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RESEARCH ARTICLE

Assessment of Learning Progression in View of Learning Theories

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ABSTRACT

This study aims to investigate how the progression of learning and its applications in higher education can be assessed in terms of cognitive learning theory and sociocultural learning theory. Based on these two perspectives, learning is expected to occur stepwise with the help of coordinated planning for progression. Further, progression in learning means that knowledge, subject competence, skills, and expertise should be able to build on what the teacher already knows about the student's previous knowledge and skills, either in the form of the student's current cognitive level or learning development zone. The assessment of learning progression based on sociocultural learning theory may be implemented with the help of a formative assessment. However, the progression of learning based on cognitivism/constructivism can be assessed using taxonomies as assessment schemes.

Keywords: Higher education, learning assessment, learning theories, progression.

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1. Introduction

Progression in learning has become increasingly relevant in higher education, as the concept paves the way towards high-quality education that provides students with the knowledge and subject-specific competencies they need to succeed within and after their education. Against this background, the word "progression" can be understood as knowledge development that students can demonstrate or undergo. However, knowledge development as a process cannot occur sporadically but systematically through careful design of the study courses that constitute support elements for the curriculum and educational program. In this context, the teaching methods based on learning theories can have an influence on measuring the learning progression.

The assessment of students' learning progression along with enhancing abilities, such as communication, interaction, and collaboration, can be decisive factors in effective learning strategies. In most cases in practice, the teacher or tutor needs to continuously supervise students' learning in order to evaluate whether the learning is effectively progressing towards the anticipated level of knowledge, competence, and skills (Hassan, 2011). Additionally, learning progression can be an important resource for teacher learning (Jin *et al*., 2019). Most of the literature on progression in learning deals with learning in children and adolescents, see e.g., Stevens *et al*. (2013). Gallacher and Johnson (2019) examined the "learning progression" method, a relatively new approach that aims to support three aspects of education: teaching and learning, assessment, and curriculum design. Wilson and Lehrer (2021) studied the use of an organized learning model, specifically learning progression, to support instructionally useful assessments. However, only a few studies have addressed the progression of learning in higher education. Elmgren and Henriksson (2013) investigated progression through education and linked the concept of progression to different taxonomies. Säfström (2017) examined the meaning and use of word progression in higher education. Nylén (2012) provided an example of the progression reflected in student report writing. Rovio-Johansson (2016) conducted a phenomenographic study to examine students' knowledge development during a three-year bachelor's program in business administration. Hammer and Green (2011) investigated, from the perspective of learning progression, the disparity between ambition and teaching practices in a first-year management unit. Shepard (2018) investigated the teaching and learning side of the learning progression literature, in which examples are cited whereby learning progressions can be used to help teachers improve their skills in setting learning and progression goals. Björn *et al*.

(2023) studied the progression between courses in an electrical engineering program within the framework of the CDIO approach. Bamforth *et al*. (2007) investigated the progression of engineering students with diverse mathematical backgrounds and suggested, based on student feedback, that a pre-sessional course offers the additional benefit of aiding students in their transition to higher education. Ahlberg and Wahlgren (2011) discussed the assessment of progression in chemical and biotechnology engineering programs by investigating program objectives and student progression and designed activities to evaluate and stimulate integrated engineering capacities.

This work investigates "progression in learning" and its assessment from a different perspective. It addresses a practical gap in the literature concerning the assessment of learning progression specifically within higher education, particularly from a theoretical perspective. It provides practical insights by proposing a framework that integrates theoretical underpinnings with practical assessment methods, offering a structured way to think about progression. The purpose of this article is to apply cognitive learning theory and sociocultural learning theory to provide better insight into how the progression of learning can practically be assessed in higher education. The teaching methods, as dictated by the aforementioned learning theories, can be associated with different assessment strategies that capture students' stepwise development of knowledge, competence, and skills since the two learning perspectives investigate the formation of learning using different viewpoints, as discussed later.

2. Methods and Limitations

This study adopts a conceptual approach and builds on the foundation of established learning theories and ideas. In this context, learning progression is discussed based on these theories as well as the classroom experiences that the author has gained as a lecturer of different civil engineering courses. The study is limited to discussing cognitive learning theory and sociocultural learning theory in light of learning progression and its assessment. The study lies within the framework of applied pedagogy in higher education and it doesn't involve empirical data collection. Finally, this study is not comprehensive, but can provide insight into the subject through theory, further experimentation, and other relevant work.

3. Learning Progression in an Educational Program

Generally, an educational program aims to provide the level of competence and skills required for a job position. It usually consists of a series of courses, and the objectives of these courses are expected to describe the learning progression of each subject towards the required goal, as described in the plan of the educational program. Progression in courses means that the relevant courses show mutual development, so that within the same subject area, the courses are linked together either in terms of in-depth study or specialization. Fig. 1 shows the interconnected elements that are included in a typical education program (as a system) show how assessment of progression in learning can become an integral part of the system. Within an educational program, information is conveyed in a course or a series of courses that lead to the required level of learning, so that the related study courses in the program should be mutually integrated. Knowledge acquisition as a result of this process can thus be assessed to provide opportunities for further development of the knowledge, competence, skills, or abilities that are the focus of an educational program. Consequently, the assessment of progression in learning can serve as a basis for the optimization of the learning process within a course and within the educational program.

