

“TED”: Teaching Educational Device, a digital tool to educational practice for special needs

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Abstract. Literature shows as new technologies can aid different professional figures who work in various educational fields, from schools to rehabilitation. However, in a Landscape of technological tools, today many technologies are abandoned or used with little frequency and poor clinical interest by teachers and therapists. TED was born with the need to be an all-inclusive tool, which allows the teacher/therapist, in a clear and specific way, to manage all aspects concerning the educational programming of the student with Special Educational Needs (SEN), from the initial evaluation phase to final phase, concerning the results of the personalized didactic action. Taking advantage of specific algorithms, which with the help of AI change over time becoming more and more precise, TED offers the user the opportunity to work on the fundamental areas of the individual's life (problem behaviors, academic skills, relational skills, etc.) and lends itself to be a complete tool for operators (in education, health, and school) who work with special needs daily.

Keywords: technology, educational practice, teacher.

1 Introduction

The role of technology in special education has increased over the last 20 years [1]. New interactive technologies in terms of smart mobile devices and accompanied applications (apps) attract increasing attention in various fields: preschool, school, early-primary education, occupational therapy [2–4]. Teachers and operators that work in Educational settings as school or rehabilitation centres face every day with the management of children and young people with special needs (SEN) [5] and there is a great interest in new technologies as a source of help for educational practices [4]. The term Special Educational Needs was born in the 1960s from the dissatisfaction with the terminology (not always appropriate) of Handicapped children and above all as a need to support the increase in the differentiation of the difficulties of children at school (due to the expansion of diagnoses and the advancement of research) [6].

SENs, as shown over time, affect different areas ranging from communication, educational processes, instrumental learning, problem behaviours. various researchers have faced various challenges by tackling problems individually or working on multiple areas at the same time. However, even today, the gap in the resources offered to the School and other educational contexts and real needs are far from being filled [4].

Nevertheless, new technologies have made a great contribution to various educational figures [7–9]. In recent years, a great resource has allowed a leap forward in new technologies: artificial intelligence (AI). With AI we refer to a computer algorithm capable of accomplishing tasks that generally require human intelligence, such as creating pictures, songs, and writings [10]. The field of artificial intelligence (AI) has come a long way since the term was first coined by a group of researchers in 1956 [11] and its fields of application have grown enormously, ranging from medicine to physics up to rehabilitation [12]. There are many types of AI, including the subfield of Machine Learning (ML). ML approaches enable computers to create predictive algorithms and to learn without any explicitly programmed rules, i.e. learning through experience from new datasets. Deep-learning approaches are a subset of ML-based on artificial neural networks that mimic how the nervous system processes information [12].

The literature offers us numerous insights into the implementation of new technologies as a form of support for SNs (from neurodevelopmental disorders to simple special educational needs) [7, 13]. Numerous increasingly sophisticated Speech-generating devices (SGD's) have facilitated communication processes, extending the Augmentative and Alternative Communication (AAC) area [14, 15]; Various educational software founded for instrumental learning [16, 17], for working with children with autism [18–20] for working on attention [17, 19], for recording and decreasing problem behaviours have been developed and many are available on the app-stores. A lot of these apps are supported by AI.

However, in the literature, no software or hardware guarantee a "total" take-over of the student: a tool that ranges from the initial diagnosis to treatment and that accompanies the educator, teachers, the therapists for the entire didactic path/rehabilitation.

This paper aims to illustrate the functionality of TED: TED is an educational tool that allows you to describe the educational and didactic interventions intended for pupils with developmental disabilities starting from a single and already created assessment for special educational needs. TED allows the teacher/therapist, in a clear and specific way, to manage all aspects concerning the educational planning of the pupil with Special Educational Needs (SEN), from the initial to the final evaluation phase concerning the outcomes of the personalized didactic action. The role of technology in special education has increased over the last 20 years.

2 TED

TED is conceived as a real tool, which goes from evaluation, passing to monitoring to finally arrive at programming (consisting of real external apps that can be incorporated into TED) to offer an overview of procedures that can be used by the user at any time to carry out adequate programming. The programming itself and the procedures implemented will not be freely chosen by the user, but will be selected by the same tool based on the previously compiled evaluation to offer a supervised practical guide that leads to the expected result.

TED involves all the figures involved in the life of the pupil who attends school: for this reason, the use of the same is borne by both the support teacher and the curricular teachers.

TED becomes an integral part of the educational-didactic planning both in the classroom and in rehabilitation centers for pupils with special needs. The assessment of the pupil with TED is carried out at the beginning of each school year and subject to verification and reassessment every four months or as needed. "TED" is not immutable, but it is a tool that allows an integrated analysis of the specific teaching objectives and of the areas involved during the same school year both to evaluate their effectiveness and monitor learning and to allow for the modification of educational programming taking into account the results achieved by the student, to update or confirm the objectives and to adapt it to needs that emerged during the school year.

