

# Brightsteps AI Based Learning Platform or Children with Down Syndrome

Roshan Rajendra Kamthe<sup>1</sup>, Madhura Mohan Kadam<sup>2</sup>  
doi.org/10.64643/ijirt.208559-459

**Abstract**—BrightSteps is an all-around digital learning application that is designed for the children who are affected with Down syndrome for developing their daily life skills, interactive communication and essential academic background. Children with down syndrome have problems with reading, memory, communication and focusing on the topics that make their life challenging to perform their day-to-day tasks. Many existing systems are present but they provide specific personalization and are limited to particular modules. However, the application lacks AI based support, speech and overall progress. To address these problems our proposed system helps the children to provide a simple, interactive and user-friendly application that integrates activities like basic educational games, quizzes, visual learning, memory exercise, daily life communication practice and brain development games to enhance their skills. These platform helps the children to engage in different activities and helps to gain knowledge. It also allows the parents, teachers and even the mentors to monitor the children's daily activities, progress and encourage their skills. The main objective of the proposed system is to provide an opportunity to support the development of the children. These learning applications help to create an integrated platform for education and support the development of children with Down Syndrome.

**Index Terms**—Artificial Intelligence, Down syndrome, Personalized Learning, Adaptive Learning, Special Education.

## I. INTRODUCTION

Down syndrome is a genetic disorder that is caused by the presence of an extra copy of chromosome 21(i.e., trisomy 21). It is one of the common genetic conditions that affects physical growth, speech, memory, overall development and learning abilities. Children with down syndrome experience moderate intellectual disability, reduced attention span, often have difficulties in problem solving and

communication, reading, writing and even performing daily tasks becomes a problem in day-to-day life [1]. Although these challenges vary from child to child, it remarkably affects the academic development of the children.

In everyday life, children with this genetic problem may require support for performing their daily activities such as reading, writing, communicating with people, recognizing their thoughts and also in making decisions. The traditional method for teaching in classrooms is not sufficient because these children productively learn through visual text, images, repetitive learning, interactive and user-friendly activities and personalized assistance to train their thoughts [1] [2]. Continuous guidance from parents, teachers and even therapists also help effectively to improve their social and communication skills.

As the era of modern technology is growing on a large scale. The advancement of Artificial Intelligence (AI) and even educational technology (EdTech) has been involved in the development of an intelligent learning system that helps to adapt the educational content in various topics and can help the learner to adapt and make progress on it [2][3]. AI based learning provides personalized instructions, immediate feedback and also helps in performance analysis and also engage in learning through interactive modules. However, to overcome this problem many existing systems are present but they are limited to specific skills such as alphabet recognition, reading or in speech practice and lack in merging all the modules, personalization and even in progress tracking [4][5][6].

To address these limitations and problems, this research paper BrighSteps... focuses on an AI based learning platform that is designed for the children with down syndrome. The proposed system provides a simple, interactive and child friendly application that combines multiple modules like learning modules, brain development games and creative zones within a

single application. The modules contain alphabet, numbers learning, reading and practice words, quizzes on education, memory games, visualized learning, communication practice, daily life problems solutions. This application enables an AI based learning that allows them to analyse the child's progress and recommends learning activity, and even the recognize the child's emotion and suggest activities. As the interface of this application is child friendly it involves

gaming features such as rewards, badges and achievements to maintain their motivation and encourages them to participate continuously.

The aim of this proposed system is to improve their overall development and to engage them through personalized learning. This application also allows the parents, teachers, mentors and even their therapist to monitor their progress through detailed performance reports.



The proposed system helps to create a positive impact on children by increasing their engagement, improving memory and attention and even enhancing their reading, writing as well as communication skills, by improving it through personalized application. By integrating an assistant technology and all educational modules in a single platform BrightSteps it offers a comprehensive solution that supports their mental and personal development of children while assisting it more effectively and through personalised modules.

In conclusion, BrightSteps demonstrates the AI powered educational technology that contributes to adaptively addressing the needs of children with down syndrome. Its interactive modules, progress tracking and continuous learning approach enables the system to potentially improve learning outcomes and enhance their qualities in day to day lives along with valuable supports for their guardians

