

## Assistive Technology for Students with Disabilities: A Review of History, Theories, Regulation, and Practices

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### Abstract

*The history of AT, starting in the late 1970s, is clarified by this overview of the literature. Regulations are analyzed and discussed including: the Act of Rehabilitation issued in 1973, the 1975's Act entitled as Education for All Handicapped Children of, the 1988's Act of Tech, and IDEIA regulation made in 2004 which enable the employing assistive technology among people with disabilities. A thorough discussion of theories relating deploying assistive technology is also provided in this paper. The following frameworks are discussed in his manuscript: the framework of innovations diffusion; the framework of technology acceptance model (TAM); the framework of Education Tech Points Model; the last theory to be discussed in the present paper has to do with the framework of Technological Pedagogical and Content Knowledge (TPACK). Further, assistive technology forms which students with disabilities can employ are presented and discussed. Finally, Universal Design for Learning (UDL) is examined in the context of those students' needs.*

**Keywords:** *Assistive technology, theories, regulation, practices, review, students with disabilities.*

### Introduction

Assistive technology devices were not commonly and formally used in classrooms when the first special education law was created in the seventies to serve kids with disabilities (Hager, 1999). Employing assistive technology was not a big concern on the grounds that the main objective was to educate students with disabilities (Day & Huefner, 2003). The majority of the tools were not always accessible (Hager, 1999). This legislation's main benefit was the ability to merge students who are with and without disabilities in the same classes (Day & Huefner, 2003), which allowed them to access a variety of services and privileges. Following this, the US Congress passed the Act of Technology Related Assistance for Individuals with Disabilities (PL. 100-407) in 1988 to enhance and finance employing assistive technology for the benefit of students with disabilities (Dyal, Cappenter, & Wright, 2009).

States are needed to assist schools in ensuring that all disabled students receive the same opportunities of accessing assistive technology tools in their schools in accordance with a number of regulations. These regulations include: the Individuals with Disabilities Education Act (IDEA) which is issued in the year 2004; the second regulation is the Assistive Technology Act issued in the year 2004 as well; and the third and last regulation is the Act of 1988 entitled as Technology Related Assistance for Individuals with Disabilities. Furthermore, various federal laws, such as the regulations 504 and 508 found in the Rehabilitation Act of 1973 (a 1998 amendment), incorporate support for assistive

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technology in their provisions (Day & Huefner, 2003). Another federal law that encourages the adoption of assistive technology is the Americans with Disabilities Act passed in 2000 (Day & Huefner, 2003). In a nutshell, this legislation was mainly meant to guarantee that learners with disabilities can make use of assistive technology equipment and facilities inside their classrooms.

Consequently, for the benefit of students with disabilities attending schools in the 1990s, assistive technology tools and services including computers and some communication devices were widely used (Blackhurst, 1997). There are many different assistive technology services and devices available among the many different forms of technology utilized in schools to accommodate the demands of students with impairments. In order to assist students with disabilities and make them gain more independence, the number of assistive technology devices and services is now fast growing (Mechling, 2011; Wong & Law, 2016).

Legislation and increased usage of technology are two variables that have a significant impact on the increasing interest in assistive technology in the domain of special education (Lee & Templeton, 2008). The fact that academics and educators are giving assistive technology more attention is another factor contributing to the rise in using assistive technology tools and facilities in the domain of special education (Weber & Demchak, 1996). The usage of assistive technology in schools has also been influenced by federal legislation (Weber & Demchak, 1996).

#### Governing the deployment of Assistive Technology

A number of pieces of legislation, such as the Rehabilitation Act passed in the year 1973, the Education for All Handicapped Children Act passed in 1975, the Tech Act passed in 1988, and IDEA passed in 2004, have long supported the use of assistive technology in the United States. These rules make certain that people with disabilities receive the assistive technology they require. The requirement for assistive technology in the lives of those with disabilities was also included by the Rehabilitation Act of 1973. According to part NO. 504 of this law, learners with disabilities must be able to use school facilities in order to use educational resources (Caverly & Fitzgibbons, 2007). The U.S. Department of Education has pledged to guarantee that its services are accessible to people with disabilities according to the Rehabilitation Act issued in 1973, especially parts No. 504 and 508.