Progression in learning can be described as a dynamic process that aims to ensure a logical flow of knowledge within the same course and within related courses in an educational program. Technically, a dynamic learning process can promote a holistic approach in which the different themes of the courses are integrated in such a way that they can lead to continuous learning in accordance with the objectives of the educational program.

Learning progression over time requires continuous evaluation to effectively assess the processes that are part of the educational system, as shown in Fig. 1. Teachers and tutors should be able to continuously assess students' learning progression to evaluate and measure the level of learning progression in a uniform and systematic manner. It can, therefore, be appropriate to describe how learning progression can be measured and assessed in the curriculum or course plans. Several methodologies are used to measure the progression of learning. For instance, it is possible to use the "learning curve," which is a graphical representation of the relationship between learning and experience (Eimicke *et al*., 2023). The learning curve can be created by observing an individual's knowledge development. However, the assessment of learning progression is closely related to the learning theory employed by teachers and tutors, as discussed below.

4. Learning Theories

4.1. Cognitivism/Constructivism

Constructivism is a branch of cognitive psychology based on Piaget's theory of knowledge and learning (Jensen, 2016). Learning from this perspective is based

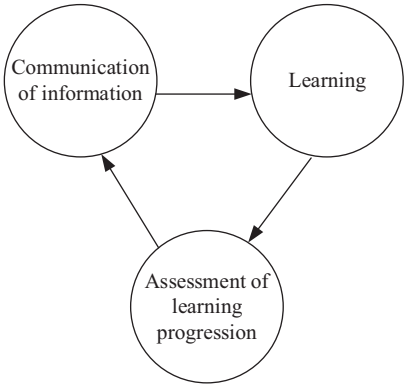

Fig. 1. Assessment of learning progression through education program as a system.

on the assumption that individuals build cognitive structures for their understanding, and that learning develops cognitively as well as neurologically. Development comes from within, and the individual develops at a rate that corresponds to a specific period, namely developmental stages. It is considered that humans are a product of innate characteristics and the environment, and the role of schools is to develop these characteristics (Hassan, 2011).

Although the systematic concept analysis of progression is not explicitly expressed in the cognitivist view of learning, it can be concluded that it best coincides with the development of learning over time. Knowledge development is considered an individual construct, but an individual's actions and connections to the social environment can also have an impact on learning development. Learning environments can thus be considered a means for the progression or development of acquired knowledge accumulated over time in an educational program. Against this background, progression in learning means that knowledge development is not exactly a continuous but a "leap" process as it is mainly due to developmental stages. In other words, by increasing maturity and experience with new knowledge, students come to see things differently than before. Cognitivism focuses not only on what a person learns, but also on how the learning process itself takes place, that is, how the person learns. Consequently, the progression of learning based on cognitivism/ constructivism can be assessed using taxonomies (assessment schemes). Taxonomies were developed to detect qualitative leaps in the students' learning process (Anderson & Krathwohl, 2001), but above all, to control how the development of knowledge in the subject continues. Moreover, taxonomies can be designed to detect the cognitive skills related to learning progression.

The influence of the cognitive approach on the progression of learning means that gradual development of learning can be planned using teaching activities within the same course or throughout the educational program. With gradual learning development, individuals build cognitive structures for learning and understanding that change over time, depending on the influx of knowledge that they obtain through learning. Consequently, learning progression implies that new knowledge, subject competence, and expertise can be assessed based on what the teacher already knows about the student's previous knowledge, namely, the student's current cognitive (or mental) level. The acquisition of new skills and knowledge should pave the way for the development of methods to optimize the learning process. Thus, the teacher's role is to plan for the themes of the courses so that they contribute to the desired cognitive level of the students' cognitive development.

4.2. Sociocultural Learning Theory

From a sociocultural perspective, learning occurs mainly through interaction with the environment. Consequently, the environment creates learning conditions (Jensen, 2016). What controls learning is, therefore, interaction with the environment and cooperation between people (Hassan, 2011) Social activity, in turn, gives rise to external stimuli for the intellectual development of the individual, not the innate characteristics emphasized by cognitivism/constructivism. The basic cognitive skills that an individual possesses can be derived primarily from the sociocultural environment. This means that the development of students' learning as a result of progression is dependent on the support they can receive from the environment and how teachers choose to organize their teaching.

Two central concepts that sociocultural theory has developed, which can be linked to learning progression, are scaffolding and the zone of proximal development. Scaffolding means that the teacher (or another knowledgeable person) provides continuous support during the construction of knowledge but then takes down scaffolding (support) when the knowledge has been anchored (Gibbons, 2014). Against this background, scaffolding in practice is about learning taking place step by step with the help of a type of "communicative" support between teacher and students.

