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Transforming our World through Universal Design for Human Development

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An environment, or any building product or service in it, should ideally be designed to meet the needs of all those who wish to use it. Universal Design is the design and composition of environments, products, and services so that they can be accessed, understood and used to the greatest extent possible by all people, regardless of their age, size, ability or disability. It creates products, services and environments that meet people's needs. In short, Universal Design is good design.

This book presents the proceedings of UD2022, the 6th International Conference on Universal Design, held from 7 - 9 September 2022 in Brescia, Italy. The conference is targeted at professionals and academics interested in the theme of universal design as related to the built environment and the wellbeing of users, but also covers mobility and urban environments, knowledge, and information transfer, bringing together research knowledge and best practice from all over the world. The book contains 72 papers from 13 countries, grouped into 8 sections and covering topics including the design of inclusive natural environments and urban spaces, communities, neighborhoods and cities; housing; healthcare; mobility and transport systems; and universally-designed learning environments, work places, cultural and recreational spaces. One section is devoted to universal design and cultural heritage, which had a particular focus at this edition of the conference.

The book reflects the professional and disciplinary diversity represented in the UD movement, and will be of interest to all those whose work involves inclusive design.

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Universal Design for Learning at University: Technologies, Blended Learning and Teaching Methods

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Abstract. After almost 10 years from the first report on the diffusion of the Universal Design for Learning (UDL) in Europe, didactic planning related to the UDL is slowly spreading in Italy, while research is still in its infancy; there is a lack of documented experiences and impact assessments, especially for higher education. International research discusses the opportunities to redesign learning environments to create equal access to education for all in higher education courses. In this paper we report a university teaching experience based on multiple means of Engagement, Representation, and Action & Expression. We have experienced active and inclusive teaching methodologies in dual mode with second year students enrolled in a course on "Teaching and Learning" of the bachelor's degree program in Education. The proposal repeats, with some improvements, a previous university experience of Flipped Classroom in distance learning. The paper reports the first results of the teaching innovation in progress. It investigates the students' perception about: 1) the attractiveness of the proposal compared to more traditional approaches; 2) their own learning paths; 3) their motivation.

Keywords. Universal Design for Learning, higher education, active learning, ICT

1. Universal Design for Learning

1.1. Principles of inclusive teaching

The Universal Design (UD), as discussed within the *United Nations Convention on the Rights of Persons with Disabilities*, is an inclusive design approach from the very beginning, as it supports methodologies that put the final users at the centre of the process. This approach "broadly defines the user. […] Its focus is not specifically on people with disabilities, but all people" [1] and it does not imply a basic standardisation, but an enhancement of differences when proposing inclusive products, environments, and services. In the field of teaching, UD principles translate into Universal Design for Learning (UDL), that promotes flexible materials and alternative activities for students with different abilities. The goal of UDL is to improve and optimise teaching and learning for all people, by valuing everyone's learning styles and supporting their different motivations.

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In the 90's the Center for Applied Special Technology (CAST), a non-profit education research and development organization in the United States, theorised the three main principles of UDL [2]:

- support recognition learning: provide multiple, flexible methods of presentation (the "what" of learning);
- support strategic learning: provide multiple, flexible methods of expression and apprenticeship (the "how" of learning);
- support affective learning: provide multiple, flexible options for engagement (the "why" of learning).

By 2018 the Guidelines developed by CAST were translated into several languages, including Braille code. They have been updated on the ground of recent research in the areas of education, cognitive science, psychology, and neuroscience, so that the third principle has become the first one: in fact, research has amply shown the importance of engagement and self-efficacy in learning [3]. These principles aim to break down barriers to learning through flexible and diversified teaching methods and proposals: as in architecture, teaching accessibility consists in offering to students different, but equally valid ways to gain knowledge.

About "Engagement" the UDL Guidelines highlight that "there is not one means of engagement that will be optimal for all learners in all contexts" [4]: among the ten points of this guideline, for the experience described in this paper we emphasize the importance of "optimizing individual choice and autonomy" (checkpoint 7.1) and "fostering collaboration and community" (8.3).