Additionally, the Rehabilitation Act guaranteed that learners with disabilities have the freedom to study the content in educational settings and make use of assistive technology equipment and services (Lewis & Doorlag, 2003). Education for All Handicapped Children Act had been issued in the year 1975. Significant areas of the requirements of people with disabilities, especially assistive technology, were addressed by this Act. According to the Act, employing assistive technology is important in the settings of public education. Therefore, the majority of learners with disabilities were not previously satisfied with their educational requirements (Rehabilitation Research and Design & Disability Center, 2004).

Based on the Amendments made on The Education of the Handicapped Act in 1986, funding became totally available to the use of assistive technology by students who have disabilities in order to increase access to educational programs. The Amendments of 1986 made to the Rehabilitation Act were issued in the same year, allowing impaired students to have equitable opportunities of accessing computers and other AT tools (The Center for an Accessible Society). More information on technology access was provided in the amendments made on the Rehabilitation Act in 1998, which also mandated ability to use cutting-edge tools (The Center for an Accessible Society & Rehabilitation Research and Design and Disability Center, 2004)

In 1988, rules concerning assistive technology were signed into law. One of the most significant and beneficial laws was the Tech Act which granted disabled students an easy access to assistive technology tools inside their schools (Bryant et al., 1998). Rehabilitation

Research and Design and Disability Center issued in 2004 stated that this legislation was the first which is specifically related to assistive technology. It was referred to as the first federal legislation of assistive technology by Marino et al. (2006).

More significantly, the Tech Act provided the first official definition of assistive technology services and devices (Jacobsen, 2012). The definitions supplied by the Tech Act were later utilized in laws that incorporated assistive technology. The provision of assistive technology tools and financial support for training for those who have disabilities were two of the Act's goals (Dyal, Carpenter, & Wright, 2009). Another goal, according to Behrmann and Jerome (2002), was to guarantee that all people with disabilities and their relatives were allowed to use assistive technology tools. However, neither the delivery of assistive technology services and devices nor the qualifications of service providers were governed by the Act. Instead, it put more of an emphasis on supporting the training initiatives (Jacobsen, 2012).

Another piece of assistive technology-related legislation was passed in 1990. In its sections II and IV, the Americans with Disabilities Act improved the accessibility of a number of services related to transportation and telecommunication for people who suffer a form of disability (Lissner, 1995). Furthermore, according to Merbler, Hadadian, & Ulman (1999), the rules of Individuals with Disabilities Education Act, issued in 1990, mandated that schools offer the required assistive technology and guaranteed that people with disabilities get a free, suitable public education.

#### The Diffusion of Innovation

An example on the philosophical theories which offers a thorough perspective for using assistive technology in educational institutions serves as the foundation for this investigation. Rogers first proposed the diffusion of innovations idea in the year 1962 (Rogers, 2003). Based on Rogers' definition of innovation under this theory, it is "an idea, practice, or object that is perceived as new by an individual or another unit of adoption" (p. 12). As Rogers argues, diffusion is "the process by which an innovation is communicated over time among the members of a social system through specific channels" (p. 5). Assistive technology is regarded as a new concept in this study. According to Rogers, "an innovation presents an individual or an organization with a new alternative or alternatives, as well as new means of solving problems" (p. 12). Different assistive technology tools may offer usable alternatives for special education instructors.

As Rogers argues, the diffusion of innovations, , is influenced by four key factors: the first factor has to do with innovations, the second factor has to do with communication channels, which he described as "the means by which messages get from one individual to another" [p. 18], the third factor has to do with time, and the fourth factor has to do with a social system, which is defined as "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (p. 23). Rogers stated, "The structure of the social system can facilitate or impede the diffusion of innovations" (p. 25), which can help us better grasp the meaning of social system in the diffusion of innovations theory. All of the teachers, administrators, and members of the Individualized Education Plan (IEP) team, such as families, learners, and everyone else interested in the development and usage of assistive technology, may have an impact on using assistive technology in the current study. The researcher in the present study investigates whether those components might be relevant to instructors' employment of assistive technology for students in the four special education schools using the theory of innovations diffusion.

#### Davis's Theory of Technology Acceptance Model (TAM)

The TAM framework has been used extensively to analyze how technology is used, particularly how well people embrace technology (Chuttur, 2009). In 1985, Davis proposed and outlined the TAM framework in his dissertation (Davis, 1985). The theory of reasoned

action (TRA) model, which was developed by Fishbein and Ajzen in 1975, served as the foundation for this framework's initial design. According to Masrom (2007), "individual behavior is driven by behavioral intention, where behavioral intention is a function of an individual's attitude toward the behavior and subjective norms surrounding the performance of the behavior" (p. 2) is the TRA's guiding principle.