The Zone of Proximal Development (ZPD) concerns the development potential that students can achieve on their own and what they can manage with the support of peers or with the guidance of a more knowledgeable person (Hassan, 2011). ZPD is thus closely linked to learning opportunities, so that the teacher's role is to discover the student's ZPD in order to be able to build on future teaching strategies in accordance with learning progression. In practice, the two concepts of scaffolding and ZPD complement each other, as shown in Fig. 2. Against this background, the teacher can assess the learning progression by evaluating the zone of development that the student is in and, based on this, provide support during the construction of knowledge. Once the desired level of knowledge has been established, the teacher can build on the already created zone of development and continue to build on it until the entire knowledge system is complete. Subsequently, as knowledge development is here a continuous process, the learning progression based on the sociocultural learning theory, can be assessed using "formative assessment" as a tool to examine how the development of knowledge is achieved and also to identify the learning gaps to be repaired.

5. Results and Discussion

5.1. The Connection Between Learning Theories and Assessment Methods

The concept of progression is implicitly built into the mindsets shaped by the two investigated learning theories. The two learning theories have different mindsets regarding how the assessment of learning progression can be

Fig. 2. Model for learning progression based on the sociocultural perspective.

achieved. According to cognitive theory, learning progression can be realized through a stepwise development of cognitive structures in the individual in connection with the developmental stage of the individual. Consequently, taxonomies can be an appropriate assessment scheme to control learning progression. The sociocultural learning theory employs the concept of ZPD to check the level of learning or zone of development of the individual and then uses scaffolding to further develop learning. Consequently, a formative assessment of learning progression can be an effective method in this context. It is noteworthy to indicate that some of concrete examples of how the taxonomies and formative assessments would be applied in specific higher education contexts can be found in Hassan (2011).

5.2. Practical Model for the Assessment of Learning Progression

As a basis for designing taxonomies and formative assessment methods, the following model for the assessment of learning progression is proposed:

Step 1. Progression through subjects in the same course: Students should be able to effectively use previously learned material in the same subject such that the constituent parts of the subject are interconnected.

Step 2. Progression through the course: Students should be able to use the learned material in other subjects/elements of the course in applied contexts.

Step 3. Progression through related courses in educational programs: Students should be able to use the materials learned in a course to build on new knowledge and maintain a logical flow in the different themes of the courses.

Step 4. Progression throughout the educational program: Students should be able to use the materials learned in a course to form a holistic picture of the educational program. This can be achieved by organizing and combining different pieces of knowledge in such a way that they form a pattern or structure that was not previously clear.

The central content of the curriculum within the educational program specifies which mandatory content is to be covered in teaching. These can be structured so that they should also consider the learning progression. This means that the content can be broadened and deepened through the assignments, both individually and in groups. Consequently, teachers/tutors and curriculum designers may carefully plan and organize teaching strategies and provide students with access to materials with learning opportunities of both breadth and depth to realize the required level of students' learning progression. Additionally, the assessment of learning progression in the same course and related courses in the educational program can be made on a continuous basis to assess students' learning development.

From an instructive point of view, the proposed four-step model and the linkage of assessment methods to learning theories can guide curriculum design and teaching practices.

Peer learning as a pedagogical model (Hassan, 2014) can also be designed in such a way that progression in learning becomes an important element to take into account, in order to streamline the supervision process (teacher-students). For instance, step 1 to step 2 can be used, in this context, as a starting point to assess the learning progression within the same course and step 3 to step 4 across-course and program-level.

6. Conclusion

Two current learning theories are cognitive and sociocultural. In this context, development of knowledge can be linked to these learning theories in their classical meaning to understand the meaning of learning progression and its assessment in practice. We can trace signs of progression in learning within the framework of these theories even though progression assessment as a systematic concept analysis is implicitly included in these theories. Based on the two aforementioned theories of learning, learning is generally expected to occur stepwise with the help of coordinated planning for progression. Progression in learning further means that knowledge, subject competence, skills, and expertise should be able to build on what the teacher already knows about the student's previous knowledge and skills, either in the form of the student's current cognitive level or development zone. The educator's role is to plan and continuously control learning progression across the curriculum to assess students' development, both cognitively and socially. The assessment of learning progression based on sociocultural learning theory may be implemented with the help of a formative assessment. However, the progression of learning based on cognitivism/constructivism can be assessed using taxonomies as assessment schemes.

Progression in learning is needed not only to assess the quality of education, but also to describe and focus on the learning that is essential for knowledge development rather than on the specification of standards to be achieved throughout education. Against this background, the teacher's role is to create the conditions and organize them and give the student access to learning materials with space for learning different scopes, depths, and complexities. Throughout education, students' previous skills and subject competencies can provide an indication of the level of progression in learning.

For futures studies, it can be of interest to test empirically the effectiveness of the proposed assessment model by incorporating case studies or surveys to validate the proposed model and enhance methodological rigor. Additionally, future work could include pilot studies measuring learning gains under taxonomy-guided versus formative assessment-guided designs.

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Conflict of Interest

The author declares no conflict of interest.

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