Design Thinking and Early School Dropout

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Design Thinking (DT) is a design process originally used in the conception and validation of innovative and technologically efficient human-centered solutions for ill-formed problems. Being an iterative and collaborative process with a human point of view, DT allows adopters to improve several intrapersonal and interpersonal skills, like collaboration, creative thinking, leadership, presentation, project management, ethics, storytelling, negotiation, empathy, willingness to learn, etc. As such, DT has been adopted in several other areas and has also become highly relevant in educational contexts to develop the aforementioned skills in students. It has also been shown to contribute to minimizing the school dropout problem by keeping students motivated and integrated in the school context.

Design Thinking active learning secondary education School Dropout

1. Introduction

Education is a key element in building a society. One of the most important sources of education is school, as a host of formal education, even though individuals, as social beings, also construct their knowledge in non-formal and informal ways. It is therefore highly important for the development of citizens and society to invest in initiatives and projects that guarantee that everyone has the same opportunities and that schools are truly able to provide a good environment for all, ensuring that everyone is motivated to complete their educational path and is prepared for their personal, professional, and social role in society. Nevertheless, traditional passive learning approaches based on expository lectures do not motivate students to continue in school and do not develop the required skills for current societal challenges—active learning methodologies are required to achieve that [1].

Active learning is rooted in the constructivist learning theory, which emphasizes that individuals build their knowledge by connecting new ideas and experiences to their own pre-existing knowledge and experiences to form new or enhanced understanding. The theory grounded in work by Piaget and others, posits that learners assimilate new information by incorporating it into an existing framework, even if that information contradicts prior understanding [2]. Approaches that promote active learning often explicitly ask learners to make connections between new information and their current mental models, extending their understanding. In other cases, teachers may design learning activities that allow learners to confront misconceptions, helping learners reconstruct their mental models based on more accurate understanding [3].

Active learning approaches often embrace the use of collaborative and/or cooperative learning groups, a constructivist-based practice that places particular emphasis on the contribution that social interaction can make. Lev Vygotsky's work elucidated the relationship between cognitive processes and social activities and led to the sociocultural theory of development, which suggests that learning takes place when learners solve problems beyond their current developmental level, with the support of their instructor or their peers [4].

Approaches that promote active learning focus more on developing learners' skills than on transmitting information and require that learners do something—read, discuss, write—that requires higher-order thinking. Therefore, the role of the teacher changes from lecturer to tutor and the role of the pupil changes from passive receiver to active designer of knowledge. When teachers serve as collaborators, co-learners, and mentors rather than as authoritative figures dispensing factual information, they rest on the same epistemological grounds as their learners. This is a key point. When the contestability of any and all ideas (even one's own) is recognized, a learning space is created where critical commentary becomes something not to be feared but to be relished and embraced. Learners become actively engaged in the construction of knowledge. When learners problematize an issue, their focus shifts from articulating the meaning in other people's ideological positions and theories to theorizing their own experience within the context of the "content" introduced in the course. In this way, learners become active knowledge producers instead of passive recipients.

Design Thinking (DT) is an exemplary active learning methodology. At its core, DT is an iterative design process that focuses on creative problem-solving and encourages individuals to think outside the box, to collaborate, and to empathize with users. DT offers a powerful approach to develop transversal skills in educational settings by cultivating creative thinking, leadership, presentation skills, project management, ethics, storytelling, negotiation, empathy, and a willingness to learn through an iterative and collaborative process. Design Thinking also develops critical thinking skills, enhances creativity, and promotes collaboration among students [5][6][7]. All these skills are increasingly valued by employers and are vital for the students' long-term success in facing the challenges of the 21st century. As such, DT has gained significant attention in education in recent years [8][9], particularly because traditional teaching methods do not develop these skills [10].

