'Connective Alignment' as the Educational Approach
for Higher Education in the Digital Age

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Keywords	Abstract
connectivism, constructivism, alignment, higher education	Most students in higher education at present are 'digital natives.' They use technology in every facet of their life, including their education. They learn from formally organised courses as well as from informal learning. Hence, informal learning has been identified as crucial for the sustainability of higher education in the current global context. Technology facilitates informal learning and, thus, has made substantial changes in how learning occurs in modern age learners. These changes that occurred in the learning process due to the influence of technology should be addressed by the educational approaches used in higher education to achieve the best outcomes in relation to the academic performance of students and students' satisfaction. This commentary presents an educational approach: 'Connective Alignment' for higher education in the digital age, which can fulfil the learning needs of the learners in this digital age.

Introduction

Most of the current students in higher education are 'digital natives' who have grown up in a digital world and are highly competent in adopting the rapid advancements of technology. They use technology in every facet of their life, including their education (Turner, 2015). These digital natives learn from formally organised courses as well as from informal learning through personal networks, work-based learning and communities of practice (Decius et al., 2022). Therefore, informal learning has been recognised as vital for the sustainability of higher education in the present global context (Gramatakos & Lavau, 2019). Technology promotes informal learning (Lewin & Charania, 2018) and, hence, has made a significant change in how learning occurs in the digital era. In order to achieve the best outcomes for higher education students these changes, which took place in learning manner due to the influence of technology, should be addressed by the educational approach used in higher education.

Constructive Alignment

In contemporary higher education, 'constructive alignment' is the most widely adopted educational approach (Biggs & Tang, 2011). There are two aspects of 'constructive alignment': constructive and alignment. The 'constructive' aspect comes from the 'constructivism' learning theory and the 'alignment' aspect denotes what teachers do in teaching, which is to set up teaching and learning activities (TLA) and assessment tasks (AT) appropriate to achieving the intended learning outcomes (ILO) (Biggs & Tang, 2011). 'Constructivism' is a learning theory

which has a long history in cognitive psychology. Starting with Piaget (1950) many have contributed to the development of constructivism, which has several forms, such as individual, social, cognitive and postmodern (Steffe & Gale, 1995). All these forms of constructivism are built upon the theory that students construct meaning in their learning through relevant, specifically designed, meaning-making learning activities (Biggs & Tang, 2011). However, it should be noted that the 'constructivism' learning theory was developed at a time when learning was not influenced by technology. Therefore, 'constructivism' cannot explain how learning occurs in learners in this digital age, even in the absence of specific meaning-making learning activities such as in informal learning.

Another major drawback of constructive alignment is, though constructive alignment has identified llifelong learning as the 'ultimate aim of university teaching' (Biggs & Tang, 2011), it has failed to provide an effective method to inculcate skills required for lifelong learning in students. According to constructive alignment, lifelong learning goes beyond undergraduate education (Biggs & Tang, 2011). Therefore, the solution constructive alignment offers for lifelong learning is preparing students for later just-in-time and work-based learning (Biggs & Tang, 2011). However, due to the swiftly altering information in this digital age, students should constantly update their knowledge base (i.e., practice lifelong learning). Hence, lifelong learning skills should be promoted in higher education students while they are in the university itself and not in 'later' just-in-time or work-based learning.

Moreover, constructive alignment limits students to achieving a given set of learning outcomes. This is also known as 'prescriptive learning', where the knowledge is pre-determined for the learners to gain (Williams et al., 2011). However, it is inevitable that some students will produce 'learning outcomes' not identified by lecturers at the beginning of a course that are 'emergent outcomes' (Jervis & Jervis, 2005). In emergent learning, the learning is open and is produced and dispersed largely by the learners themselves when a need to learn rises (Williams et al., 2011). It is broadly agreed that instruction in higher education should allow students to 'go beyond the information given' (Critchfield & Twyman, 2014). Therefore, higher education should prepare students not only to fulfil the 'prescribed' learning objectives but also to effectively achieve an 'emergent' learning outcome whenever a learning need arises. Therefore, the skills required for emergent learning should be inculcated in students during their university education, which, sadly, cannot be accomplished through 'constructive alignment'.