According to Davis (1985), there are three primary factors considered as the main drivers of users' incentives. The first factor is perceived ease of use (PEOU), the second is perceived usefulness (PU), and the third and last is attitude toward utilizing the system—. PEOU is defined as "the degree to which an individual believes that using a particular system would be free of physical and mental effort," and perceived usefulness is defined as "the degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis, 1985, p. 26). PEOU and PU have the potential to affect users' attitudes toward using technology, and PEOU directly affects (PU) (Figure 2). External factors have the potential to affect PEOU and PU (Davis, 1985), which may restrict teachers' concerns of employing auxiliary aids in front of their pupils with impairments.

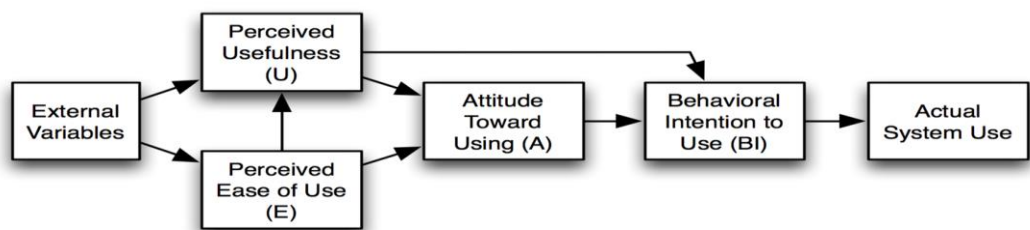


Figure 2. Tamy (Bagozzi, Davis, & Warshaw, 1989, p. 985).

There is a "intervening motivational response on the part of the user," claims Davis (1985). Specifically, "the system's characteristics influence users' motivation to use the system, which in turn influences their own actual system use or non-use" (p. 11). PEOU and PU may have an impact on teachers' decisions on the use of assistive technology. As a result, the TAM framework is used in this study to quantify the difficulties that affect instructors' decisions about and utilization of assistive technology.

#### 1) Education Tech Points Model

The education tech points model was developed by Bowser and Reed in 1995 to give teachers a framework for selecting, utilizing, and thinking critically about the best assistive technology for those with disabilities. In the referral, formulation, and evaluation phases of an IEP for a student, this assistive technology planning model is regarded as advice (Edyburn, 2001; Reed & Browser, 2012). A number of important questions are included in the education tech points framework to help with decision-making while choosing and utilizing assistive technology. The primary components are recommendation, appraisal, extended assessment, planning, application, and periodic evaluation (Bowser & Reed, 1995; Edyburn, 2006).

#### Technical educational and subject-matter expertise

The pedagogical and content knowledge (PCK), which is a technical framework developed by Lee Shulman in 1986 and 1987, served as the basis for the framework named as technology pedagogical and content knowledge (TPACK) developed by Koehler & Mishra (2009). According to the PCK framework, teachers ought to be familiar with both methodology as well as topics, what and how to present to students (Bouck, 2015). The three key components of effective technology-integrated education, according to Koehler and Mishra (2009), are pedagogy, content, and technology. In order to include technology, Koehler and Mishra (2009) decided to build on PCK.

