds of students. Parents and teachers must cooperate in finding on the most effective and efficient communication intervention strategies that would promote and enhance their child's potentials and abilities to communicate. Future researchers must continue to investigate which acquired skills generalize and are maintained for children with severe disabilities.

Moreover, knowledge and familiarization on the concept of AAC should also be emphasized. In the study of Subihi (2013), it was stressed that there is an urgent need to conduct studies supported by governmental and non-governmental bodies based on clear categorization basis to reach accurate statistics on the prevalence rates of disability, types of disabilities, especially communicative ones, and the different needs resulting from them which will help in determining the size and sort of the required services. It was also underscored that there is still

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need for conducting other studies to assess how disability acts and regulations in the Arab countries and their amendments are compatible to the international acts and conventions concerning the communication rights of persons with disabilities, and to what extent have the Arab countries succeeded in raising the awareness about such acts and regulations as being an abiding force which guarantees the different rights of the persons with disabilities, particularly their right to communicate (Subihi, 2013). Hence, it was recommended that future studies should focus on several research areas, some of which are directly related to the results of the current study and some respond to what is referred to by the educational literature as impediments of the AAC technology activation in the Arab countries.

Nunes (2008) reiterated that despite the gaps identified in this discussion, many positive changes have occurred in these last decades. However, Nunes (2008) believed that the most important is the fact that researchers and clinicians stopped viewing language as being equivalent to speech, and that investigations have expanded the focus of language intervention programs from speech training to the use of non-verbal systems, such sign language or visual-graphic strategies. The adoption of non-verbal systems for individuals who are unable to speak, but motorically and cognitively competent also suggests that interventionists are focusing on enhancing skills that individuals with disabilities have, rather than centering on what this population is incapable of doing.

5.3 Focus on Augmentative and Alternative Communication Outcomes

Becoming well-acquainted and supportive to AAC practices provides an avenue for individuals to measure and evaluate the outcomes of rehabilitation services and the use of the AT. The study of Hill (2006) focused on Brent, a person with Cerebral Palsy. After he was shown video clips of individuals using AAC systems, Brent shared that he had never met another person using a device. The team conducting his previous evaluation had never performed an assessment for an AAC system. During separate conversations, Brent and his mother both related that they had no idea that persons with disabilities like Brent were communicating so effectively and fast using a voice output AAC system. They also shared that they were surprised at the number of individuals using high performance AAC systems similar to Brent or with even more significant challenges.

Creech (1995), as cited by Hill (2006), stated that individuals who rely on AAC believe that the fundamental, desired AAC outcome of independent communication can be achieved

with appropriate technology and appropriate long-term, often intensive intervention strategies. Systematic documentation of case studies reporting performance and outcomes data will contribute to the evidence base that practitioners need for decision-making. Quality of life can be dramatically enhanced when AAC teams desire the most effective, independent communication possible for an individual with significant communication disabilities. By providing a systematic framework and opportunity to compare AAC systems using evidence (research and quantitative data), the AAC team can ensure that resources are used most effectively and efficiently to achieve the best results. As in the case example, recommendations were based on quantified evidence and not impressions of effectiveness. AAC team members, families, and augmented communicators can feel secure that the client's benefits are placed first when evidence is used judiciously and conscientiously within an organized framework (Hill, 2006).

6. Conclusion

Learning how to communicate effectively is definitely a challenge especially for learners with special needs. For them, communication competence is an essential component to be productive and independent individuals in the society. However, these learners are cognizant of the positive impact of psycholinguistics and AAC in their careers. Hence, beyond learning the basics, they aspire to be confident communicators not only for extrinsic, but for intrinsic reasons as well. They value tools, techniques and technology that can help them overcome their fear and shortcomings in communicating. Thus, educators, institutions, government agencies and the private sector must prioritize meeting the special needs of every learner for the latter to succeed not only academically but holistically.

On the other hand, language teachers should not be frustrated if they do not achieve desired results in an instant. Rather, language teachers should be more realistic in terms of their expectations from the learners since the nature of the learners and various environmental, psychological, and socio-cultural factors can affect the learning process. If the language teachers understand how the learners acquire new languages, they will be in a better position to design or adapt various instructional practices and assessment tools to enable their students to become successful language learners.

Overall, the findings of this review can serve as aid for the language teachers in empowering their learners and the latter's communication skills. The continued study of

language, AAC, and psycholinguistics per se promises to reveal the precise nature of the relationship between language and mind. The quest for a richer and a more meaningful means of communication in our society should never end.

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