About "Representation" the Guidelines highlight that "there is not one means of representation that will be optimal for all learners" [4]: among the twelve points, we stress the importance of "promoting understanding across languages" (2.4), "illustrating through multiple media" (2.5), as well as all the references of the Guideline 3 (named comprehension), which aims to build deep knowledge through an active process involving each student.

About "Action & Expression" the UDL Guidelines highlight that "there is not one means of action and expression that will be optimal for all learners; providing options for action and expression is essential" [4]: there are nine points for this guideline, but we report the importance of "using multiple media for communication" (5.1) and "building fluencies with graduated levels of support for practice and performance" (5.3).

How is this possible? As Rose and Meyer argue [2], methodological flexibility and content adaptation according to the characteristics and preferences of the students require multimodal instruments; in practice, the UDL implementation in educational contexts is possible through the use of digital technologies: hypermedia; modularity, variability and transcoding [5, 6] are the most important characteristics of digital media that allow content personalization and different language convergence.

1.2. Universal Design for Learning in Italy

In 2013, when one of the authors defended her doctoral thesis on UDL, there was already a good culture of UD in Italy, especially in the field of technologies and by researchers dedicated to inclusion issues. In the educational field, those years were characterized by the debate between the concepts of *integrazione* and *inclusione*, whose terms, in Italian, have specific cultural references: in Italy, in fact, the culture of inclusion in education has a 50-year history. However, the UDL approach was not known and there were no

documented experiences, except for a few descriptions of pioneer teachers in blogs or social web groups and except for the first academic studies [e.g. 7], as reported in the European study on the diffusion of UDL at that time [8].

Since 2016 several studies have been published in Italian by publishers known to teachers; scholars are integrating UDL's operational lines into the national cultural and educational landscape. At the same time, the Ministry of Education began citing UDL as a framework for the implementation of an inclusive school curriculum, and some refresher courses for teachers were started by universities and training centres.

Compared to other approaches, we believe that UDL is having a fair diffusion in Italy thanks to its operability and strong connection with technologies, that make it appreciable for those who believe in the digital school opportunities.

To understand this interest, it must be considered that in 2020/21 there were more than 300,000 pupils with disabilities attending Italian schools (3.6% of those enrolled), around 4,000 more than the previous year (+2%)[2]: these figures have been growing in recent years, due to the increase in medical diagnoses and disability certifications. This increase prompts the school system to look for strategies and tools for everyday teaching. Moreover, inclusive education is among the priority goals of the 2030 Agenda (Goal 4) to "ensure inclusive and equitable quality education […] for all": it is an important issue for Italy, where 23% of people in the 18-24 age range have either dropped out of school or finished it without acquiring minimum basic skills[3].

1.3. Application in higher education

Data on early school leaving prompt us to look for strategies to involve and include students in higher education. In 2008 the US Department of Education published *The Higher Education Opportunity Act* which refers to UDL to improve student outcomes and success. The document confirms the UDL principles, with some adjustments due to students being older than those originally imagined for UDL. The experiences documented in the literature and on the web concern the use of the UDL framework for teaching various disciplines, ranging from humanities to science and technology, not only for students with disabilities or learning disorders, but also to achieve each student's learning goals.

It is often thought that inclusion in higher education is mainly related to accessibility and that it is enough to offer accessible materials to students with sensory disabilities or learning problems. According to UDL, accessibility is a necessary but not sufficient condition for breaking down learning barriers: students must also be able to manifest what they have learned and also apply it. This means that courses must be designed with a variety of training proposals, in addition to lectures and the use of textbooks: technologies can help this process, but it is necessary to be aware that digital tools are a support for the students, not for the teacher (e.g., in the creation of multimedia materials).

For several years, students have been taking notes on their own personal devices, despite sometimes university classrooms are not properly equipped (electricity, appropriate desks, widespread connectivity); using computers to take notes encourages sharing and exchange between students, but also the personalization of study materials. The use of technology for personalisation must now be transferred from the level of the

[2] Source: Istat. L'inclusione scolastica degli alunni con disabilità a.s. 2020-2021.

