

Students with Learning Disabilities at University. Design of a Protocol for Usability of Teaching and Individual Study

Studenti con Disturbi Specifici di Apprendimento all'Università. Costruzione di un protocollo per la fruibilità della didattica e per lo studio individuale

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The Learning Disabilities (LD) creates a real difficulty in the study, because they assume the evolution of certain prerequisites and involve a number of functions that impact against the decoding of the alphabetic code. By definition they have an evolutionary nature, ie they vary with the age of the person. This article explores the characteristics of LD in adulthood and the impact with the university teaching. It presents the results of an interdisciplinary project in progress (educational, medical and engineering area) at University of Florence, suitable to provide a procedural protocol for the usability of teaching in university and to support individual study. The purpose of project is to design of a protocol for usability of teaching and individual study, even at university level as indicated by the recent Italian legislation (Law 170/2010).

Key-words: learning disabilities, inclusive education, special education needs, didactic tools, university

abstract

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III. Esiti di ricerca 125

L'articolo è un lavoro globale, frutto di interscambio culturale e professionale tra gli autori. Tuttavia, per ragioni di responsabilità scientifica, si rende noto che la Premessa è di **Sandra Zecchi**; il paragrafo 1 e le Conclusioni sono di **Tamara Zappaterra**; il paragrafo 2 è di **Claudia Zudetich**; il paragrafo 2.1 è di **Costanza Rossi**; il paragrafo 3 è di **Gianni Campatelli, Lisa Ariani e Andrea Meneghin**.

Premise

This paper refers to an ongoing study under the coordination of CESP (Study and Research Centre for Disability Issues of the University of Florence). CESP is the institutional center that offers services and supports to disabled students in Florence University and it is also the institution devoted to the applicative measures of Italian law 170/2010¹ in the field of Learning Disabilities (LD).

LD problems are relatively new for the education at university level, and they have therefore pushed teachers and researcher to define research projects, both scientific and pedagogic, aimed to suit the needs of LD students. In such perspective, due to the high variability of LD manifestations and degrees and also to the peculiar students' features, a multidisciplinary approach and strategies are required to identify personalized educational paths for LD students while respecting, the peculiarity and the objectives of the different university courses.

CESP offers to LD students, such as to disabled students, a series of services including incoming orientation and job placement support, tutoring, technological and didactic tools, mediation with the teachers.

1. Theoretical framework. Dyslexia in adults

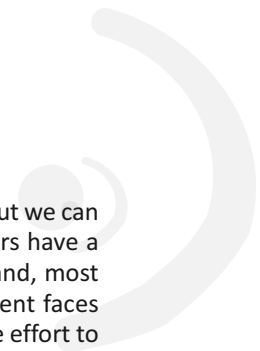
To cope with the LD in schools is a problem that Italy has taken over the last fifteen years, slightly late compared to the international scenario. The reason is due to phonological features of the mother tongue of Italian pupils, a language with orthographic transparency, which means that the almost perfect correspondence between grapheme and phoneme in Italian moves the bar or the attention span higher than in countries with a language spelling *non-transparent* based.

Such a delay raised awareness of the teaching staff in order to Learning Disorders only recently. In fact, the law that protects the LD students in Italy has recently established (Law 170/2010), which has led to the awareness of teachers to be in front of an organic-based disorder but with evolutionary characteristics, even at 5 years by law, it is not a widespread awareness. This aspect is however of considerable importance. Learning Disorders are specific difficulties but evolutionary in the sense that the difficulties are attributable to a pathological frame, but the same difficulties in an individual pupil or student vary with the age and evolution of the disease (Dehaene, 2009; Gérard, 2011).

The LD is then partly biologically determined, but partly depends on the circumstances of the environment, such as the time of diagnosis, the impact school, the type, frequency and enhancement of interventions which the person has benefited. The literature notes the repercussions and the risks that these disorders can also result in emotional-affective sphere. In fact, beyond the impact on reading and writing, the LD have consequences more generally on the personality.