Collaboration is a key skill fostered by Design Thinking, as it encourages students to work in multidisciplinary teams, share ideas, and leverage diverse perspectives [11][12]. Creative thinking is another core aspect as it promotes the generation of novel solutions and encourages students to think critically and imaginatively [13]. Leadership skills are also nurtured through DT as students are encouraged to take initiative, guide group discussions, and effectively communicate their ideas [11]. Good presentation skills play a vital role in the process as students learn to articulate and visualize their concepts effectively to communicate their ideas to others [14]. Project management is another critical skill developed through DT as students learn to plan, organize, and execute their projects within given constraints [13]. Ethics and storytelling are emphasized in Design Thinking by fostering a sense of responsibility and integrity among students [14]. Negotiation skills are also developed as students collaborate with team members, reconcile conflicting ideas, and reach consensus [15]. Empathy, a central pillar of DT, enables students to understand and address the needs of end-users, promoting human-centered design

solutions [11]. Lastly, the willingness to learn is inherent in the process, as students are encouraged to embrace failure, iterate, and continuously improve their ideas [15].

To maximize the potential benefits of DT in education, it is essential to establish a teacher training model that supports its implementation. This model should aim to increase the academic success of teachers, enhance professional development opportunities, and equip educators with the necessary resources and mindset to teach DT skills effectively. By providing teachers with guidance and feedback, they can effectively guide and support students through the process. Moreover, the model should seek to empower educational authorities, policymakers, and decision-makers to promote mainstream DT practices. This involves strengthening their capacity to understand and support the integration of DT in curricula and educational policies also because the implementation of DT in education has been linked to a decrease in early school dropout (ESD) rates. Schütte et al. attribute this effect to the engaging nature of Design Thinking, which emphasizes hands-on, project-based learning and contributes to increased student motivation and interest in education [16]. By providing students with a sense of ownership and relevance in their learning experiences, DT can help reduce disengagement and dropout rates.

2. Design Thinking

Design Thinking is a user-centric approach to design, focusing on developing appropriate solutions for business or social challenges by deeply understanding how users interact with a proposed product or service. In a business context, its primary goal is to improve customer experiences and foster company growth [17]. The Design Thinking process is organized into five stages (**Figure 1**) according to the framework proposed by the Stanford d.school [6][11][18][19]:

- Stage 1: Empathize—the first step is related to understanding the real needs of a specific group. This helps to gain an empathetic understanding of the problem through research, observations, interviews, or any other process that allows understanding the problem from the users' point of view.
- Stage 2: Define—the second step is related to defining the problems based on the research performed in the first step. This includes introducing a problem statement based on the perspective gained previously.
- Stage 3: Ideate—the third step is related to introducing solutions to problems. This includes "thinking out of the box" and searching for alternatives and identifying innovative solutions to problems. In the end, a decision is made to implement in the next step.
- Stage 4: Prototype—the fourth step is related to building a representation of the idea conceived in the previous step in the form of a product, service, project, framework or other.
- Stage 5: Test—the last step is related to implementing the solution and testing it through the involvement of the users. If the solution proves to be not adequate for the problem, it implies returning to a previous DT step.