[3] Source: INVALSI. La dispersione scolastica in Italia 2021.

individual student to the course design by teachers: UDL can provide a framework, especially now that many courses are delivered in dual mode due to the health emergency.

The *UDL On Campus* website developed by CAST provides guidelines for developing curriculum and inclusive lessons from the course syllabus. An UDL-oriented syllabus clearly presents the lecturer and the course through different media (text, images, videos, …). At the beginning, the lecturer makes explicit the accommodations, states each goal to increase students' awareness and motivation to learn, includes a variety of materials to increase the options of representation, provides clear assignments and assessments that consider possible barriers, states teacher's expectations and students' responsibilities. The website provides many other operational guidelines for designing a course according to the UDL perspective, e.g. on the definition of learning goals, on how to enhance learning by valuing its emotional dimension, on the evaluation of the learning process, on how to work on increasing the students' executive functioning, on how to promote peer learning, also in relation to the type of teaching environment (synchronous, asynchronous, face-to-face).

2. Universal Design for Learning in practice

2.1. Context

During a course on "Teaching and Learning" for the students of Education Sciences at the University of Bergamo, we have experienced active and inclusive teaching methodologies with students enrolled in their second year. The degree course is aimed at training professionals capable of accompanying the development of boys and girls in early childcare services: for the 2021/2022 academic year, 296 students are enrolled in the virtual classroom on Microsoft Teams, the digital platform used by our university to deliver courses in simultaneous dual mode due to the COVID emergency (some students attend in-person and others remotely). Among the students, there are people with a university personalised learning plan, students with Italian as L2, and working students.

The course consists of two modules for a total of 68 hours of lessons and workshop activities: this paper will focus on the first module "Methodologies and teaching in early childhood" (and workshop) which took place in autumn 2021. Among the general goals of the course: defining the concept of teaching, understanding strategies for the development of teaching with reference to the main collaborative and cooperative forms of organization of educational and teaching activities, exploring methodological and technological approaches for teaching, acquiring a scientific vocabulary in relation to teaching contents.

In addition to MS Teams, aimed at delivering lectures in synchronous mode and at archiving video recordings to facilitate working students or students with real-time connection difficulties, university lecturers may exploit the Moodle platform for e-learning course management. The critical health emergency and the possibility of dual mode lectures prompted most students to take advantage of distance learning, instead of attending lessons in person. This fragmented context imposed a flexible teaching approach and reflection on the quality of the use of digital tools in dual mode teaching.

2.2. Method

In the following we describe the teaching actions taken, based on the UDL approach at University: theoretical lessons supported by technologies; synchronous and asynchronous modes of attending lessons; use of different communication tools; active research on the website in real/virtual classrooms through a BYOD approach; sharing ideas and brainstorming activities; collaboration platforms; Social Networks.

The proposal repeats, with some improvements, a previous academic experience of Flipped Classroom (FC) in distance learning [9]. This time the FC methodology is envisaged as one of the teaching actions to propose different ways to support recognition learning, strategic learning, and affective learning. Others will be described in the "activities" section.

A quantitative and qualitative survey detected the students' perception of the teaching methods for this course, with main focus on the use of active teaching aimed at breaking down learning barriers, in the UDL perspective. The results deepen those of the 2020/2021 experience: at that time, 381 volunteer students participated in the FC project (out of a cohort of 513 enrolled) and 307 answered the questionnaire with encouraging results that prompted us to propose the experience to the students of the following year, with more focus on UDL practices. This year the students who took part in the FC project were 194, distributed in 56 groups; 163 volunteers responded to the anonymous questionnaire which was also open to those who did not take part in the FC-based group work (12 respondents among them).

The questionnaire proposed three questions about the learning experience: the first one investigated the students' perception of the effectiveness of the course in general through answers to 8 items on a 5-point Likert scale (strongly agree, agree, undecided, disagree, completely disagree); the second one investigated the perception of the students who participated in the group work regarding the effectiveness of this approach (8 more items, same Likert scale); the third question, free and open, on the opportunities or criticalities of the course. At the end, three profiling questions (gender, age, length of professional experience in education). The data we propose in the next chapter have been analyzed with descriptive intent.