At school we have to face the problem from a technical point of view, using

1 L. 170/2010 "Nuove norme in materia di Disturbi Specifici di Apprendimento in ambito scolastico".



methods and learning strategies that are appropriate to the problem, but we can not ignore, as teachers and the training providers, that these disorders have a big impact on the well-being of pupil, on his quality of life at school and, most generally, on self-perception and self-esteem. Daily the dyslexic student faces the difference, the incomprehension, the failure. He must make a huge effort to stay abreast of and he may have the impression of not succeeding because the gap between himself and fellows is likely to increase with time. Indeed, we can count the characteristics of the disorder in adolescence and adulthood. These studies are less numerous than those relating to the characteristics of the disorder in childhood (Hatcher *et al.*, 2002; Reid *et al.*, 2006, Genovese *et al.*, 2011).

At the secondary school, reading aloud it is no longer essential and the student, if it was detected early, has already had the benefit from rehabilitative interventions. Also factor maturation has run its course, so the specific errors of LD, omissions and replacement, are less frequent because the time and effort have left a mark, but the reading remains an arduous task that requires a major cognitive effort. Some spelling errors remain and he needs additional time to achieve the same delivery mates. In fact, the difficulties of reading automatically slow down the pace, and jeopardize its purpose, to acquire information. Still too much energy is channeled in decoding the written code and not enough on content. The dyslexic student need more time for study and greater application to prepare for school test, because the amount of information that must be handled in secondary school is much higher than in the previous cycle (Hatcher *et al.*, 2002; Pannetier 2010; Marzocchi *et al.*, 2011).

Another notation must be made on the objectives of learning in secondary school. If the primary school goals concern learn to read and write and produce the language proper and independent, at the secondary school and also at University level the students must handle a specific language proficiency for each subject. Writing correctly spelled and the appropriate use of such specific vocabulary are a further challenge for the dyslexic student. Even in this age, the psychological effects of difficulties related to the LD are important. The adult dyslexic, more and better than child, captures the differences between his performances and those of other students. He continues to work harder, putting more effort and commitment to succeed in school achievement. Sometimes, when the effort seems enormous and there is misunderstanding on the part of teachers and the family, absenteeism from school or behavioral difficulties can produce school drop-out. Sometimes early school drop-out is just the result of a waiver due to the excessive increase of schoolwork and the amount of materials to be read (Zappaterra, 2012; Trisciuzzi and Zappaterra, 2014).

We know that LD have an evolutionary nature, as mentioned above, that vary with the age of persons and thanks to rehabilitative interventions, however they are permanent disorders. In the adult, the greater track of LD is constituted by spelling errors, rather than by the slowness of reading or of writing. If the difficulties in spatial orientation in the writing of letters and numbers have almost disappeared with practice or with the use of compensatory measures such as the computer, the errors due to confusion phonological persist and are manifested clearly in the spelling difficulties. There are areas in which the LD is not a difficulty, but where on the contrary the atypical lateralization of dyslexic becomes the basis for excellent ability visuospatial, mathematical and musical. Some

statistical studies have shown that there are many left-handed and dyslexic among architects, designers and sportsmen, i.e. in activities that require certain visuospatial abilities (Davis, 2004; Pannetier, 2010). Continuous frustrations lead to the consolidation of the sense of learned helplessness and the reduction in the level of self-esteem, which can give rise to the emergence of relationship difficulties such as anxiety, depression, psychosomatic disorders, behavioral problems (Lami *et al.*, 2008).

Therefore, even in case of late diagnosis, a specific didactic intervention performed to secondary school may be effective. We must take account of a number of priorities: if the primary school is important that the student reads fluently and correctly and understands the text, to secondary school and university priority becomes the method of study, because the workload is remarkable. Even the autobiographical testimonies reveal that the method of study would be the key, because these students are forced to apply for many more hours than their peers do. We must therefore find the most effective strategies to find the pupil together strategies to study the different materials, introducing, if necessary, compensatory measures such as digital books, speech synthesizers and software to build maps that allow autonomy in the study. Normally the student with LD has a support for homework, but autonomy is a need that from the age of secondary school starts to appear and becomes a target of evolution. It can only be achieved through a process of awareness of the strengths and weaknesses and through knowledge of compensatory instruments in use (Reid *et al.*, 2006; Marzocchi *et al.*, 2011).