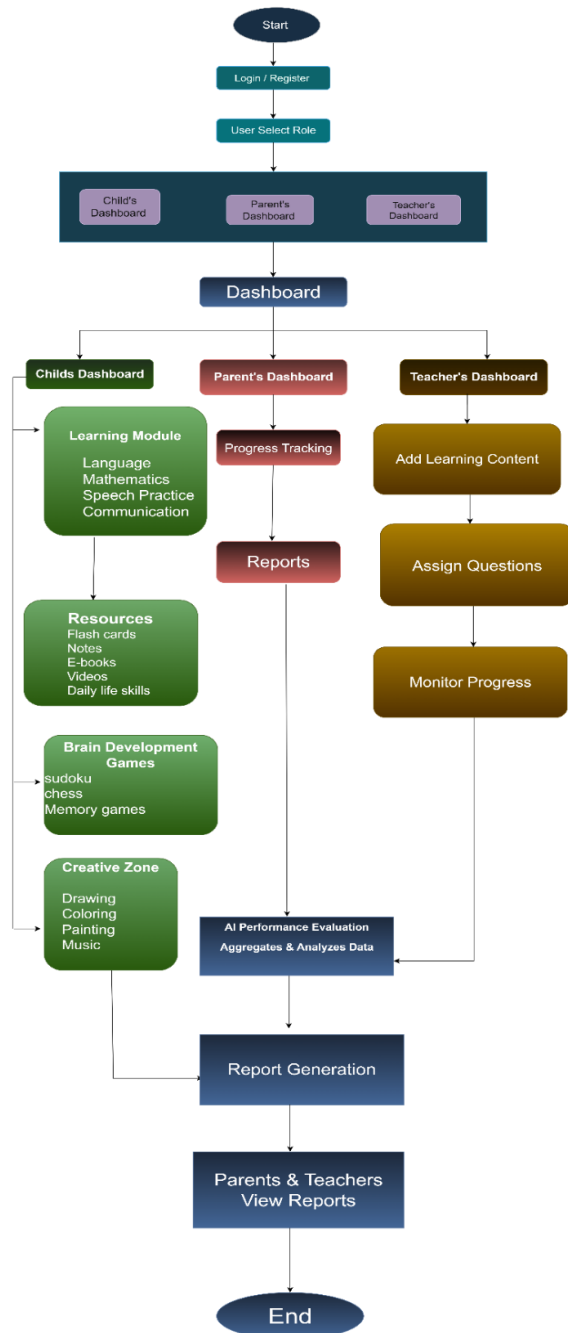
## II. METHODOLOGY

The research focused on the user-oriented and system framework methodology for improving the communication and overall learning abilities of children that are facing problems due to down syndrome by providing a web-based application that interactively helps children for the development. The proposed framework integrates learning modules in different languages (eg. English, Hindi and Marathi) brain development games, creative zones, education content through e books and flash cards, progress monitoring and an AI assistant that helps for recommendations and even acts as personal assistant into a single platform that supports children, parents and even their mentors.

The framework combines the educational learning through modern web technologies to improve the efficiency of children [4] [5]. Preferring only on

academic learning, this platform helps the children to improve their daily life communication, memory, creativity and even the language skills in a personalized and appealing manner [6]. This proposed system provides a separate dashboard for children, parents and their teachers to learn new things effectively and maintain their records as well as helps to track their progress.

The flowchart of this framework is designed as:



The modules work together in a continuous cycle that enables children to perform educational as well as entertainment activities, teachers and parents monitoring, Ai based analysis based on evaluation and personalized recommendations on it.

### 2.1. Role section and Authentication of the user

The system begins with the secure login/register interface that allows the user to create or log in an account through their credentials.

The user can select the roles like

- Child
- Parent
- Teacher / Therapist

Based on the role the system will directs to the user's dashboard through the personalized functionality and secure access

### 2.2. BrightSteps... Dashboard

After logging to the system, the user can enter in the BrightSteps dashboard that is the main or centred interface of the system.

The dashboard can provide access to different modules depending on user role:

- Child it can access the learning modules, games, creatives zones etc
- Parent can access to the monitoring their child's learning progress and reports
- Teachers / Mentors can access and manage the educational content and student performance.

This dashboard helps to improve the efficiency and provides an easy mapping through this platform.

### 2.3. Children Module

#### 1. Learning resources

The system provides a learning module that is designed for improving the academic as well as the communication skills of the children.

The learning module includes:

- Language learning
- Mathematics
- Speech practice
- Communication skills

Each of the subjects provides educational resources that are:

1. Flash cards
2. E-Books
3. Educational videos
4. Notes

These multiple resources help the children to learn new things in an attractive manner and helps to attend and make decisions in a fun learning environment.

## 2. Brain development games

These module helps the children to enhance their decision-making skills, memory, logic building and even the problem-solving skills and get connected by playing interactive games

The games include:

- Chess
- Sudoku
- Memory match
- Puzzle games
- Colour match
- Number game
- General Knowledge Quiz

These games enable the children to focus, concentrate, make decisions and also help to think logically in an enjoyable environment.

## 3. Creative zone

This zone helps the children to express their imagination, thoughts and even their emotions to express creatively.

