



## The effectiveness and validity of learning media based on IT for chemistry students with intellectual disabilities: review article

*La eficacia y validez de los medios de aprendizaje basados en TI para estudiantes con discapacidad intelectual en la asignatura de química: artículo de revisión*

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### Resumen

Este estudio tiene como objetivo determinar la validez de los medios de aprendizaje basados en TI a partir de varios estudios y la eficacia de los medios de aprendizaje basados en TI para estudiantes con discapacidad intelectual. Este estudio utiliza el método de Revisión Sistemática de Literatura (SLR) procedente de búsquedas en bases de datos en línea como SINTA. Los artículos revisados provienen del año 2015 al 2022. El número de artículos revisados es de 10 artículos según el tema utilizado. Los resultados de la revisión muestran que los medios de aprendizaje basados en TI pueden atraer la atención de los estudiantes con discapacidad intelectual, de modo que pueden aumentar la motivación de aprendizaje de los estudiantes con discapacidad intelectual y pueden facilitar que los estudiantes con discapacidad intelectual comprendan el material que se les enseña. Los estudiantes se sienten motivados por la presentación de material estructurado, imágenes, audio y videos animados que pueden existir como medios de aprendizaje. Los resultados de la validación de medios de aprendizaje basados en TI de varios estudios muestran resultados muy válidos. Esto demuestra que los medios de aprendizaje pueden ser aceptados y utilizados por estudiantes y profesores.

### Palabras clave

Medios de Aprendizaje Basados en TI, Validez, Motivación de Aprendizaje, Estudiante con Discapacidad Intelectual.

### Abstract

This study aims to determine the validity of IT-based learning media from several studies and the effectiveness of IT-based learning media for students with intellectual disabilities. This study uses the Systematic Literature Review (SLR) method originating from online database searches such as SINTA. Articles reviewed come from 2015 to 2022. The number of articles reviewed is 10 articles based on the topic used. The results of the review show that IT-based learning media can attract the attention of students with intellectual disabilities so that it can increase their learning motivation and can make it easier for them students to understand the material being taught. Additionally, students with intellectual disabilities are motivated by the presentation of structured material, through images, audio, and animated videos that can be in such learning media. The results of the validation of IT-based learning media from several studies show very valid results. This shows that the learning media can be accepted and used by students and teachers.

### Keywords

Learning Media Based On IT, Validity, Learning Motivation, Student with Intellectual Disabilities.

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## Introduction

Children with disabilities are children who experience limitations both physically, mentally, intellectually, socially, and emotionally during their growth and development. Children with disabilities have several types, including (1) Intellectual Disabilities, namely children who experience obstacles in mental development, (2) Learning Disabilities, namely children who have difficulty learning in terms of understanding or using spoken or written language, and these difficulties are seen in terms of listening, thinking, reading, writing, and spelling, (3) Attention Deficit Hyperactivity Disorder, which is a mental disorder that causes children to have difficulty paying attention, and have impulsive and hyperactive behavior, (4) *Tunalaras* (a term in Indonesian) are children who experience obstacles in regulating emotions and adjusting to the environment in which they live and their surroundings, (5) Hearing and speech disabilities can occur when children have problems in hearing and in communication, (6) Blind children experience obstacles in vision, (7) Autism is a neurodevelopmental disorder that causes behavioral and social interaction disorders, (8) Physical disability is a form of abnormality or disability in the muscle, bone, joint, and nervous system caused by disease, virus, and accidents occurring before birth, at birth or after birth, (9) Gifted children and children who have Special Talents are children who have potential or abilities above children of their age in certain fields such as intellectual, academic, artistic, and leadership (Chamidah, 2013).

Children with disabilities require special attention, especially in the field of education. Based on the Law on the Indonesian National Education System Number 20 of 2003 Article 5, Paragraph 1 reads "Every citizen has the same right to obtain quality education services". Article 11 states that the government is obliged to provide services and facilities, as well as ensure the implementation of quality education for every citizen without discrimination. Based on this article, students with intellectual disabilities are entitled to the same educational services as students in general in the form of special education. Regulation of the Minister of Education and Culture concerning Special Education Number 46 of 2014 Article 4 states that this special education is carried out inclusively. Inclusive education for children with disabilities consists of Elementary School, Junior High School, and Senior High School. Inclusive schools can support children with special needs to obtain the same education as children without disabilities.