Only this awareness will enable success in university curricula. If the school is called upon to make a strong contribution in this direction by drafting a customized curriculum that covers the adaptations best suited for each student with LD, all this in the university must be requested independently by the student. Although Law 170/2010 also addresses the university student, universities are now taking the first steps to match the educational rights of these students in adulthood. This article, like other similar studies in Italy (Genovese *et al.*, 2010; Olofsson *et al.*, 2012; Dettori, 2015) presents a proposed protocol for the management of teaching and usability self study from the survey of their special needs: flexible times, examination programmed with the teacher, reduced amount of exercise, consultations of drawings, diagrams, concept maps for the study, support tools of information and communications technology. The aim is to draw up guidelines for the dyslexic student at the University for use by students, teachers and administrative staff.

2. Project plan

The Italian national education system, due to the Law 170/2010, have to apply inclusive protocols for student with disabilities. These protocols have to be adopted by schools and universities and they encourage the use of teaching methodologies and strategies for students with special needs in order to promote their school success and to ensure the education processes.

The increasing number of university students with LD is a consequence of the education tutelage promoted by the law 170/2010. As a consequence, there

is a need of specific support strategies and personalized teaching models that allows to use compensatory measures, tools and assessment modalities, suitable for specific study courses. For compensatory measures means all those tools that do not potentiate the task from the cognitive point of view but which serve to relieve strain respect to the specific difficulty that derives from the LD.

The research project “Students with Learning Disabilities at University - Realization of a Protocol for Usability of Teaching and Individual Study” is part of this kind of approach. The project is an ongoing study under the coordination of CESPD (Study and Research Centre for Disability Issues of the University of Florence) and it is financed by “Cassa di Risparmio di Firenze”.

The project began in January 2015. Its purpose is to ensure a full application of education law for university students with LD. Its specific objective is to create a teaching-management protocol for the inclusion of students with LD inside the University of Florence.

It has been possible to reach this objective thanks to an interdisciplinary approach which offers an integrate view of the object of research, on the perspective of the opportunities and the criticalities. This is the reason why the research team members have different competencies, with pedagogical, sanitary and engineering skills. This allowed, from the early steps of the project, the integration of different observation levels in order to understand and fit the needs of students with LD from several points of view and to develop aimed to the achievement of their welfare within the University path.

2.1 Project phases

During the first step have been performed a study of the previous data of students with LD enrolled at University of Florence and a detailed research on the state of the art. This step also enabled the research team to create a group of students to be involved in the project in order to better acquire, in a structured manner, their needs and requests. Some other associations as the Florence section of *AID (Italian Association for Learning Disabilities)* and *Pillole di Parole*, an association that gathers students with LD, were also involved to create the student group. For this reason, a meeting for project’s presentation took place in the library *Libriliberi* in Florence which currently hosts the meetings of the two above-mentioned associations and owns a publishing house that produce texts about those specific topics.

At the end of this step, a group of 43 students provided their contacts in order to participate to the project research initiatives.

During the second step a data collection and a student specific needs analysis were performed, thanks to the presentation meeting, an on-line questionnaire for the students and four focus group took place. The results of this steps are presented in the following paragraph.

At the end of the final steps of the Project, the following outcomes will be delivered:

- a University Guide Lines for teachers, university staff and students. It should offer good praxis and indications useful for students career, educational offer, teaching activities and university services efficiency;

- a web site, which will be part of the institutional University site, built according to the usability and universal design standards, suitable for students with LD. The web site will also be addressed to teachers, university staff and students and should offer information and suggestions about services, requests, assistive materials given by the University to students with LD. In particular, it should help the students from the beginning to the end of their university career and the teachers to have an effective approach with students with LD.

The project is currently in progress. The University Guide Lines and the web site will be delivered within the very first months of Academic Year 2015-2016.

3. Tools

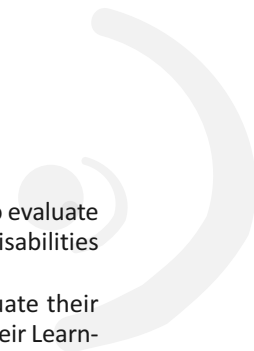
3.1 Questionnaire definition

From the earliest meetings of the working group it arises the idea to submit a questionnaire to students with Learning Disabilities. Starting from the research plan, this kind of entry survey would have permitted us to reach rapidly a wide number of goals:

- to establish a first interaction with students;
- to have an early feedback from students about the actual aims of the project, based on the number and type of the received responses;
- to collect information regarding the personal student's experiences, in order to better organize the following steps of the project;
- to test the students' Learning Disabilities knowledge and awareness, in order to have a future comparison on the same topics at the end of the project;
- to use the questionnaire as a test itself in order to verify, where possible, the layout and contents compliance level.

