International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Leveraging Assistive Technologies to Enhance the Learning of Diverse Learners

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Abstract

This article explores the VARK learners, their learning preferences, and assistive technologies, to providing useful insights for educators, technologists, stakeholders, and policymakers. As education increasingly shifts to digital formats, using technology to support diverse learning styles has become increasingly important. Learning styles refer to the different ways people absorb, process, and recall information. Technology enables innovative approaches to customise learning for different preferences, such as kinesthetic, visual, auditory, and reading/writing. The research focuses on how digital tools- like interactive simulations, educational software, multimedia resources, and adaptive platforms- enhance learning outcomes. Neil Fleming's VARK model classifies learners by their preferred sensory modalities: Visual, Auditory, Reading/Writing, and Kinesthetic. Understanding these preferences helps educators adapt their teaching strategies to improve learning efficiency. Recently, assistive technologies have become vital in supporting diverse learners, especially within inclusive educational environments. Combining these tools with the VARK model can boost student engagement and understanding. This article examines assistive technologies associated with each VARK style and their potential to improve educational outcomes for all learners.

Key Words: VARK learning style, Assistive technologies, Technology in education, Learning preferences.

1. Introduction

Overview of Learning Styles

The term "learning styles" describes the preferred methods or techniques people use to acquire, process, and retain knowledge. The VARK (Visual, Auditory, Reading/Writing, Kinaesthetic) framework is a well-known approach that groups students according to their preferred senses.

By recognising and addressing learners' diverse learning styles, educators can significantly enhance and motivate the learning experience. This approach not only boosts comprehension and engagement but also fosters more inclusive and supportive educational environments.

2. Role of assistive technologies in education

Assistive technologies play a pivotal role in modern education by making personalised accessibility to learning. Assistive technologies, including hardware and software, engage all learners effectively with educational content. By combining these resources, stakeholders can make learning more engaging and equitable for all students (VARK) while creating an enjoyable environment that accommodates a range of learning styles and skill levels.

3. Understanding of VARK Learners / Learning characteristics

3.1 Visual learner

Instructional content presented via charts, diagrams, infographics, and other visual aids is beneficial to visual learners. They may have trouble following only audible directions, but are good at visually processing information. For this group, the following assistive devices help improve learning: 3D models, Interactive Infographics, Multimedia presentations, etc.

Characteristics of visual learners

People who learn by observation are more likely to favour this kind of instruction. Information that is just heard may be forgotten by them; instead, they want to see directions and information. Being able to visualise helps them recall information by enabling them to perceive images and mind maps. It is in their nature to write.

Although visual learners often possess outstanding spelling skills, they can forget names. Since they prefer a less formal learning environment, they could not benefit much from a regular classroom setting. Although they are commonly structured and insightful, they may be distracted by others' movements when trying to focus. People who learn visually can comprehend complex maps, graphs, and charts and tend to be enthralled by colour. Therefore, to edit and aid memory, they might rewrite passages of text or other information in their own unique style, or employ colour coding, diagrams, and symbols.

3.2 Auditory learners

Auditory learning, or the auditory modality, describes a learner who primarily thrives on speaking and hearing during the learning process. Auditory learners mainly rely on verbal instruction, collaborative learning, and group discussion. Audio information is the most effective way for auditory learners. For those students, the way they learn might be entirely changed by assistive devices that improve the auditory learning experience.

The research was carried out by Kayalar (2017)**.** On the" effects of the auditory learning strategy on learning skills of language learners (students' view)", results show that many students prefer learning through listening rather than reading and writing, and they prefer a quiet learning environment along with the auditory devices to enhance their learning. They hope their learning will be enhanced through group discussions and collaborative learning. The teacher's role in that environment is to include more auditory elements to cater to the needs of auditory learners.

3.3 Read/write learners

Students who are learning to read and write prefer text-based resources for processing information. Interacting with text seems to be chosen for reading and writing learners. They frequently perform best in classroom settings, emphasising organised instruction and chances for writing and reading.

Characteristics of Read /Write Learners

They perform best in settings where they can read books, take notes, and engage with written material, such as digital textbooks, e-books, and online learning modules. (Setiawan, 2019**)** studied the effectiveness of mind maps and brainstorming techniques in teaching visual and read/write learners. It demonstrates that brainstorming and mind mapping can support and enhance students' writing abilities for both visual and read-write learners. It is intended that both the teacher and the students will be able to employ that strategy in teaching and learning.

3.4 Kinaesthetic learners

People who learn best by doing, moving, and interacting with others in the actual world are known as kinesthetic learners. They frequently have difficulty in conventional school environments, which are mos-

tly devoted to sedentary pursuits.

Characteristics of kinaesthetic learners.