Students with intellectual disability are divided into three classes: mild, moderate, and severe. Students with mild intellectual disability have an IQ of 50-70, so it is included in individuals with intellectual and social disorders who can thrive in academic classes, develop adequately, and require special services. The impact of intellectual conditions causes them to experience difficulties in the educational field and the need for adaptation to the surrounding environment where language, verbal, and emotional disturbances occur. Students with mild intellectual disability have almost the same level of knowledge as students aged 9 to 12 years (Maulidiyah, 2020).

Schools that implement inclusive education accept students with disabilities. One of the students with disabilities who got into the school was a student who has trouble thinking. According to Dedi Kustawan (2016), children with intellectual disabilities are children who have below average intelligence. He also said that children who suffer

from intellectual disabilities will experience problems in the academic field because it is difficult to understand the material at school (Ramirez-Tagle et al., 2022; Sari et al., 2017). Teachers who teach in schools with the implementation of inclusive education should employ specialized teaching methods. This is particularly crucial due to the presence of students with certain limitations, especially those with intellectual disabilities. However, some teachers in the class still use the same method as with students without disabilities so that the learning is not optimal. During the learning process, the students with intellectual disability have difficulty accepting and understanding the material presented by the educator. This is also because not all educators can provide special treatment to students with disabilities in overcoming learning difficulties. The lack of special learning media for students with disabilities is also one of the factors that make students experience difficulties during the learning process.

These problems can be overcome by developing appropriate learning media and, of course, attracting the attention of students with intellectual disabilities. One of the learning media that can be used is interactive learning media combined with game content. Gamification is a type of learning that uses games or video games and aims to attract students' attention in the learning process and make learning more fun (Jusuf, 2016). In gamification there are several elements, namely game thinking, game design, and game mechanics which aim to increase students' learning motivation (Darnanta et al., 2020; Nenohai et al., 2022; Widarti et al., 2022). Learning media combined with games is the right solution for students with intellectual disabilities. This is because with the concept of gamification, learning becomes more fun, students with intellectual disabilities become more focused and can maintain their concentration in the learning process during class and can increase the learning motivation of students with intellectual disabilities. Learning media with the concept of gamification can also train the cognitive and motor skills of students with intellectual disabilities (Mejia Camacho et al., 2022; Nurmanditya, 2021; Saputra & Kurniawati, 2021).

## Methods

The method used in this research is Systematic Literature Review (SLR). Systematic Literature Review (SLR) is an article review method that uses standardized rules to identify and synthesize relevant research articles and assess what is known about the topic being studied (Permatasari et al., 2022). The articles analyzed in this discussion come from online database searches such as SINTA. In this study, the keywords used were “IT-based learning media to increase students' learning motivation”, “Edugame-based learning media to increase learning motivation of students with intellectual disabilities”, and “Edugame-based learning media for students with intellectual disabilities”. After searching for these keywords on Google, the researcher reads the title of each article that appears in the search view. Then choose several articles that match the criteria set by the researcher. The criteria consist of (1) related to IT-based learning media for students with intellectual disabilities; (2) related to Edugame learning media for students with intellectual disabilities; (3) the year of publication of the article from 2015 to 2022.

## Results And Discussion

### Effectiveness of IT-Based Learning Media

The development of technology is a solution to innovate in the field of learning, especially in terms of making and developing learning media so that the learning process becomes more enjoyable. Making IT-based learning media using computer technology and its application can be done using a smartphone. IT learning media can be used to increase and direct students' attention so that it can increase student learning motivation, more direct interaction between students and their environment and students' ability to learn on their own according to their abilities. According to Hikmah and Maskar (2020), incorporating visual displays and animations into learning materials can boost students' interest in learning, it makes the material seem not boring, students are more enthusiastic in learning, and IT-based learning media is very practical because it can be used anytime and anywhere.

Based on research conducted by Permana (2019), IT-based learning media can make it easier for students with intellectual disabilities to understand the material being taught and they get motivated by the presentation of structured material, images, audio, and animated videos that can be found in these learning media. In addition, IT-based learning media can also increase the activity of students with intellectual disabilities and can improve their learning outcomes (Permana, 2019). Based on observations made by Prihati and Paramita (2016), IT-based learning media can make students more active and participate more in the learning process and students can also interact directly with learning resources to increase their learning motivation. In the use of IT-based learning media, the role of the teacher is still very much needed. Teachers must be able to arouse the interest of students with intellectual disabilities so that they want to be actively involved and participate in the learning process using IT-based learning media (Nenohai et al., 2022; Prihati & Paramita, 2016; Rizzatti & Jacaúna, 2022).