The survey was titled "Inquiry on students with Learning Disabilities in the University of Florence" and the questions had been grouped in the following sections:

1. "Biographical Information", in which information about age, gender, year and kind of university course and other previous educational experiences were requested.
2. "Diagnosis and treatment", where the students were asked to indicate the kind of Learning Disabilities, the presence of co-morbidities and the age of the first Learning Disabilities diagnosis.
3. "Degree of satisfaction of various aspects of university life", where the students were asked to evaluate different aspects of their university life as bureaucracy, lessons, entrance test and exams organization, usability of the university web sites, quality of learning material.
4. "Relationships inside the University", where the students were asked to evaluate their degree of satisfaction in their relationship with professors, university personnel and other students.

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5. “Supports available in University”, where the students were asked to evaluate the supports provided from the University: the CESPd Learning Disabilities help desk and the tutoring services.
 6. “Tools and instruments”, where the students were asked to evaluate their use frequency of technological tools and software able to support their Learning Disabilities and the degree of satisfaction achieved in their use.
 7. “Individual strategies”, the students were asked to evaluate the efficacy of their personal strategies used to improve the learning.
 8. “Feedback”, the students were asked to give a feedback about the questionnaire itself, starting from their specific issues, giving an assessment of the relevance of the content, the chosen language and the layout.

A total of 24 questions were submitted to participants: mainly multiple-choice ones and, only where necessary, open-ended questions. The aim was to achieve easily grouped and quantifiable answers, together with examples, motivations and students personal observations, otherwise undetectable.

For the multiple-choice questions, a four-value Likert scale was used, where the choice of a response with an increasing value always corresponded to more positive item evaluations.

The questionnaire was anonymous and it was submitted online to a chosen group of students with different Learning Disabilities, using an email invitation containing the link to the questionnaire web page, a personal password and some synthetic compilation instructions. Further explanations and clarifications were also provided to students during the first meeting with the research group in which the whole project was presented.

The questions were formulated using, whenever possible, a Learning Disabilities friendly language:

- short sentences;
- coordinated sentences rather than subordinate ones;
- grouped questions for thematic areas;
- simple vocabulary.

For the same reason, the questionnaire layout was created according to the following rules:

- large, sans serif fonts;
- targeted use of capital and bold letters to emphasize the logical structure of the text;
- alignment of the text to the left;
- no use of hyphenation;
- choice of not too contrasting colors for text and background, (no black characters on a white background).

The choice of the final graphic form - which involved the use of the font Verdana dark gray on a beige background - was made based on the evaluation given by members of the Florentine section of the association AID to five graphic evidence submitted respecting different combinations of the rules explained above.

3.2 Questionnaire results

The invitation to participate to the questionnaire was sent to a group of 43 students enrolled at University of Florence with a learning disability certification. We obtained 26 answers (60% of the total amount).

The average age of students is approximately 21 years old; they received their first Learning Disability diagnosis when they were, in average, 12 years old. Between the 26 answers only 13 (50%) declared to be in contact with organizations representing the interests of people with learning disability.

Despite the small sample size, it must be noticed that there is a significant percentage students enrolled in the School of Humanities and Education (46%), highlighting that this field of study, directly connected to their personal problems, constitute a prime choice for students with learning disabilities.

An extract of the main data emerging from the responses received to the questions were summarized in Tab. 1, where some of the answers to multiple choice four-value (with 1 meaning not satisfied and 4 meaning fully satisfied) Likert scale questions are reported.


Biographical Information - Diagnosis and treatment	Values
Gender	Female 58%, male 42%
Mean age	20.92 years
LD first diagnosis mean age	12.31 years

Satisfaction of various aspects of university life	Mean value	Pos. Answers
Entrance test and exams organization	2.65	11
Lessons slides	2.64	9
University web site	1.88	18
Available digital texts and multimedia	2.70	10
Exams tests and worksheets	2.14	15
LD helpdesk & office	2.52	9
Faculties LD in charge person	2.47	11

Relationships inside the University	Mean value	Pos. Answers
Professors	2.88	7
University personnel	2.61	10
Other students	3.21	6

Instruments available inside the University	Mean value	Pos. Answers
Book digitalization service	1.50	15
PC ad hoc	3.22	2
Smart Pen	1.25	4
Tablet with LD apps	2.70	4
E-book reader	2.00	3
OCR software	1.67	5
Text-to-speech software	2.38	4

Tab. 1: Summary of findings from "Student survey DSA University of Florence."