By providing interactive simulations, virtual reality experiences, and other experiential learning materials, educational technologies can accommodate kinesthetic learners. By allowing kinesthetic learners to engage with the course materials actively, these immersive technologies can improve their comprehension and engagement.

4. Assistive technologies

4.1 Assistive technologies for visual learners

Interactive whiteboards, such as smart boards and projectors, allow instructions to be presented in dynamic ways, including animation, quiz polls, interactive quizzes, and graphical representations. These tools and technologies support visual learners by providing high-quality content.

Virtual and Augmented Reality

Virtual and augmented reality are designed to provide immersive experiences for visual learners. Tools such as **Expeditions and Nearpod Virtual Reality** allow learners to explore historical events, Scientific phenomena, and graphical locations in 3-D. Teachers can help visual learners enjoy and engage with visual content beyond traditional textbooks or images by virtually placing them in a 3-D environment.

Infographic Creation Tools

Infographic creation tools are used to create visual representations of information and to communicate it clearly and quickly in classrooms, e.g., Canvas. Ditochart. Vennage and visme.

4.2 Assistive technologies for aural learners

Speech-to-text software

Speech-to-text software tools such as **Google Docs, Bravia, Microsoft Dictate, and Gboard allow learners to convert** speech into text. The above tools are very useful for learners who are struggling with writing and want to verbalise their thoughts.

Audio Books and Podcasts

Audio Books and Podcasts are helpful for learners who want to intake information by listening. It looks like an alternative way to engage with content. The following apps and platforms are specifically designed for aural learners, including Audiobook, Overdrive, Ku Ku FM, and Leap Head. Concerning education, there are TED Talks and History Extra.

Sound amplification devices

Sound amplifiers such as (FM) Systems and hearing loops are specially designed for those who have problems hearing.

4.3 Assistive technologies for Read/Write learners.

The use of assistive technology appears to have transfer effects on reading ability and to be particularly supportive, especially for students with the most severe reading and writing difficulties. In addition, it increases motivation for overall schoolwork. (Svensson et. al.).

The text offers reading/writing learners opportunities to interact with it. Because after being in environments where we can take notes, read books, and engage with written content, they thrive. The following assistive technologies can enhance learning experiences for these students:

E-Readers and Digital Textbooks: Implications for Education in the 21st Century.

Text-based content that uses reading/writing to its advantage is available on e-readers like the Kindle or in **digital textbooks, including VitalSource.** Often, there are features on these platforms, such as

highlight, annotate, and search, that take much of the interaction with the material out of the student's hands, leaving them to rely entirely on the platform to customise how and when they interact with the material. Text size and font are also adjustable on e-readers, which can help students with visual impairments find better accessibility regardless of the gadget.

Note-Taking Apps

Evernote, Notion, and Microsoft OneNote are tools meant for note-taking and organising. Students can use these apps to type, organise, and link notes with other digital content. It is great for reading/writing learners who consolidate content into a cohesive study guide by combining different content types (PDFs, images, hyperlinks, etc.) in OneNote. This allows students to tag more easily and search for specific information.

Digital Word Processors with Integral Tools

Digital word processors (such as Google Docs and Microsoft Word) have built-in tools, including grammar checkers, citation managers, and collaborative document features. However, these tools are especially helpful for readers/writers who love to learn by doing through text-heavy assignments. The work they provide allows you to write, edit, and rewrite in real time, with 'real-time' feedback on spelling and grammar, helping you become a better writer.

Research and Online Libraries Databases

There are enormous repositories of academic articles and books available through online research databases such as Google Scholar, JSTOR, and Project MUSE, which match the reading/writing needs of learners. By providing high-quality written content for students to read and study, many students can now easily highlight, annotate, reference, and use it for research. Learners use these platforms to form their ideas and create arguments in their written assignments.

4.4 Assistive technologies for kinaesthetic learners

Best when retained through hands-on activities for kinesthetic learners. In labs, experiments, and in physical activities, they excel. For these students, movement and interactive experiences are critical.

Gesture-Based Learning Tools

With gesture-based technologies such as Microsoft Kinect or Leap Motion, learners interact with digital content through physical movements. Specifically, these tools are great for kinesthetic learners because they allow physical interaction with the learning material. One example is in the science lesson; students can use motion to play with virtual molecules or to go through virtual dissections, thereby engaging in hands-on experiences in digital space.

Interactive Simulations

Kinesthetic learners can do these interactive simulations in programs **like PhET Interactive Simulations or Explore Learning Gizmos**. These are simulations in physics, chemistry, or math in which the variables are manipulated, the results are observed, and conclusions are drawn. It helps people gain practical, hands-on experience rather than just watching.

3D Printing

During the era of 3D printing, this technology enables the creation of physical objects from designs generated by digital technologies. To design models, students can use software such as **Tinkercad or Autodesk Fusion 360** to turn their ideas into 3D models. The applications in engineering, biology, and architecture, in particular, where tactile learners build models and physically visualise their ideas, make this especially useful.