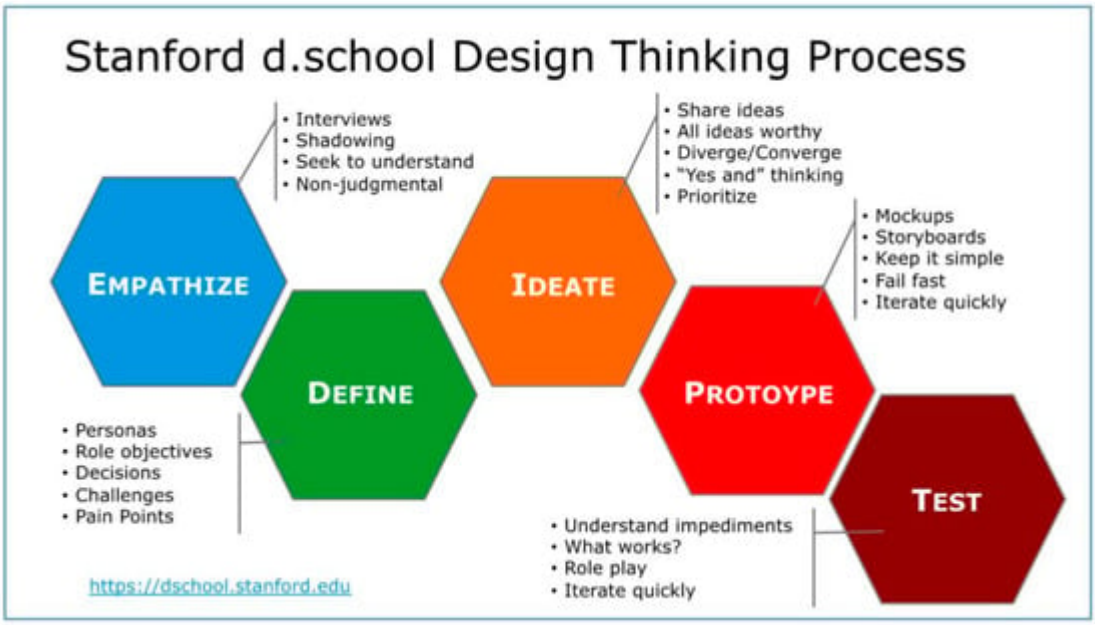

Figure 1. Design Thinking stages [18].

As mentioned before, the successful adoption of DT in education was due "to the core of the design concept, which encompasses elements such as thinking, developing empathy, promoting action-oriented prejudices, developing meta-cognitive awareness, being active, problem solving, and using one's imagination" [20]. Design Thinking requires learners to be active at all moments, so it promotes active learning, which is commonly defined as a methodological process that scaffolds an organized set of activities that learners do to construct knowledge and understanding through the involvement of higher-order thinking [21][22]. Metacognition—learners' thinking about their own learning—is an equally important element, and active learning strategies should include instructional activities involving learners in doing things and thinking about what they are doing. These activities can range from very simple (e.g., pausing lectures to allow learners to clarify and organize their ideas by discussing with peers) to complex (e.g., using case studies as a focal point for decision-making).

It has been shown that with the Design Thinking methodology, students tend to be more dedicated and to put more effort in the idealization and drawing steps than while immersed in traditional teaching [23][24]. It also enables the students to easily create new options, think of new solutions, and register insights. It is considered a great tool to support the activities of discussing and sharing thoughts, as it supports the process of working in groups and has a positive impact on the social development dimension of students.

The mentality, values, and set of skills that DT develops in learners, thanks to the thought processes implicit in the different stages, make them more tolerant and sensitive to cultural problems and to those topics directly related to language and culture, such as cultural conflicts, racial and/or linguistic discrimination, mediation and identity problems, stereotypes, or globalization, among others. Therefore, the methodology also influences the development of the social–affective awareness of students. Affective competence is especially developed by the abductive thinking process, which, by fostering thinking in new and different perspectives, detaches itself from pre-established models and considers that feelings and emotions are as important as rationality [25].

3. Design Thinking and Early School Dropout

Early school dropout (ESD) is defined as a situation in which a student stops attending school without having completed the minimal required qualification. ESD is a very complex and multifaceted phenomenon that results from a combination of social, economic, educational, and even personal (family) factors. In fact, although it is often associated with socioeconomic disadvantages, the decision is rarely sudden or the result of an isolated episode and normally originates from a long (and quite visible) process of disinterest and failure. The six main causes that have been proposed for ESD are (1) a mismatch between school and student reality; (2) poor family cooperation with the school; (3) an inadequate response of the school to the expectations of teachers and students, families, or society; (4) poor pedagogical preparation of teachers; (5) a lack of reading habits; and (6) a lack of study methods [26]. Other frequent causes are related to special needs not being catered to; personal or family-related problems; bad relations with professors; poor relationships with peers or a negative school climate (including the existence of bullying); health problems and dissatisfaction with the results obtained; socioeconomic status, such as a lack of money to continue school or having to start to work at an earlier age to help in the household; the cultural identity of the family, which can enter into conflict with the school system; and family members' dedication to, and expectations of, the student [27].

In 2010, the goal of the European Union was to lower the early school dropout rate below 10% by 2020. The "European Toolkit for Schools" was created with an aim to promote inclusive education and combat ESD. This guide provides useful information, examples of measures, reference materials, and a set of tools with concrete ideas aimed at improving the actions of schools to enable all students to be successful. The support students receive from teachers is the most important enhancer of school engagement. This strong relationship is linked to social, emotional, and behavioral well-being and attitudes. Increasingly, teachers are expected to become facilitators of learning [28]. By continually motivating, guiding, and supporting students, teachers can help students to control their own learning. This approach requires teachers to develop a strong, trust-based relationship with students and their parents, thereby developing positive environments in classrooms and schools.