Analyzing the results, the main critical items are the following:

- the University of Florence web site (mean value of 1.88);
- the online (mean value of 2.19) and paper (mean value of 2.21) forms;
- the exams and test worksheets (mean value of 2.14).

The degree of satisfaction about the relationship with professors (mean value of 2.88), university personnel (mean value of 2.61) and other students (mean value of 3.21) is high.

The questionnaire received a positive feedback from the students. In particular, the layout received a mean value of 3.38, the contents a mean value of 3.35 and the easiness of use a mean value of 3.77.

Other results are explained in the following paragraph of this paper.

3.2 Focus groups

Once analyzed the results of the questionnaire, the investigations on the needs of students with Learning Disabilities continued by means of four focus groups. The aim was to investigate some of the most critical items perceived as a priority by the students, which, at the same time, are found to be actually improvable elements during the following steps of the Project. As a result, the following areas of analysis were identified:

1. the website of the University: when the students with Learning Disabilities were asked about their degree of satisfaction on various aspects of their university life, it received the lowest mean, equal to 1.88. The decision to carry out a further study on the website is also linked to the fact that one of the final outcomes of the project will be a DSA-friendly website;
2. the relationship with the professors: although judged satisfactory in terms of interpersonal relationships (mean value of 2.88), and in terms of teaching support tools (mean values for slides is 2.64, for available digital texts and multimedia is 2.70 and for exams procedures is 2.14), had the higher number of issues in the open-ended responses, the relation with teachers revealed a widespread behavior heterogeneity;
3. the teaching support tools: the most relevant results was, surprisingly, not the level of satisfactory use but rather the low level of knowledge and use by the students themselves, in many cases less than 50% of the total students responding to the questionnaire;
4. the support services provided by the University: students with Learning Disabilities, often did not know their existence or, in many cases, judged them unsatisfactory.

For collecting data during the focus groups it was decided to use a method typical of the Quality Function Deployment (QFD), a tool originally used for quality management, whose versatility makes it easy to use in a number of different contexts. In fact, since each set of objects and people interacting with each other can be considered a system and since any sequence of activities oriented to

achieve a purpose can be considered a process, it follows that the theoretical bases and methods developed from quality engineering can also become functional in other, heterogeneous areas.

Specifically, the used method was a simplified correlation matrix, a grid where, after identifying the customer (in this case the focus group participating students, with the guidance of some moderators) and the critical elements (the so-called VOC, voice of customer) relating to the scope of analysis, the possible solutions (so-called CTQ, critical to quality) for each VOC are defined. The result is a matrix in which each VOC is associated with one or more CTQ. During the four focus groups, moderators and students have therefore worked in teams to build four correlation matrices, one for each of the chosen areas. The matrix definition was made in real time, using a wide screen to display all the steps.

The time for each focus group was limited to 30 minutes, including introduction, VOC collection and reorganization (to eliminate repetitions, not relevant items, etc.), CTQ collection and final construction of the matrices. Obviously all matrices were further ordered in a more organized way in a subsequent debriefing, exclusively reserved to moderators.

Each focus group was attended by two moderators, two observers and a working group of 8 students. This latter number is judged to be suitable, as a result of statistical studies available at the state of the art, to determine at least the 90% of the relationship issues between the users of a system and the system itself, as shown in Fig.1.