The educational path of a pupil with disabilities requires differentiated programming that sets specific and personalized objectives not necessarily adhering to ministerial programming but rather based on a criterion evaluation: in this case, the TED allows you to carry out a single evaluation through a questionnaire created ad hoc by our team that provides for the integration of various diagnostic tools.

Through an on-boarding procedure an evaluation test is carried out (owned by us, which will be described below) following which the following are automatically defined:

- specific areas of teaching,
- for each area, objectives for programming will be proposed,
- for each objective, a series of individualized teaching procedures and evaluation criteria will be suggested. The part concerning the procedures must be structured in such a way that the text of the procedures can be updated independently of the app through a download system of additional information. The system will also allow you to add other procedures, allowing you to reuse those already existing but placing constraints present only in the text.

2.1 Development and evaluation

TED is a personal mobile application. It requires a username and a password for the user to log in.

An internet connection is not required but is needed to synchronize local data with the server's database instance and share outcomes with the clinical team behind the app.

The application is developed as a Progressive Web Application (PWA) in HTML5 and React. The server part is managed by a Linux - Python - PostgreSQL stack.

The tool guides the user through the entire process: once logged in, it is possible to fill in the student profile, starting from the personal information to move on to personal information (diagnosis, communication skills, scholastic skills, possible pharmacological treatment, etc.).

Once the preliminary information has been filled in, the user can complete the questionnaire "Easy Life": Easy Life is set up as a semi-structured questionnaire which, by integrating the knowledge and requirements of the questionnaires ad AFLS [21], ABBLs-R [22], VB-MAPP [23], has the purpose of collecting relevant information

about the skills possessed by the subject and outlining the teaching objectives of the learning areas with a deficit. The test consists of 420 items and is divided into 7 macro-areas (each of which has 4 different macro-areas) which represent the fundamental areas for correct scholastic insertion and good quality of life.

The questionnaire can be re-administered and updated every six months, to evaluate the progress of the ongoing programming.

Based on the TED assessment, educational goals and objectives are identified and in particular educational, socialization, and learning objectives related to the different areas, which can be pursued during the school year also concerning class planning. The objectives for each area are prescribed and included in the school/life planning by the teacher/therapist herself, being able to choose which are the priority ones to implement for her pupil.

The teacher/therapist himself will have a monitoring system at his disposal to capture all the variables necessary to build an adequate program.

Finally, on the same device, it is possible to access a basic calendar (monthly, weekly, 3 days, daily) in which to view the specific programming for each student. The scheduling, also organized by time slots, allows you to view in writing both each specific objective that you have chosen to implement my teaching area, but also the procedure to be implemented associated with that objective, i.e. a detailed and methodological explanation to clarify how to operate following well-specified indications, and the possibility of evaluating the latter daily through a rating system.

For each objective it is also possible to check the active or inactive status and dynamically insert, through photos, the specific activities carried out.

Once the evaluation phase is over, the user will be redirected to the "activity planning" phase where, depending on the chosen objectives, there will be educational procedures based on applied behavior analysis (ABA) [24] and the main cognitive-behavioral theories for SENs.

The procedures can be textual (created tailored to the objectives) or they can be real external Apps that are integrated into TED: this allows the tool to be an innovative multifaceted platform that over time allows the integration of external components that enrich its functionality and performance.

2.2 Data recording and AI

During the use of the procedures, the user will have several data recording and a rating system available that will allow the teacher/therapist to monitor the processes and adding data over time.

Indeed, data collection is a fundamental component of TED: thanks to an AI-based pattern recognition system, all the information collected by the various users allows TED to enrich itself with new information and improve over time, becoming more and more fluid and precise in the choice of objectives and the programming of the intervention.

3 Conclusion

New technologies are now a well-established reality within educational contexts (school, rehabilitation centres, etc) and the literature is full of cases in which these have proved to be irreplaceable and ergonomic tools. Communicators, pedagogical apps, learning software, represent a new way of conceiving teaching, especially for those segments of the population that require greater support and more flexible educational processes, such as the SEN. The heterogeneity of the SENs creates great difficulties towards the educational pedagogical figures, who need adequate tools to face the various daily problems (problem behaviours, personal autonomy, learning difficulties). New diagnostic criteria and the greater interest in the creation of innovative educational/didactic paths give strength for new opportunities that are well suited to the use of New Tech. TED was born to intercept the need for an all-encompassing tool that helps and guides the operator throughout the didactic/educational path and that has a real impact on the student's life, allowing him to achieve meaningful outcomes or the goal of any figure who work with disabilities or special educational needs.