The creative zone consists of:

- Drawing
- Colouring
- Painting
- Music
- Art activities

These activities help the student to explore their creativity, hand-eye coordination, and to improve their skills and also helps to maintain their emotional development in a happy environment.

## 2.4. Parent monitoring module

This module enables the parent to continuously monitor their child's record and progress in different activities.

The module includes:

- Track daily and weekly activities
  - View learning modules are completed
  - Monitor their progress through Ai analysis
- So, this module can help the parents to get involved in their child's activity and can provide support for learning outside the classroom.

## 2.5. Teacher management module:

The teacher module can help the therapist /teacher to assess the student's activity and can monitor their progress.

Teacher module includes:

- Adding daily task and questionnaires
- Create puzzle
- Assign activities
- Monitor progress
- Review their reports of performance

This module can help the teacher /mentors to record the progress and even assigning the task helps the student and can track the student's personal records.

## 2.6. AI based evaluation and recommendations on performance

The system integrates a special feature that is the Artificial intelligence that can continuously monitor and evaluate children's learning progress [4],[5] and based on the evaluation it can recommend the child's interest and study.

The AI system can analyse:

- Speed of learning
- Game score
- Quiz score
- Recommendation on learning
- Overall engagement
- Emotion detection

Based on weekly and daily observation the AI can identify the strength and can recommend their interest of study and learning difficulties.

The proposed methodology integrates all these modules such as user authentication, role-based dashboards, interactive modules for learning, games and creative zones, parent monitoring and teacher management, AI based evaluation, progress tracking and recommendations into an integrated web platform. BrightSteps provides an inclusive and adaptive

platform that provides an educational environment in an interactive and enjoyable platform. The system aims to improve academic growth, communication skills and daily life skills and provides collaboration among students, parents and teachers [2],[6].

### III. LITERATURE REVIEW

Children with down syndrome have problems like delays in cognitive development, memory, communicating in daily life, learning educational modules etc [1]. To address these problems this research helps to indicate the appropriate educational support, personalized learning modules and contents, and even it helps to train in daily life skills that improves their overall academic growth and performance [2].

Grieco et al. (2015) this research paper explains about the down syndrome and generally having strengths in visual learning but experiences problems in communication, pronunciation, language learning and even in daily life functioning. The study helps to get the knowledge and importance of child learning methods and also it matches child abilities.

Technology has become an important part in our life and in education too. Van Herwegen et al. (2015) recognized and reported that the technology assistive learning, inclusive learning method helps to improve and build the academic growth in the children. This study helps to understand that personalized application and cognitive learning can increase the children's involvement in learning new things and provides a positive impact [2].

As the world is developing in our modern era due to the presence of Artificial Intelligence (AI) in other fields and even in the education system that provides adaptive and personalised learning experience discussed by Holmes et al. (2019) that analyse student performance, suitable recommendation based on analyses. Comparably Zawacki-Richter et al. (2019) found that AI analytics and intelligent tutoring can help the children to learn effectively as well as can help parents and teachers to monitor the progress and efficiency of the student [3],[4].

Education in the forms of games can help the children to learn new things in a very interactive and enjoyable way and has positive effects on children as rewards, achievement makes children stay motivated and helps to continuously learn things. Deterding et al. (2011)

helps to understand that incorporating the game elements such as rewards, levels and even challenges in a unified platform can help children to stay engaged and enhance their knowledge by playing brain development games, quizzes and puzzles [5].

As all these advancements are present, most of the existing system focuses only on individual modules like only learning topics, communication skills, interactive games, etc. This addresses the limitation of an integrated system in a single platform combining children's parent and teacher portal, AI based learning and monitoring system, progress tracking and evaluation of performance. The proposed system BrightSteps helps to overcome this research gap by integrating all the features and modules into a single web-based application [2],[3],[4].

### IV. PROBLEM STATEMENTS

Children with down syndrome can face difficulties in their day-to-day life such as learning, communication, memory, language development and performing daily life activities [1],[2]. In traditional methods the teacher and parents have to monitor the children's progress regularly which creates difficulties to track every child individually and also this method is time consuming. The techniques of traditional teaching do not work equally for each and every child. Many existing applications provide educational resources to the children but they are limited to personalised learning, progress tracking or interaction between students, teachers and parents [4],[5].

Because of this limitation there is need of simple, personalised and interactive learning platform that can support children according to their individual learning needs. The BrightSteps system helps to provide educational activities, cognitive exercises, speech practice, progress tracking, and different portals for students, teachers and parents [2],[3]. The main aim/goal is to create a supportive digital learning environment that helps children improve their communication, cognitive, academics and daily living skills while also making it easier for teachers and parents to monitor their learning [5],[6].

### V. BENEFITS

The BrightSteps platform is designed to support children in improving their skills and learning while

also helping teacher and parents monitor their progress more efficiently.