Wearable Technology

Wearable devices provide immersive learning experiences for kinesthetic learners, including **Google Glass or haptic feedback gloves.** These devices make interactions in digital environments more physical and provide real-time feedback on students' movements or actions. For example, wearable technologies could be used to simulate medical procedures in medical training, allowing learners to feel as if they are doing the procedure without risk.

5. The objective of the outline

Assistive technologies, including hardware and software, help students with different learning styles overcome barriers to achieve better results. So, in this article, I consider the importance of assistive technology and why it matters. Also, will list examples of available, accessible applications and online software systems designed specifically for VARK learners.

1. To understand VARK learning styles and the characteristics of various learners.
2. To explore how assistive technologies can enhance teaching and learning.
3. To identify assistive technologies for visual, auditory, read/write, and kinaesthetic learners.
4. Analyse how assistive technologies enhance accessibility, engagement, motivation, and academic success for diverse learners.
5. Discuss the significance of incorporating assistive technologies into inclusive education settings.

6. Methodology

The study uses a theoretical, qualitative research methodology that solely depends on secondary data sources. The study investigates how assistive technology can improve the learning experiences of diverse learners. Thus, the researcher employed peer-reviewed journals, e-journals, books, research articles, and real educational websites on learning styles, inclusive education, and assistive technologies as secondary sources from which data for the study were gathered. The study's main objective is to analyse and synthesise the body of research on a variety of assistive technologies.

7. Literature review on the role of AT in educational outcomes

Bell & Foiret (2020). Review the impact of assistive technology (AT) on the educational outcomes of college and university students with hearing impairments. Their study highlights the role of C-Print, which provides real-time captioning to improve accessibility and learning outcomes. C-Print is an example of a real-time, speech-to-text transcription system used as a support service for deaf students in mainstream classes.

Similarly, Ansari (2021) conducted the study to know the efficacy of Hearing screening programs. In order to know equal educational and learning opportunities for children with hearing impairments in school. A methodical, planned hearing screening program will enable accurate diagnosis of educationally significant hearing loss and provide appropriate intervention through amplification devices, speech-language therapy, and other educational remedial measures.

Alit etal (2025). His research has shown that technologies such as speech-to-text systems and captioning are crucial for deaf students to access auditory content. Meanwhile The use of podcasts has been shown to enhance motivation and reading engagement, particularly benefiting neurodiverse students, including those with ADHD (Jafarian & Kramer, 2024)

Similarly, Adebayo & Ayorinde.(2022) Study shows that assistive technology is necessary for equal ac-

cess in inclusive and mainstream education. Teachers and students agreed that without assistive technology, inclusive education cannot succeed. The study also reveals that regular training for both teachers and students in the use of assistive tools is essential; without such training, inclusive education may fail. Therefore, the study recommends that schools, the government, and other stakeholders support the use of assistive technology and provide ongoing training to ensure success for both teachers and students.

Khasawneh, (2023). The primary objective of this research was to investigate whether the incorporation of an infographics program into elementary school curricula affected students' overall academic achievement. A total of 40 participants, with 20 in each experimental and control group, were studied. The research findings showed that the experimental group had significantly higher post-test scores on academic achievement than the control group. Infographics improve academic achievement by making lessons clearer, more engaging, and more connected to real-world ideas. They motivate students to explore subjects more deeply and support active learning. Overall, infographics are an effective teaching tool that enhances motivation, understanding, and achievement in elementary education.

McNicholl et al. (2023) reported that assistive technology (AT) offers clear benefits for students with disabilities in higher education. When students' assistive technology needs are fully met, they experience greater academic confidence, improved well-being, and stronger engagement. AT also enhances competence, adaptability, and self-esteem.

Svensson (2021) conducted a study among 149 participants to examine the effects of Assistive technology and educational outcomes. It reveals text-to-speech and speech-to-text apps, thereby enhancing students' educational outcomes with severe reading difficulties. While both intervention and control groups improved at similar rates, AT showed positive transfer effects, especially for those with the greatest challenges. It also boosted motivation for schoolwork, though measuring text comprehension and communication remains complex.

Ahmad (2015). The study involved higher secondary students and employed a descriptive design. Its primary goal was to explore how assistive technology enhances accessibility and inclusion in classrooms, ensuring students with disabilities can participate equally in the curriculum. The study also emphasised how technology can redirect attention from limitations to these students' strengths.