Students' needs are presented as the central focus of education. All students are entitled to high-quality teaching, a relevant curriculum, appropriate assessment, and valuable learning opportunities. Schools must provide an environment that accommodates the diversity of students, including their various learning needs, to maximize the potential of each young person. Quality education must be designed and tailored to students, rather than forcing them to adjust to an existing system. This approach should guarantee their participation in the learning process, as well as the perception of a clear purpose for their studies. These are important incentives for their permanence in the school system, and a support framework should be in place that consists of a wide range of different measures for different groups of students.

By adopting DT in the classroom, the educational model is enriched by making the object of discovery fascinating and involving, motivating, and guiding the students as "design thinkers" towards personal and educational success. Thus, DT becomes a glue that keeps teams together, allowing students to take intuitive leaps, think differently, and see old problems in new ways. This promotes students' creative confidence, achieved through active problem

solution promotion, while combating early-school leaving, as teachers can create a more immersive curriculum focused on real-world problem-solving, where students can solve creatively and infuse meaning into what students learn, regardless of the subject or grade.

One of the justifications for dropping out of school is the inadequacy of the teaching method for some students [26]. Therefore, the whole learning process should be adapted to the reality of teachers and students. The DT methodology can be of acute importance to changing the early school dropout scenario, as it stimulates innovation and the search for the most suitable solutions for the most varied types of problems.

The Design Thinking methodology is by nature multidisciplinary; hence, it can be implemented in a vast series of contexts and supportive of people from different backgrounds and with different goals. Since a main educational problem is to have adequate learning techniques that boost and support students' learning, the application of the DT methodology, as it promotes greater engagement and more active participation of students in the learning process, will, by deduction, avoid the early school dropout of students. By using the Design Thinking methodology, students are more integrated in the learning process because they develop their skills through a problem-solving approach based on real-life situations while immersed in a collaborative environment.

To sum up, changing the curriculum to integrate DT within the traditional school system can lower school dropout rates as DT is an innovative learning process that is adapted not only to the students' reality, but also to the teachers'. In fact, when educators are exposed to DT methodology, they are better able to conceptualize individual ideas and perspectives on various topics. They acquire the ability to plan more dynamic classes that are in accordance with the level of knowledge of all those involved. As such, DT is one of the most efficient ways to transform teaching and empower teachers.

References

1. Vaz de Carvalho, C.; Bauters, M. Technology to Support Active Learning in Higher Education. In Technology Supported Active Learning; Lecture Notes in Educational, Technology; Vaz de Carvalho, C., Bauters, M., Eds.; Springer: Singapore, 2021.
2. Piaget, J. The Origins of Intelligence in Children; International Universities Press: Madison, CT, USA, 1952.
3. Brame, C. Active learning. Vanderbilt University Center for Teaching. 2016. Available online: https://cft.vanderbilt.edu/active-learning/ (accessed on 27 January 2022).
4. Vygotsky, L.S. Mind in Society: The Development of Higher Psychological Processes; Harvard University Press: Cambridge, MA, USA, 1978.
5. Blikstein, P. Digital fabrication and "making" in education: The democratization of invention. FabLabs Mach. Mak. Invent. 2013, 4, 245–263.