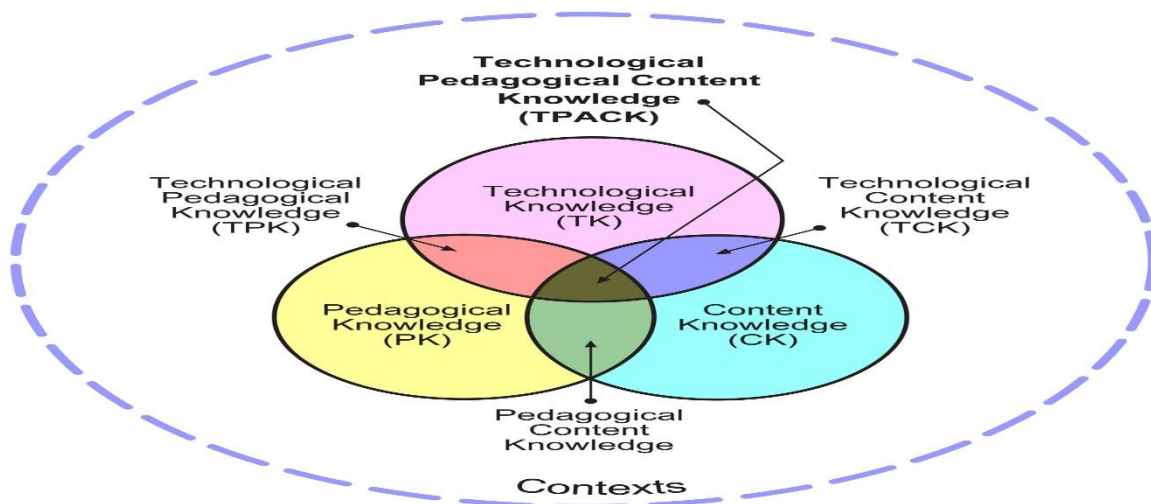


Figure 3. The TPACK model and its content parts.

In TPACK, pedagogical knowledge (PK) means instructors' in-depth knowledge of how to combine that with technology in classrooms with students who have impairments. Content knowledge (CK) refers to what instructors are aware of about the content of the course they are delivering. The TPACK framework can be used to prepare instructors as well as serve as a roadmap for teachers as they choose assistive technology products and services (Bouck, 2012).

#### Types of AT

According to researchers (e.g., Constantinescu, 2015; Ganschow, Philips, & Schneider, 2001), there exist three different forms of AT: low-tech, mid-tech, and high-tech. Sometimes, low-tech and high-tech assistive technology are the categories of assistive technology taken into account more for individuals with severe disabilities (Reichle, 2011).

#### 2) Low-tech

The non-electronic AT equipment is typically referred to as low-tech. For kids with impairments, these tools are affordable, readily available, and adaptable (Alkahtani, 2013; Constantinescu, 2015; Cook & Hussey, 2002). Additionally, because they may be adjusted to meet the unique requirements and skills of each learner, these tools are simple to use (for example, flashcards, modified seats and charts, hand-held writing boards, pen grips, sticks, and markers.). Both training and continuous maintenance are generally not necessary for these low-tech tools.

#### Mid-tech

According to Alkahtani (2013) and Constantinescu (2015), "mid-tech" refers to electronic equipment that is simple to use for students with impairments, needs little training, and requires little upkeep. Talking calculators, modified keyboards, and electronic dictionaries are a few examples of mid-tech tools.

#### 3) High-tech

According to Cook and Hussey (2002), devices related to high-tech are typically pricey and hard to come by. The usage of such complicated gadgets necessitates further training, sophisticated skills, and regular maintenance. high-tech devices include e-tablets like iPads and iPods as well as other cutting-edge gadgets.

The classifications of low-tech, mid-tech, and high-tech appear to be the more frequently used globally. These classifications are typically depending on the level of technology, pricing, and accessibility (Constantinescu, 2015). According to Cook and Hussey (2002),

"as the field advances, there will be new considerations that will further stretch our concepts and force new ways of categorizing and describing assistive technology" (p. 9). They also contend that due to the growing amount of AT devices, "yesterday's high tech is tomorrow's low tech" (Cook & Hussey, 2002, p. 9).

The best form of assistive technology to use will depend on the needs and aptitude of the pupils (Zabala, 1995). When creating the IEP, the IEP team may take the student's needs into account and take into account if the technology is available (IDEA, 1997). Families should be aware that, despite of the exorbitant cost of high-tech's gadgets, when IEP teams select appropriate assistive technology facilities for students, these assistive technology facilities ought to be supplied without charge (IDEA, 1997).

#### Universal Design for Learning and Students who are Disabled

According to the Universal Design for Learning (UDL) concept, everyone should have access to all environmental services, regardless of their skills (Mace et al., 1991). According to Rose & Meyer (2002), the title "universal design" initially originated during the 1950s. The first focus of this concept's attention was mostly on people who have particular disabilities and whether they can use buildings in Europe, Japan, and the United States (Rose & Meyer, 2002). In 1987, it had been decided by the World Design Congress that architects and design specialists ought to take people with disabilities into account when creating new structures (Adaptive Environments, 2006).

Because there are more and more sophisticated and advanced technologies and services available today, the UDL framework is becoming more crucial. In order to assist people with disabilities gain access to the resources and information they might need, UDL fills in the gaps that may prevent them from doing so. According to Zascavage and Winterman (2009), UDL helps teachers develop innovative teaching strategies in the classrooms, and assistive technology is crucial to their success. Additionally, UDL encourages participation and communication in both classroom and community contexts for students, in particular students with disabilities (Rao, Smith, & Lowrey, 2017).

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