

Osama.o "Peer learning" is an example of a pedagogical model in which students achieve subject competence together and actively learn with and from each other in both theoretical and practical sections (Hassan, 2014). In this type of learning, the students are responsible for their own learning. As peer learning can stimulate self-directed learning, the problem of reading and writing difficulties can be eased if evaluation take place continuously in order to develop the best learning method over time (via peer learning) that can be considered comfortable for dyslexics. Note, again, that these learning strategies could be designed so that no time pressure occurs during educational activities, because time pressure can reinforce dyslexia symptoms (Skeide, 2022).

4.3. Zone of Proximal Development

One of the aspects of learning that the sociocultural learning theory developed is the ZPD (a Zone of Proximal Development) or the closest zone of development (Vygotsky, 1986). This focuses on the opportunity for development that the student can achieve on his or her own, and what he or she can manage with the support of peers or a teacher. In other words, the ZPD can be expressed as the distance between what an individual can perform alone and what he or she can do in collaboration or under the guidance of a more knowledgeable person/tutor. The moment when the student acquires a certain knowledge concept does not denote the end of the development of this operation or of the concept; it is only the beginning. The ZPD is thus intimately connected with the possibilities of learning (Hassan, 2011). Against this background, it is the teacher's role to discover the student's ZPD in order to be able to build on the following steps for future teaching strategies. Artefacts and participation in activities (which were previously reviewed) can thus be adapted according to the specific ZPD of the student with dyslexia. In this context, the teacher can:

- o structure the tasks so that the time aspect does not become decisive, because students with dyslexia need plenty of time compared with normal students.
- o support students in identifying the problem and how to solve it, as well as support in the form of cognitive aids/artefacts.
- o support students in developing independence and self-esteem, for example, through increased involvement in laboratories or discussions in groups/seminars.
- o encourage students to ask questions about the teaching subject if they has difficulty understanding. This includes naive questions or questions that are taken for granted by ordinary students.
- o plan for several meetings with students with dyslexia during the course to map out the learning level and identify the students' ZPDs, as well as to get feedback on teaching methods. In return, universities must be able to support the teacher with appropriate resources for this.

5. Learning model for problem-solving

Within the socio-cultural perspective, the role of the teacher is to guide or supervise students in their journey to acquire knowledge. In this context, a learning model for problem-solving is proposed as shown in 3

Osama.A.B. Hassan Social Sciences & Humanities Open 8 (2023) 100718 problem. What are the reasons that make him or her unable to solve the task? Do these relate to reading comprehension or their own understanding of the subject? If the student cannot identify the problem on his or her own after many attempts, this must be done with the help of the teacher. Therefore, it is important that the right questions are asked so that the problem becomes well defined and easier to solve. The next step will be to describe the problem and present the possible approaches to achieve a solution. The teacher explores the student's ability to describe the problem and assess whether his or her way of thinking is correctly

formed. In the next step, possible solutions are developed using course material and lecture notes. In this learning phase, the solution is generally formulated, not fully described or motivated. Finally, the solution will be described in such detail that it is completed. This process may be repeated on a trial-and-error basis until the correct answer is obtained. In the model, it is important that students ask the right questions and have course material with them. To avoid creating stress, the teacher should not press students with dyslexia during the different phases of the model. To increase the students' self-esteem, encouragement or a reward in form of bonus evaluation points on the assignment could be planned by the teacher.

6. The developmental psychological theory The sociocultural learning theory means that attention must be directed towards students' abilities and skills in the teaching situation, as well as in the external environment with which students interact. In practice, however, it is the features of both the individual and the environment that interact and influence each other in the long term. In other words, changing factors in the learning environment can constitute obstacles or better conditions for students in need of special support efforts, for example students with dyslexia problems. Consequently, the developmental psychology, or Bronfenbrenner's ecological systems theory (Bronfenbrenner, 2005), can be used to understand how the individual interacts with the environment and how the environment affects the individual's continued development. There is, apparently, a common denominator between Bronfenbrenner's theory of developmental psychology and the sociocultural learning theory, as they both treat the individual from the perspective of socialization and the fact that human development takes place in interaction with the environment. Furthermore, developmental psychology can provide more detail about how human behaviours, thoughts, feelings and social abilities develop during the life course than sociocultural learning theory can. Nevertheless, the area that developmental psychology theory deals with is comprehensive. For this study, it has been decided to raise some influencing factors that are considered suitable for students with dyslexia problems.