6. Meinel, C.; Leifer, L.; Plattner, H.; Meinel, D. Design Thinking for Innovation: Research and Practice; Springer: Berlin/Heidelberg, Germany, 2017.
7. Faria, M.; Novo, C.; Lopes, A.; Moura, A.; Tsalapatas, H.; Heidmann, O.; Vaz de Carvalho, C. A utilização de Design Thinking para promover a adoção de práticas sustentáveis no Ensino Básico e Secundário. Rev. Ibér. Sist. Tecnol. Inf. 2023, E57, 217–230.
8. Li, T.; Zhan, Z. A systematic review on design thinking Integrated Learning in K-12 education. Appl. Sci. 2022, 12, 8077.
9. Baričević, M.; Luić, L. From Active Learning to Innovative Thinking: The Influence of Learning the Design Thinking Process among Students. Educ. Sci. 2023, 13, 455.
10. Androutsos, A.; Brinia, V. Developing and Piloting a Pedagogy for Teaching Innovation, Collaboration, and Co-Creation in Secondary Education Based on Design Thinking, Digital Transformation, and Entrepreneurship. Educ. Sci. 2019, 9, 113.
11. Brown, T. Design thinking. Harv. Bus. Rev. 2008, 86, 84–92.
12. Guaman-Quintanilla, S.; Everaert, P.; Chiluiza, K.; Valcke, M. Fostering Teamwork through Design Thinking: Evidence from a Multi-Actor Perspective. Educ. Sci. 2022, 12, 279.
13. Dorst, K. The core of ‘design thinking’ and its application. Des. Stud. 2011, 32, 521–532.
14. Liedtka, J. Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction. J. Prod. Innov. Manag. 2014, 31, 1068–1083.
15. Kelley, D.; Kelley, T. Creative Confidence: Unleashing the Creative Potential Within Us All; Crown Business: New York, NY, USA, 2013.
16. Schütte, S.; Fraefel, N.; Meinel, C. Design thinking in the classroom: An analysis of students’ long-term retention and application of design thinking concepts. Front. Psychol. 2020, 11, 2596.
17. Tsalapatas, H.; Heidmann, O.; Pata, K.; Vaz de Carvalho, C.; Bauters, M.; Papadopoulos, S.; Katsimendes, C.; Taka, C.; Houstis, E. Teaching Design Thinking through Gamified Learning. In Proceedings of the 11th International Conference on Computer Supported Education (CSEDU 2019); SCITEPRESS—Science and Technology Publications, Lda.: Heraklion, Greece, 2019; pp. 278–283, ISBN 978-989-758-367-4.
18. d.school. An Introduction to Design Thinking Process Guide. 2023. Available online: https://web.stanford.edu/~mshanks/MichaelShanks/files/509554.pdf (accessed on 28 January 2022).
19. Plattner, H.; Meinel, C.; Leifer, L. (Eds.) Design Thinking: Understand—Improve—Apply; Springer: Berlin/Heidelberg, Germany, 2011.

20. Tramonti, M.; Dochshanov, A.M.; Zhumabayeva, A.S. Design Thinking as an Auxiliary Tool for Educational Robotics Classes. Appl. Sci. 2023, 13, 858.
21. Bonwell, C.C.; Eison, J.A. Active Learning: Creating Excitement in the Classroom; ASHE-ERIC Higher Education Report No. 1; George Washington University: Washington, DC, USA, 1991.
22. Freeman, S.; Eddy, S.L.; McDonough, M.; Smith, M.K.; Okoroafor, N.; Jordt, H.; Wenderoth, M.P. Active learning increases student performance in science, engineering, and mathematics. Proc. Natl. Acad. Sci. USA 2014, 111, 8410–8415.
23. Vallecillo, N.R. Aplicación de Design Thinking Para la Sistematización de Procesos Artísticos en el Alumnado de Secundaria. Revista de Investigación en Educación. 2020, pp. 24–39. Available online: http://revistas.webs.uvigo.es/index.php/reined/article/view/2628 (accessed on 29 January 2022).
24. Mena, O.M. Design thinking: Un enfoque educativo en el aula de segundas lenguas en la era pos-COVID. Tecnol. Cienc. Educ. 2021, 18, 45–75.
25. Moreira, A.R.A. O Papel da Criatividade e do Design Thinking na Inovação; FEUP: Porto, Portugal, 2015.
26. Rocha, M.; Ferreira, A.; Moreira, A.; Gomes, T. Redução do Abandono Escolar Precoce-Uma Meta a Prosseguir, Estudos e Intervenções. RH+50. 2014. Available online: https://iefp.eapn.pt/docs/Combate_ao_abandono_escolar_precoce.pdf (accessed on 29 January 2022).
27. Pereira, M.; Cezareti. Evasão Escolar: Causas e Desafios. Revista Científica Multidisciplinar Núcleo do Conhecimento. 1, 36–51. Available online: https://www.nucleodoconhecimento.com.br/wp-content/uploads/kalinspdf/singles/evasao-escolar.pdf (accessed on 30 January 2022).
28. School Education Gateway, Practical Approaches to Early School Dropout Prevention. Available online: https://www.schooleducationgateway.eu/pt/pub/teacher_academy/catalogue/detail.cfm?id=227520 (accessed on 30 January 2022).