2.3. Actions

In order to guarantee a sound UDL proposal, the course included four kinds of action: 1) frontal theoretical lessons to provide the fundamentals of teaching and the basic vocabulary (with an introduction to the UDL framework); 2) brainstorming on collaborative platforms to stimulate student participation on educational issues; 3) group projects, according to the FC methodology, to study and try approaches and educational actions aimed at children in the 0-6 age range; 4) seminars and workshops with education professionals: a nursery coordinator, an expert in art and museum services for children, a musician in nursery schools, two technology experts (coding and educational robotics, inclusive technologies).

In general, to ensure the variability of the media, we used a wide range of the Microsoft Teams functions (audio, video, chat, emoticons), and of the Moodle e-learning functions, as well as collaborative platforms (Padlet, Google Drive), and a virtual reality environment (ArtSteps). To foster deeper knowledge building (Guideline 3), we set up a multimedia collaborative summary map to summarise the course key concepts and link

them together; the concepts were illustrated through multiple media (checkpoint 2.5), also through web videos in English with Italian or English subtitles (2.4).

In this paper we focus on Action 3: in continuity with the experience of the previous academic year, the direct goals were to encourage active participation by students, to support their interests, and to enhance the participants' professional and extra-academic experiences. The indirect goal was to experiment with an active teaching methodology and assessing the students' opinions on the perceived increase in knowledge, research and digital skills and on the possibility of expressing themselves according to their interests and preferred modes of expression.

The students were invited to participate in a project divided into three phases: 1) definition of topics; 2) group work; 3) presentation and discussion. Participation was optional and provided for the availability to work in self-managed groups formed of 3 to 6 members: 194 students took part, divided into 56 groups.

Through computer-mediated brainstorming techniques [10] the students, with the teacher as facilitator, identified 8 project macro-themes relevant to the 0–6 age group and the didactic perspective as constraints: environment and animal world; body and mind; inclusion and interculture; verbal and non-verbal communication; storytelling and reading; art, music and technology; sport; history and territory. The students were therefore asked to independently form interest groups and to register via an online questionnaire by communicating a project title referring to one of the 8 macro-themes. This action was aimed at optimising the individual choice and autonomy (7.1) and fostering collaboration and community (8.3): despite the dual mode of the lessons, thanks to the informal networks among the students and their ease of communication through social media, no organisational barriers were perceived, and teacher interventions were not necessary in this first stage.

In the second stage the groups worked independently, outside of scheduled class hours, to focus on the chosen theme and deepen the related topics both from a theoretical point of view (research of sources, analysis of documents, etc.) and from a practical one, with the possibility of proposing or documenting educational and teaching activities aimed at children aged 0 to 6.

In the following weeks (third stage), the groups publicly presented their work using tools of their own choice (5.1): PowerPoint or Prezi presentations; videos of activities conducted with children; self-produced videos with examples of educational and teaching proposals; photographs of materials, environments, and activity-related settings. At the end of each lesson dedicated to the presentation of the works, the teacher encouraged discussion with questions, requests for clarification, narration of experiences, inviting participants to do the same. The chat proved to be the favourite tool for questions, comments, or observations from peers. The presentations of the first students served as a model for subsequent performances: the teacher's suggestions on communication style and adjustments to the content gradually helped the subsequent groups to design their own presentations (checkpoint 5.3).

3. Results

At the end of the first part of the course, 163 students answered the questionnaire: 95.7% are women; 85.9% are aged 18-24, 12.3% are aged 25-34, 1.2% are aged 35-44; 0.6% are over 45 years old; 31.9% currently work in the educational field. With reference to professional experience, 45.4% of the students reported that they have never worked in

education; 15.3% have worked in the sector for less than a year; 27% have 1 to 3 years of experience; 9.2% have 3 to 6 years; 3.1% more than 6 years. Compared to the previous year, this sample has more men among its respondents (+3.6%), a greater proportion of the 25-34 age group (+ 2.5%) and less work experience in the educational field (+7% have never worked or have only this year started a professional activity in the field of education). In general, the students of this course are a heterogeneous group in terms of age and professional experience, with a strong female component.