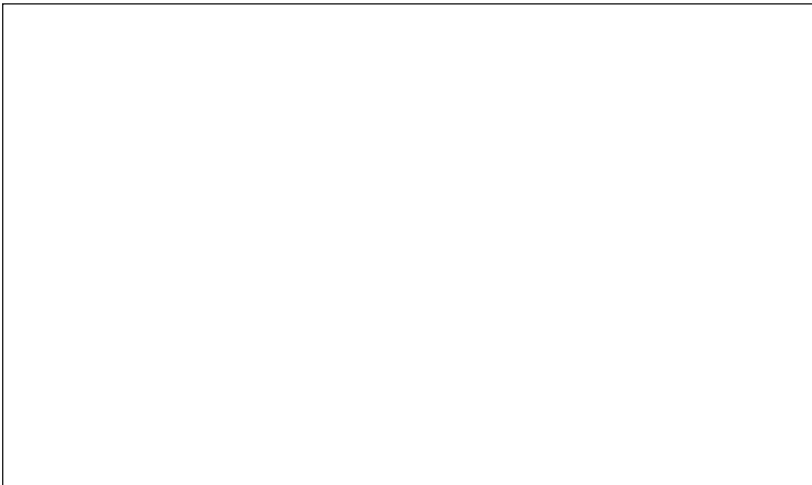


Fig. 1: Number of users to define issues with a system

The final version of the correlation matrices is shown in Figure 2, where, as an example, the result obtained at the end of the focus group on teaching support tools is shown. The X in the matrix defines when a relationship between a VOC and a CTQ exists: There is at least a CTQ for each VOC and, at the same time, a CTQ can solve more than one VOC. It cannot exist a VOC without CTQ: in this case, a critical element would not have solutions.

Organizing the matrix in a coherent way, specific areas of interest can be easily defined. For example, in Fig. 2, the light blue area shows the need to invest in training and information for all the people involved in the University system: teachers, students and University staff.

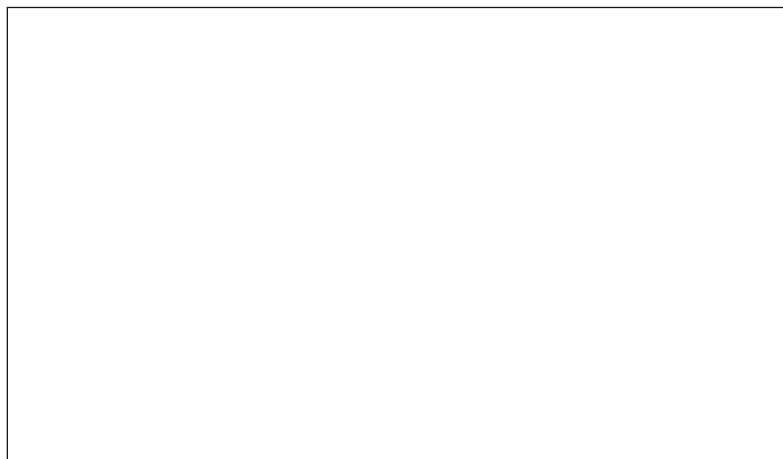


Fig. 2: Simplified correlation matrix for teaching support tools focus group

The analysis of the correlation matrices permitted to better define the following project steps towards some specific items, directly obtained from the CTQ analysis. In particular, the main results could be summarized as follows:

1. the legislation alone is not enough to ensure that students with Learning Disabilities a full integration within their university career. The laws must be associated to guidelines and to good practices handbook;
2. there is a need to invest in training and information processes, able to “educate” all users to relate properly with each other and with the available educational tools;
3. as a consequence, a homogeneous behavior policy has to be promoted in the relationship between teachers and students: teachers and students need to know what they can get one from each other but also what are the limits of their possible requests;
4. a website that collects guidelines and good practices handbook is mandatory, it must be structured in several levels of interpretation (for teachers, for students, for the university personnel involved with students) and above all it must be easily usable by the “weaker” users, the students with Learning Disabilities themselves, with ad hoc contents and layout;
5. some compensatory easy-to-use instruments must be provided, not affected by a technological obsolescence, which effectively would make them quickly unusable.

Conclusions

From the survey questionnaire and focus groups we can already deduce the important considerations for further work, although it is only the half the project. Five years after Law 170/2010 University institutions are not yet fully able to match the educational needs of LD students' study. But even these students aren't sometimes aware of their rights. We need to invest in global educational processes at all institutional level in order to spread knowledge about the needs of people with LD in adulthood.

The University has a specific responsibility in this direction, it must have teachers trained, they have to know the rules and the results of studies with scientific evidence around the theme of LD and their characteristics in adulthood. The teachers have to be able to implement a university teaching LD-friendly and know how to adopt specific protocols to which all students with LD can be accessed directly in the form systematized and not just occasionally and sporadically. This is in fact the purpose of this project.

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