The main benefits of proposed systems are:

- It provides personalized learning platforms for each child.
- Improve cognitive skills like attention, memorizing, logical thinking, and problem solving to improve their brain development.
- Enhance the speech ability, communication and language through interactive activities and practice modules.
- Making learning much easier, engaging and enjoyable using games, puzzles, quizzes and visual learning content.
- Improve transparency between child, Parents and teachers.
- Using Ai based recommendations to suggest suitable learning activities according to the child's progress.
- Provide a secured system with a separate dashboard for students, parents and teachers.

## VI. CONCLUSION

The proposed BrightSteps system is an AI-based learning platform that is designed to support the educational and development needs for children with Down syndrome. The system having different learning activities in one platform including personalized lessons, brain development games, speech exercises, creative activities and AI based progress tracker. It also provides a separate dashboard for teachers, students and parents which makes it easier to keep track progress and provide the right support when needed.

The main purpose of BrightSteps is to make learning more interactive while helping children to develop necessary skills such as memory, communication, problem solving and decision making. The system can also generate progress reports and suggest suitable learning activities based on child activities. This can make it easier for both parents and teachers to monitor a child's development without having to depend only on manually monitoring each child separately.

Overall, BrightSteps aims to create a supportive learning environment where children can learn at their own pace, enjoy playful activities and build

confidence. With this progress monitor feature, the parents and teacher can understand a child's progress better and provide more suitable guidance as needed. In the way, BrightSteps can make the learning process more engaging and meaningful for children with Down syndrome.

## REFERENCE

- [1] J. Grieco, M. Pulsifer, K. Seligsohn, B. Skotko, and A. Schwartz, "Down syndrome: Cognitive and behavioral functioning across the lifespan," *Am. J. Med. Genet. C Semin. Med. Genet.*, vol. 169, no. 2, pp. 135–149, Jun. 2015, doi: 10.1002/ajmg.c.31439.
- [2] D. Fidler, "The emerging Down syndrome behavioral phenotype in early childhood: Implications for practice," *Infants & Young Children*, vol. 18, no. 2, pp. 86–103, 2005.
- [3] J. Van Herwegen, T. Masterman, J. Dockrell, R. Gordon, C. Marshall, and M. S. C. Thomas, "Raising educational outcomes for individuals with Down syndrome: Findings from a larger systematic review of targeted interventions for individuals with SEND," *Journal of Research in Special Educational Needs*, vol. 25, pp. 714–723, 2025, doi: 10.1111/1471-3802.70004.
- [4] G. Zawacki-Richter et al., "Systematic review of research on artificial intelligence applications in higher education—Where are the educators?" *International Journal of Educational Technology in Higher Education*, vol. 16, Art. no. 39, 2019, doi: 10.1186/s41239-019-0171-0.
- [5] J. F. Pane, E. D. Steiner, M. D. Baird, L. S. Hamilton, and J. D. Pane, *Informing Progress*. Seattle, WA, USA: RAND, Jul. 2017.
- [6] S. Devikar, M. Hinge, and S. S. Shevkari, "Human vs. machine: A review of AI's impact on language learning interaction or replacing human interaction," *International Journal for Multidisciplinary Research*, vol. 7, no. 3, 2025, doi: 10.36948/ijfmr.2025.v07i03.49459.
- [7] J. E. Roberts, J. Price, and C. Malkin, "Language and communication development in Down syndrome," *Mental Retardation and Developmental Disabilities Research Reviews*, vol. 13, no. 1, pp. 26–35, 2007.
- [8] I. Granic, A. Lobel, and R. C. M. E. Engels, "The benefits of playing video games," *American*

- Psychologist, vol. 69, no. 1, pp. 66–78, 2014, doi: 10.1037/a0034857.
- [9] G. N. Taur, M. M. Vidhate, and S. S. Shevkari, “Deep learning meets biometrics: A comparative study of modern identification techniques,” *International Journal of Innovative Research in Technology*, vol. 12, no. 2, pp. 545–552, 2025.
- [10] K. Verbert, S. Govaerts, E. Duval, J. L. Santos, F. Van Assche, G. Parra, and J. Klerkx, “Learning dashboards: An overview and future research opportunities,” *Personal and Ubiquitous Computing*, vol. 18, no. 6, pp. 1499–1514, Aug. 2014.
- [11] P. Long and G. Siemens, “Penetrating the fog: Analytics in learning and education,” *Italian Journal of Educational Technology*, vol. 22, no. 3, pp. 132–137, 2014. [Online]. Available: <https://www.learntechlib.org/p/183382/>
- [12] W. Holmes, M. Bialik, and C. Fadel, *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Boston, MA, USA: Center for Curriculum Redesign, Feb. 28, 2019.