References

1. Miglino, O., Di Ferdinando, A., Di Fuccio, R., Rega, A., Ricci, C.: Bridging digital and physical educational games using RFID/NFC technologies. *J. e-Learning Knowl. Soc.* 10, (2014).
2. Valentine, A.Z., Brown, B.J., Groom, M.J., Young, E., Hollis, C., Hall, C.L.: A systematic review evaluating the implementation of technologies to assess, monitor and treat neurodevelopmental disorders: A map of the current evidence. *Clin. Psychol. Rev.* 101870 (2020).
3. Kervin, L.K.: Powerful and playful literacy learning with digital technologies. (2016).
4. Smith, R.O.: Measuring assistive technology outcomes in education. *Diagnostique.* 25, 273–290 (2000).
5. Van Herwegen, J., Ashworth, M., Palikara, O.: Views of professionals about the educational needs of children with neurodevelopmental disorders. *Res. Dev. Disabil.* 91, 103422 (2019).
6. Gulliford, R., Upton, G.: *Special educational needs.* Routledge (2002).
7. Folgieri, R., Galbiati, P.D.V., Dei Cas, L., Lucchiari, C.: A Cognitive-Driven BCI-Based E-Learning Platform for Learning Disorders: A Preliminary Study. In: *Project and Design Literacy as Cornerstones of Smart Education.* pp. 235–246. Springer (2020).
8. Rega, A., Mennitto, A.: Augmented Reality As An Educational And Rehabilitation Support For Developmental Dyslexia. In: *10th annual International Conference of Education, Research and Innovation. IATED* (2017).
9. Ponticorvo, M., Di Fuccio, R., Ferrara, F., Rega, A., Miglino, O.: Multisensory educational materials: five senses to learn. In: *International Conference in Methodologies and intelligent Systems for Technology Enhanced Learning.* pp.

- 45–52. Springer (2018).
10. Palace, V.M.: What If Artificial Intelligence Wrote This: Artificial Intelligence and Copyright Law. *Fla. L. Rev.* 71, 217 (2019).
 11. Wahl, B., Cossy-Gantner, A., Germann, S., Schwalbe, N.R.: Artificial intelligence (AI) and global health: how can AI contribute to health in resource-poor settings? *BMJ Glob. Heal.* 3, e000798 (2018).
 12. Rapaport, W.J.: What Is Artificial Intelligence? *J. Artif. Gen. Intell.* 11, 52–56 (2020).
 13. Sigafos, J., Drasgow, E., Halle, J.W., O'reilly, M., Seely-York, S., Edrisinha, C., Andrews, A.: Teaching VOCA use as a communicative repair strategy. *J. Autism Dev. Disord.* 34, 411–422 (2004).
 14. Moreno, G.: Expanding Definition of Technology in Special Education: Impact of Training on the Adoption of iPad Tablets by Special Educators. *Int. J. Disabil. Dev. Educ.* 1–17 (2020).
 15. Rega, A., Mennitto, A., Iovino, L.: Liar (Language Interface For Autistic's Rehabilitation): Technological Aids For Specialists Supporting The Acquisition Of Verbal Behavior In Persons With Autism. In: 9th International Conference on Education and New Learning Technologies. IATED (2017).
 16. Lumbreras, M.A.M., de Lourdes, M.-T.M., Ariel, S.-R.: Aura: Augmented reality in mobile devices for the learning of children with ASD—Augmented reality in the learning of children with autism. In: *Augmented Reality for Enhanced Learning Environments*. pp. 142–169. IGI Global (2018).
 17. Elsahar, Y., Hu, S., Bouazza-Marouf, K., Kerr, D., Mansor, A.: Augmentative and alternative communication (AAC) advances: A review of configurations for individuals with a speech disability. *Sensors.* 19, 1911 (2019).
 18. Banire, B., Al Thani, D., Makki, M., Qaraqe, M., Anand, K., Connor, O., Khowaja, K., Mansoor, B.: Attention Assessment: Evaluation of Facial Expressions of Children with Autism Spectrum Disorder. In: *International Conference on Human-Computer Interaction*. pp. 32–48. Springer (2019).
 19. Anderson, P.J., Lee, K.J., Roberts, G., Spencer-Smith, M.M., Thompson, D.K., Seal, M.L., Nosarti, C., Grehan, A., Josev, E.K., Gathercole, S.: Long-term academic functioning following cogmed working memory training for children born extremely preterm: a randomized controlled trial. *J. Pediatr.* 202, 92–97 (2018).
 20. Rega, A., Mennitto, A., Vita, S., Iovino, L.: New technologies and autism: can augmented reality (ar) increase the motivation in children with autism? In: *12th International Technology, Education and Development Conference*. pp. 4904–4910 (2018).
 21. Partington, J.W., Mueller, M.: *The assessment of functional living skills [AFLS]*. Pleasant Hill, CA: Behavior Analysts, Inc (2012).
 22. Partington, J.W., Bailey, A., Partington, S.W.: A pilot study examining the test–retest and internal consistency reliability of the ABLLS-R. *J. Psychoeduc. Assess.* 36, 405–410 (2018).
 23. Sundberg, M.L.: *VB-MAPP Verbal Behavior Milestones Assessment and Placement Program: a language and social skills assessment program for children*

- with autism or other developmental disabilities: guide. Mark Sundberg (2008).
24. Ponticorvo, M., Rega, A., Miglino, O.: Toward tutoring systems inspired by applied behavioral analysis. In: International Conference on Intelligent Tutoring Systems. pp. 160–169. Springer (2018).