8. Conclusion

In conclusion, students with a preferred learning style are more likely to enjoy learning if they are provided with a variety of instructional materials and teaching strategies such as interactive whiteboards, videos, podcasts, simulations, animation, games and accessible educational tools in the fruitful learning environment of both conventional (offline) and non-conventional (online). Leveraging assistive technologies can revolutionise the learning experience for VARK learners (Visual, Aural, Read/Write, and Kinaesthetic). With the support of technology, educators can create a personalised, inclusive, adaptive and engaging learning environment that caters to diverse learning styles.

The integration of assistive technology can help bridge the gap between traditional teaching methods and the unique learning preferences of VARK learners. By providing equal access to education, we can empower learners to reach their full potential and academic success. As we continue to navigate the rapidly evolving educational landscape, we must prioritise the development and implementation of assistive technologies that support VARK learners.

References

1 Barbe, W. B., Swassing, R. H., & Milone, M. N. (1979). Teaching through modality strengths: Concepts and practices.

2 Kayalar, F., & Kayalar, F. (2017). The effects of auditory learning strategy on learning skills of language learners (students' views). *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, *22*(10), 04–10.

3 Gilakjani, A. (2011). Visual, Auditory, and Kinaesthetic Learning Styles and Their Impacts on English Language Teaching. *Journal of Studies in Education*, *2*(1), 104. https://doi.org/10.5296/jse.v2i1.1007

4 Weganofa, R., Liskinasih, A., Herawati, S., & Rustiani, I. (2022). An analysis of Fleming's theory on VARK (visual, aural, read/write, and kinesthetic) learning style in college students. *Jurnal Ilmiah Bahasa Dan Sastra*, *9*(1), Article 1. https://doi.org/10.21067/jibs.v9i1.7148

5 Setiawan, F. (2019). The effectiveness of mind mapping and brainstorming techniques in teaching writing to visual and read-write learning style students. *4*(5).

6 Emma, L. (2024). The Use of Technology to Support Different Learning Styles.

7 Mete, J. (2024). Inclusive education*:* Need of the hour.

8 Svensson, I., Nordström, T., Lindeblad, E., Gustafson, S., Björn, M., Sand, C., ... & Nilsson, S. (2021). Effects of assistive technology for students with reading and writing disabilities. *Disability and Rehabilitation: Assistive Technology*, *16*(2), 196–208.

9 Adaptive e-learning environment based on learning styles and its impact on the development of students' engagement. (2021). *International Journal of Educational Technology in Higher Education*, *18*(1), 53. https://doi.org/10.1186/s41239-021-00289-4

10 Bell, D., & Foiret, J. (2020). A rapid review of the effect of assistive technology on the educational performance of students with impaired hearing. *Disability and Rehabilitation: Assistive Technology*, *15*(7), 838–843. https://doi.org/10.1080/17483107.2020.1775317

11 Ansari, M. S. (2021). Hearing screening program for school-going children in India: Necessity, justification, and suggested approaches. *The Egyptian Journal of Otolaryngology*, *37*(1), 1–7. https://doi.org/10.1186/s43163-021-00182-x

12 Alit, N. A., Ellias, Mohd. S. B., & Ahmad, A. (2025). Technology application in teaching and learning for deaf students: a recent systematic review. *International Journal of Education, Psychology and Counselling*, *10*(58), 541–561. https://doi.org/10.35631/ijepc.1058036

13 Castaneda, J. A., Lin, P., Hung, P. C., Zhong, H., Tseng, H., Huang, Y., & Ahmad, R. (2025). Designing inclusive tech, playful educational solutions for visually impaired learners in STEM education. *Smart Learning Environments*, *12*(1), 1–23. https://doi.org/10.1186/s40561-024-00358-x

14 Jafarian, N. R., & Kramer, A.-W. (2024). *Sonic Scholar: Auditory learning to improve student outcomes*. https://doi.org/10.31234/osf.io/ac2zq

15 Adebayo, E. O., & Ayorinde, I. T. (2022). Efficacy of assistive technology for improved teaching and learning in computer science. *International Journal of Education and Management Engineering*, *12*(5), 9–.

16 Jadallah Abed Khasawneh, Y., & Khasawneh, M. A. S. (2023). The effectiveness of using infographics on the academic achievement of elementary students. *Migration Letters*, *20*(5), 1258–1271.

17 McNicholl, A., Desmond, D., & Gallagher, P. (2023). Assistive technologies, educational engagement and psychosocial outcomes among students with disabilities in higher education. *Disability and Rehabilitation: Assistive Technology*, *18*(1), 50–58.

18 Svensson, I., Nordström, T., Lindeblad, E., Gustafson, S., Björn, M., Sand, C., ... & Nilsson, S. (2021). Effects of assistive technology for students with reading and writing disabilities. *Disability and Rehabilitation: Assistive Technology*, *16*(2), 196–208.

19 Ahmad, F. K. (2015). *Use of Assistive Technology in Inclusive Education: Making Room for Diverse Learning Needs*. *6*(2).