### IT-Based Learning Media Validity

In the learning process, students with intellectual disabilities require an interactive learning media that is interesting and can increase learning motivation. Learning media that can be used by students with intellectual disabilities is IT learning media. According to interviews conducted by Hikmah and Maskar (2020), students are very interested in learning by using IT-based learning media. This is because, according to them, learning activities using IT-based learning media are more intriguing than conventional learning activities. Based on research conducted by Ferawati and Saputri (2022), the results of filling out the student response questionnaire to IT-based learning media were 80% on the material aspect, 90% on the design aspect, and 86% on the use of good language. This shows that students with intellectual disability can use IT-based learning media very well in learning activities (Ferawati & Saputri, 2022). Based on this, many researchers conduct research by developing IT-based learning media to increase learning motivation for students with intellectual disabilities. The results of the validation of IT-based learning media originating from several studies can be seen in Table 1.

No	Media Name	Validation Results	Chemistry Topic	Source
1.	Learning Media Based on Three Levels of Representation using Prezi	Learning media validity has a value of 0.89 with very high validity category. This validity consists of four components, namely the components of the feasibility of content, language, presentation and visualization. The content feasibility component has an average kappa moment of 0.89 with a very high validity category, which means that the material in the three-level representation-based learning media using Prezi is in accordance with core competencies and basic competencies.	Chemical equilibrium	(Guci et al., 2017)
2.	Learning Media based on android “WINLAB” (Insights in Laboratory Learning)	The results of the analysis of the Android-based learning media validation questionnaire obtained that the total number of validators of media design experts was 51 with a maximum score of 60, so the percentage of learning media validity was 85%, meaning that Android-based learning media were in the “very valid” category. The results of the analysis of the android-based learning media validation questionnaire obtained that the total number of learning material expert validators was 63 with a maximum score of 65, so the percentage of learning media validity was 96.92%.	Introduction to chemistry laboratory equipment	(Saputra & Kurniawati, 2021)
3.	Android-Based Learning Media	Material expert validation includes aspects of material content, learning and language. The results of material validation obtained a percentage of 80% with very decent qualifications. Media expert validation includes aspects of display, presentation and programming. The results of media expert validation obtained a percentage of 80% with very decent qualifications. Practitioner validation includes aspects of cover and material content, learning aspects, linguistic aspects as well as presentation and display aspects. Based on the practitioner’s assessment, the percentage obtained is 82.22% with very decent qualifications.	Redox and electrochemical reactions	(Harianto et al., 2019)

**TABLE 1.** Results of Validation of IT-Based Learning Media from Several Researches

4.	Learning Media Based on e-magazine	The evaluation of the e-magazine by media experts got a percentage of 81.25% in the “very valid” category. And the evaluation of the e-magazine by material experts got a percentage of 91.25% in the “very valid” category.	Electrolyte and nonelectrolyte solutions	(Juliani & Refelita, 2022)
5.	Edmodo Learning Media	The results of the validation by media experts on the feasibility of the media obtained an overall score of 38 with an eligibility percentage of 86.36%. Based on the assessment of media experts, this learning media has several advantages, including in the engineering aspect software that can be easily maintained (maintainable), easy to use and simple, can be run on a variety of hardware and software. The results of the validation of the feasibility of learning materials by expert 1 and expert 2 obtained an overall score of 45 and 38, respectively, with a feasibility percentage of 93.75 and 79.17%.	Redox and compound nomenclature	(Fadloli et al., 2019)
6.	Flappy Chem Game Media	The results of the validity test got a score of more than 3 with good categories. Practicality scores get an average percentage of <85% for each goal with a very practical category. The effectiveness score can be seen through the learning outcomes of students and the level of happiness. Classical completeness achieved is 87% and the level of happiness of students is 83% with a very effective category. Based on this explanation, it can be concluded that the Flappy Chem game media has met the feasibility indicators, namely validity, practicality, and effectiveness so that it can be used as a game-based learning media.	Electron Configuration	(Nabilah & Lutfi, 2022)
7.	Poster Media	The instruments used included sheets for media validity assessment by experts and questionnaires to gauge learners’ perceptions. The results indicated that the posters met both criteria. The expert ratings for the quality of the posters achieved an eligibility percentage of 82.53%, categorized as very decent. The learners’ perceptions, overall, showed a positive response to the media posters. The range value obtained for chosen answers was 46.09%, indicating agreement.	Atomic Structure	(Rizawayani et al., 2017)