Students' responses regarding their perception of the attractiveness of the proposal, the self-assessment of their own learning paths and their motivation show a general appreciation for the approach of the course: for 93% of the students the course increased their knowledge and offered useful insights for their studies; for 85.8% the workshop approach through group work favoured the active participation of students and facilitated the attendance of the course (78.5% strongly agree or agree; 17% undecided): the topics chosen by the colleagues were stimulating (97.5%) and made it possible to discover new things (100%).

Regarding the idea that the teacher's role as mediator has been enhanced by this teaching approach, students are more undecided (11%), but most of them agree with this hypothesis (86.5%). 94.4% think that mixed teaching methodologies (lectures, videos, sharing platforms, workshops with multimedia tools) favoured their learning: this is an interesting aspect that we decided to investigate this year, and which was not considered in the previous questionnaire.

Specifically, for the group work 151 students responded: for 96% this proposal increased their knowledge and allowed them to deepen actions and didactic tools for children 0-6 years old. As far as the opportunities offered by group work to experiment with research actions and tools (defining the focus, searching for sources, etc.), 91.4% of the students agree, while they are not sure with the idea that this activity increased their digital skills (61.1% strongly agree/agree; 26.9% undecided; 11.8% disagree). Interesting results emerge from the perception that this method has enhanced the students' work and extra-university experience (78.1% strongly agree/agree; 18.5% undecided) and encouraged cooperation and discussion with colleagues (90.7% strongly agree/agree).

In percentage terms, the results of the questionnaire are in line with those of the last year, except for the data on the perceived increase in digital skills, for which it is possible to highlight a general decrease in the agreement in favor of slight increases in undecided or for those who disagree (-10.8% strongly agree/agree; +7.8% undecided; +3.7% disagree respect to last year); however, these differences are not statistically significant.

Two new questions, with more focus on the UDL framework, were added for the students who participated in the group work: "leaving space for my interests [the group work] kept my motivation high" (88.8% strongly agree/agree; 9.2% undecided; 1.9% disagree) and "[the group work] favoured personal and more functional ways of expression and communication for me" (90% strongly agree/agree; 10% undecided): these positive perceptions encourage us to continue these actions, addressing the improvable aspects that have emerged.

Among the challenges expressed by students in the qualitative section of the questionnaire: some respondents stated that some colleagues did not cooperate in the group work, some students would like more time for discussing the projects in the classroom, three students would prefer more face-to-face theoretical lessons and three others would prefer not so schematic slides, as well as their presentation according to the order of the book, others would like more student involvement.

We believe that some of these statements are conditioned by expectations that have adapted to a traditional way of teaching in higher education (frontal theoretical lectures, textbook, slides full of content, etc.), in any case, this once again demonstrates the variability of students and the challenge of findings solutions for all.

4. Conclusion

University students positively evaluate active teaching methods, both when the lessons are completely online (2020) and in dual mode (2021). The results show that active participation, discovery through confrontation with peers and freedom to choose the topics of greatest interest are significant aspects for students: this confirms the importance of the "engagement" and its variability, in UDL perspective. Even though all actions (both "presentation" and "expression") were technology-mediated, only just over half of the students recognised that the activities carried out increased their digital skills. Probably teacher mediation and metacognitive teaching activities could make some key competences more explicit.

The main barrier reported by the students concerns the context rather than the method: the short time available to the groups seems to be the main limitation of this active learning experience. We are aware that the UDL approach requires system changes, however we have experienced a different way of designing a university course, maximizing the opportunities of various technologies. We still need to experiment with an effective way of encouraging student-teacher exchange and monitoring progress along the way (checkpoint 6.4), to improve the sense of self-efficacy: the large number of students enrolling in a lesson and the time required for teachers to coordinate the activities can limit the diffusion of UDL practices in universities, but it is an approach we want to follow.

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