6.1. Microsystems The first level in the ecological system model is the microsystem. A microsystem represents various small systems in society, such as family, preschool, school or work. Three elements can be identified as active in this interaction:

- (1) The activities an individual participates in;
- (2) The roles/tasks the individual receives or gives to others;
- (3) A network of relationships will develop between people that the individual is a part of and that affects the individual's development.

These three factors – activities, roles and relationships – define the most important elements of the microsystem. The different roles are important for the individual's development. When an individual's roles change or when the individual's local environment changes, the individual's ecological microsystem changes accordingly.

6.2. How does the microsystem work for students with dyslexia? When students with dyslexia are admitted to university, it is important that there is cooperation and a consensus between the

Fig. 1. Learning model for problem-solving. Fig. 1. This model can be used to help solve the learning problem and increase the learning potential for students with dyslexia, especially within the framework of engineering education. The model may be used when supervising students, especially during lessons when a student is stuck on theoretical problems or practising tasks. With the help of the model, the ZPDs of the students participating in problem-solving processes will be identified and a plan for further learning steps can be formulated based on the outcome of this process. The student starts the problem-solving process by first identifying the 4

Osama.A.B. Hassan university and these students regarding goal setting, standards, and established routines and measures. This can create security for these students. The focus of these students' development must thus be directed towards encouraging and supporting them to become more engaged with the university's social and physical environment. A network of relationships can be developed between students, which can influence their developmental psychology and, over time, establish peer-learning. Additionally, students should be encouraged at the start of the course to contact teaching staff if they have special needs or wishes. Many students with reading and writing difficulties do not know that they can get support. The teacher may tell those who state that they have problems with dyslexia that they can also contact the university's coordinator for appropriate support. The teacher may plan several meetings with students with dyslexia problems during the course, in order to investigate their level of learning and get feedback on teaching methods. In return, universities must be able to support the teacher with suitable resources to pave the way to sustainable learning.

6.3. Mesosystem The second level in the ecological systems model is the so-called mesosystem, which is a system of the relationships and activities that develop in the various local environments, and on which the individual's development depends. Relationships that develop between the various local environments can be of decisive importance for an individual's development. The developing potential of a local environment in a mesosystem is greater if, when the individual initially enters the local environment, he or she does so not alone but in the company of one or more people with whom he or she has been together in previous local environments.

6.4. How does the mesosystem work for students with dyslexia? A student's ability to learn effectively depends not only on the teaching, but also on the contact between students in the group via group assignments, study visits and possible opportunities for practice at companies or external institutions. The nature of this contact can be important. One can therefore maintain that the design of group tasks, seminars and collaboration within the study group – as well as study visits and practice – can create some kind of communication network for students. Peer learning can also be designed to serve as a starting point for realizing effective learning. As mentioned earlier, the teacher must be able to support the student in developing independence, for example through increased involvement in laboratories and discussions in groups/seminars. It will be even more stimulating if collaboration between the various local environments is achieved. University, family and rehabilitation centre are examples of these local environments.

6.5. Exosystem The third level in the ecological systems model is the so-called exosystem. An individual's development can also be affected by environments and events that the individual does not have direct contact with (Bronfenbrenner, 2005). In this context, there are formal or informal social institutions that directly or indirectly affect the individual.