8.	Animation Video	The results of the media feasibility test by Material Expert I are 87.5% (perfect), and by Material Expert II, it is 92.5% (perfect). The Media Expert assigns a rating of 92.5% (perfect), and Media Expert II gives it 95% (good one). In the personal test aspects, it achieved a 95% rating (perfect), and in small groups, it received a 95% rating (very good). In conclusion, the media is deemed feasible for use.	Sains	(Pambudi & Arthana, 2016)
9.	Interactive Website	The validation results obtained an average percentage of media experts 82.9, which means it is perfect in media development. Material expert gave a percentage of 83.6, which means very good in the suitability of the material. Experts with intellectual disabilities gave a percentage of 80.4, meaning that it's good at matching the needs of children with intellectual disabilities.	Science	(Alawiyah & Erlani, 2022)
10.	Word Card Media (Visual )	The use of word cards as a learning medium in science for students with intellectual disabilities demonstrates a significant increase in the level of interest and ability to comprehend words related to plant structures. The percentage increase is noted to be 77.25% within the overlapping range.	Plant Structure	(Ariskayanti, 2017)

Based on several studies on IT-based learning media, the overall validity results of IT-based learning media are categorized as “very valid” and can be used by students. This learning media can be used anywhere and anytime. Even during the Covid-19 pandemic, IT-based learning media was innovative learning media that could be used by both students and teachers.

## Conclusion

Based on the results of the review of the articles carried out, it can be concluded that IT learning media can be used to attract the attention of students with intellectual disabilities so that it can increase their learning motivation; there is a more direct interaction between students and the learning media used when that students become active in learning activities. Students in the mild and moderate class of intellectual disability are still allowed to attend regular lessons like children without disabilities in general. However, students in the severe class require special treatment from teachers and parents. IT-based learning media can make it easier for students with intellectual disabilities to understand the material being taught, and it can motivate them by presenting the material in a structured manner, through pictures, audio, and animated videos contained in the learning media. Several studies' validation results of IT-based learning media show very valid results. This shows that learning media can be accepted and used by students and teachers.

## References

- Alawiyah, L., & Erlani, L. (2022). *Pengembangan Media Pembelajaran IPA Interaktif Berbasis Website bagi Anak dengan Hambatan Intelektual*. 8, 111–118. <http://journal2.um.ac.id/index.php/jo>
- Ariskayanti, A. (2017). *Efektifitas Penggunaan Media Kartu Kata dalam Pembelajaran IPA pada Anak Tunagrahita ringan Peserta Didik Kelas IV di SLB Somba Opu Kecamatan Somba Opu Kabupaten Gowa* [Doctoral dissertation]. Universitas Islam Negeri Makassar.
- Chamidah, atii N. (2013). Mengenal Anak Berkebutuhan Khusus. *Magistra*, 2(2), 1–6.
- Darnanta, I. W., Pradnyana, I. M. A., & Agustini, K. (2020). Development of mathematics interactive learning media with gamification concept for mentally disabled students. *Journal of Physics: Conference Series*, 1516(1). <https://doi.org/10.1088/1742-6596/1516/1/012043>
- Fadloli, M., Kusumo, E., & Kasmui. (2019). The Pengembangan Model Pembelajaran Blended Learning Berbasis Edmodo Untuk Pembelajaran Kimia yang Efektif. *Chemistry in Education*, 8(1), 7–12.
- Ferawati, & Saputri, F. H. (2022). Game Edukasi untuk Anak Tunagrahita Berbasis Android pada Materi Perkalian Berdasarkan Aspek Gender Equity dan Social Inclusion (GESI). *G-Tech : Jurnal Teknologi Terapan*, 6(2), 127–135.
- Guci, S. R. F., Zainul, R., & Azhar, M. (2017). Pengembangan Media Pembelajaran Berbasis Tiga Level Representasi Menggunakan Prezi Pada Materi Keseimbangan Kimia. *Prodi Pendidikan Kimia Universitas Negeri Padang, November*(November), 1–8.
- Harianto, A., Suryati, S., & Khery, Y. (2019). Pengembangan Media Pembelajaran Kimia Berbasis Android Untuk Penumbuhan Literasi Sains Siswa Pada Materi Reaksi Redoks Dan Elektrokimia. *Hydrogen: Jurnal Kependidikan Kimia*, 5(2), 35. <https://doi.org/10.33394/hjkk.v5i2.1588>
- Juliani, S., & Refelita, F. (2022). Desain dan Ujicoba Media Pembelajaran Berbasis E-Magazine dengan Pendekatan Dilemmas Stories sebagai Sumber Belajar Pada Materi Larutan Elektrolit dan Nonelektrolit. *JEDCHEM (Journal Education and Chemistry)*, 4(1), 22–28.
- Jusuf, H. (2016). Penggunaan Gamifikasi dalam Proses Pembelajaran. *Jurnal TICOM*, 5(1), 1–6.
- Maulidiyah, F. N. (2020). Media pembelajaran multimedia interaktif untuk anak tunagrahita ringan. *Jurnal Pendidikan*, 29(2), 93–100.
- Mejia Camacho, A., Santacruz, J., & Romero, J. (2022). Preconstrucción de un videojuego para análisis dimensional. *Educación Química*, 33(4), 49–64. <https://doi.org/10.22201/fq.18708404e.2022.4.0.80572>
- Nabilah, S., & Lutfi, A. (2022). Development of Flappy Chem Game Media on Electron Configuration Materials on Students' Happiness Level. *Journal of Innovation in Educational and Cultural Research*, 3(4), 634–644. <https://doi.org/10.46843/jiecr.v3i4.287>



- Nenohai, J. A., Rokhim, D. A., Agustina, N. I., & Munzil, M. (2022). Development of Gamification-Based Wordwall Game Platform on Reaction Rate Materials. *Orbital: The Electronic Journal of Chemistry*, 116–122. <https://doi.org/10.17807/orbital.v14i2.16206>
- Nurmanditya, M. I. (2021). *Gamification Design for Education in Learning Management System*. 2(3), 241–248.
- Pambudi, A., & Arthana, I. K. P. (2016). Pengembangan Media Video Pembelajaran Pada Mata Pelajaran Ilmu Pengetahuan Alam Tentang Cara Tumbuhan Membuat Makanan Untuk Siswa Tunagrahita Kelas Viii Di Slb Negeri Semarang. *Jurnal Mahasiswa Teknologi Pendidikan*.
- Permana, C. (2019). Development of audiovisual animation media of learning vocational art music for mentally disabled. *JPPi (Jurnal Penelitian Pendidikan Indonesia)*, 4(2), 122–128. <https://doi.org/10.29210/02018286>
- Permatasari, M. B., Rahayu, S., & Dasna, I. W. (2022). *Chemistry Learning Using Multiple Representations: A Systematic Literature Review*. 5(April). <https://doi.org/10.17509/jsl.v5i2.42656>
- Prihati, Y., & Paramita, P. (2016). Efektifitas Pemanfaatan Media Pembelajaran Berbasis Komputer Untuk Meningkatkan Hasil Belajar Ipa Pada Siswa Tunagrahita Ringan 1. *Jurnal Media Penelitian Pendidikan*, 10(2), 199–210.
- Ramirez-Tagle, R., Pinto, E., & Angulo, C. (2022). Plataforma interactiva para enseñanza de estequiometria y estructura de compuestos químicos, mediante el uso de impresión 3D. *Educación Química*, 33(3), 33. <https://doi.org/10.22201/fq.18708404e.2022.3.79958>
- Rizawayani, R., Sari, S. A., & Safitri, R. (2017). Pengembangan Media Poster Pada Materi Struktur Atom Di Sma Negeri 12 Banda Aceh. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, 5(1), 127–133. <https://jurnal.usk.ac.id/JPSI/article/view/8435>
- Rizzatti, I. M., & Jacaúna, R. D. P. (2022). Tecnologias assistivas e a aprendizagem significativa no ensino de química para alunos surdos. *Educación Química*, 33(3), 48. <https://doi.org/10.22201/fq.18708404e.2022.3.81151>
- Saputra, W. D., & Kurniawati, Y. (2021). Desain Media Pembelajaran Berbasis Android pada Materi Praktikum Pengenalan Alat Laboratorium Kimia Sekolah Menengah Atas. *Journal of Natural Science and Integration*, 4(2), 268. <https://doi.org/10.24014/jnsi.v4i2.12068>
- Sari, S. F. M., Binahayati, B., & Taftazani, B. M. (2017). Pendidikan Bagi Anak Tuna Grahita (Studi Kasus Tunagrahita Sedang Di Slb N Purwakarta). *Prosiding Penelitian Dan Pengabdian Kepada Masyarakat*, 4(2), 217–222. <https://doi.org/10.24198/jppm.v4i2.14273>
- Widarti, H. R., Hakim, M. I., & Rokhim, D. A. (2022). The Development of a Virtual Laboratory on Qualitative Chemical Practicum Analysis. *Jurnal Ilmiah Peuradeun*, 10(3), 783. <https://doi.org/10.26811/peuradeun.v10i3.760>