6.6. How does the exosystem work for students with dyslexia? Universities have usually included students with special needs in their rules and policies. All universities and colleges are assumed to have specific contact persons and coordinators for those with dyslexia or other learning disabilities. Students with dyslexia must be given the opportunity to coordinate their needs, expectations and wishes, and must be informed about the pedagogical support available in order to carry out their studies without significant impact due to the problem of dyslexia. Students must be able to discuss their study plans and any need

Social Sciences & Humanities Open 8 (2023) 100718 for support or adjustments to the study situation with the

university's coordinator. These rules and routines can have a great effect on students' learning development. There are also organizations for people who have dyslexia. These organizations often aim to inform society about what dyslexics need and what support society can contribute, etc. It is thus imperative to achieve some form of collaboration between the university and these organizations. This collaboration can help when developing courses intended specifically for dyslexics, in which the stated goal is to prepare these students to practise strategies to increase reading comprehension and structured thinking and to promote reading and writing learning; see e. g., Winter (1999) and Ekelund (2021).

6.7. Macrosystem The different systems at the first three levels express different ideological, economic, historical and political values and conditions. The fourth level of Bronfenbrenner's ecological systems model consists of institutions at the societal level that affect all the previous systems, such as society, laws, conventions and traditions (Crawford, 2020). For example, centrally made decisions can have negative or positive consequences for the family or the individuals.

6.8. How does the macro system work for students with dyslexia? The media, TV, the internet and traditions can influence how individuals behave towards others who have special needs. By applying the principle that everyone has the right to receive an equal education and to develop as far as possible based on their conditions, society at the macro level can create a safe learning environment that includes students who have dyslexia (or other disabilities). Adapted learning forms and prerequisites can guarantee the realization of the "equal value for all" argument (Sangiovanni, 2017). In actual language use, "literal meaning" takes on a secondary role (Vygotsky, 1986). Instead, the interaction of language with artefacts, such as computer programs, and other contextual factors is emphasized (Winter, 1999). This approach could be particularly suitable for those students who have reading and writing difficulties (dyslexia). As mentioned earlier, the diagnosis of dyslexia is often visible when encountering theoretical tasks, while practical tasks work better. Therefore, practical tasks can activate the learning potential and, over time, cognitive development can be further improved. For students with dyslexia, this means emphasizing the practical side of understanding through labs and group work in class. Against this background, the didactics in the classroom can be adapted. Below are some suggestions in connection with this point.

- o Giving students the opportunity to practise on their own can make it easier for dyslexics to get a better understanding of the subject.
- o As far as possible, teaching a subject should combine theory with practice. There are different ways to implement this in practice, for example with study visits and supervision in the workplace. The "work-integrated learning" model (Schedin & Hassan, 2016) can also be mentioned here, in which practical work experience is integrated with a learning element during ongoing education.

<https://doi.org/10.1016/j.ssaho.2023.100718> ABSTRACT This study attempts to apply the socio-cultural learning theory together with the developmental psychology theory to create a better insight into how learning and teaching methods can be made more efficient for university students who have reading and writing difficulties/dyslexia. In addition, persons identified with dyslexia can have problems associated with socio-emotional situations (Livingston et al., 2018) and psychopathological consequences (anxiety disorders) (Scorza et al., 2018), and even psychological difficulties (e.g., depression and anxiety) (Ghisi et al., 2016).

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theory Bronfenbrenner's ecological system theory Teaching methods 1. Pedagogical and didactic methods are derived, based on the sociocultural perspective, Bronfenbrenner's ecological system theory and the author's observations as a teacher in the classroom to help minimize the problem of learning for students with dyslexia. It aims to apply the socio-cultural learning theory together with the developmental psychology theory (Bronfenbrenner's ecological systems theory) to create a better insight into how learning and teaching methods can be made more efficient for university students who have reading and writing difficulties/dyslexia. The content and methodology of teaching students tend increasingly to become more standardized and abstract in universities, which can also be problematic for students facing difficulties with reading and writing/dyslexia. As the teachers' pedagogical and didactic competence form an important background for students' learning, it is imperative to optimize the applied learning method to include this sector of students who have different needs and conditions, and who face learning difficulties/disabilities. Learning and the learning environment as dictated by these theories can enable the production of pedagogical and didactic methods to streamline the learning of students with dyslexia within the framework of university education. It must be ensured that texts are clearly copied, with an appropriately large style, wide margins and clear paragraph divisions (Cederquist, 2021; Mortimore, 2008). 2.3.4.4. 1.1.4.2