Furthermore, the usefulness of constructive alignment in practice is reported to be somewhat mixed. Though it has provided a convenient structure for aligning courses in a clearer and more logical manner (Hailikari et al., 2022) that has resulted in increased students' satisfaction (Thadani et al., 2013) and increased learning motivation (Stamov Roßnagel et al., 2021), it has also been questioned whether constructive alignment in higher education actually can improve deep-level learning (Colding, 2020).

Consequently, it seems evident that the educational approach 'constructive alignment' cannot fulfil the learning needs of learners in this digital age. Accordingly, there is a need for an updated educational approach for this digital age in order to achieve effective higher education, which can improve academic performance and the satisfaction of students. Therefore, the objective of this paper is to present an educational approach that can address the learning needs of the modern age learner.

Theoretical Framework

Connectivism

The educational approach for this digital age should be based upon a learning theory which can explicate how learning occurs in learners in higher education at present. The proposed educational approach is based on the 'Connectivism', learning theory which explains how learning occurs in the digital age (Siemens, 2005). Connectivism recognises informal learning as an important aspect of the learning experience of current learners (Siemens, 2005). In connectivism, the learner is the starting point of the learning process. Personal knowledge exists in a network (Siemens, 2005) and learning is the process of connecting, growing and navigating through the networks, which comprises nodes bound by connections (Siemens & Tittenberger, 2009). Learning occurs on three levels: neural, conceptual and external. A new node of information in these three levels creates new connections, which, in turn, results in new knowledge and amplified understanding in the learner. The cycle of knowledge expansion allows learners to stay conversant in their field (Siemens, 2005; Siemens & Tittenberger, 2009). Connectivism is led by the understanding that learners' decisions are grounded on swiftly changing foundations, because new information is continually being acquired (Siemens, 2005). If the contextual information used to make decisions changes, the decision itself is no longer valid. Therefore, the learner should be involved in constant learning/lifelong learning to make valid decisions in their learning. This constant augmentation of knowledge and learning by the extension of a personal network is the core of connectivism (Siemens, 2005). A scoping review has shown that, connectivism offers positive outcomes for higher education students, such as: improving academic performance, fostering creative thinking, enhancing interactions with teachers and peers, promoting collaborative learning, providing open and flexible learning environment, promoting self-regulation of learning, facilitating action learning, improving problem solving and decision making skills, promoting reflective practice and promoting lifelong learning. Connectivism has been shown to be effective in delivering functioning knowledge (putting knowledge into action). The integration of principles of connectivism in higher education has successfully incorporated informal learning into formal learning and has enhanced skills required for emergent learning (Senadheera et al., 2022). Considering all the above, connectivism is selected as the learning theory for the new educational approach we propose for higher education in the digital age.

Alignment

Alignment is a key principle in curriculum theory, which states that assessment tasks should be aligned with what is intended to be learned and with teaching and learning activities (Biggs & Tang, 2011). The 'alignment' indicates what the teacher does, which is to set up teaching and learning activities (TLA) and assessment tasks (AT) appropriate to achieving the intended learning outcomes (ILO) (Biggs & Tang, 2011). The principle of alignment produces effective teaching and learning, ensuring maximum consistency throughout the process (Cohen, 1987; Biggs & Tang, 2011). Therefore, in order to design the proposed educational approach, 'connective alignment' (Figure 1) and 'connectivism' are joined with the alignment component.

Connective Alignment

'Connective alignment, entails two components: connective and alignment (Figure 1). 'Connective' aspect stands for connectivism learning theory, which is used as the theoretical framework to design, deliver and evaluate the teaching and learning process, including defining intended learning outcomes (ILO), designing and delivering teaching and learning activities (TLA) and designing and performing assessment tasks (AT). The 'alignment' component denotes setting up teaching and learning activities and assessment tasks appropriate to achieving the intended learning outcomes (Biggs & Tang, 2011). Alignment assures that the assessment tasks are aligned to what it is intended to be learned (ILO) and with teaching and learning activities (Biggs & Tang, 2011). The principle of alignment is integrated in the proposed approach, because the literature showed that alignment between ILO, TLA and AT produces effective teaching and learning, ensuring maximum consistency throughout the process (Biggs & Tang, 2011). Accordingly, connective alignment teaching and learning process are guided by the eight principles of connectivism (Siemens, 2005) (Table 1) and are aligned according to the 'alignment' principle (Biggs & Tang, 2011).
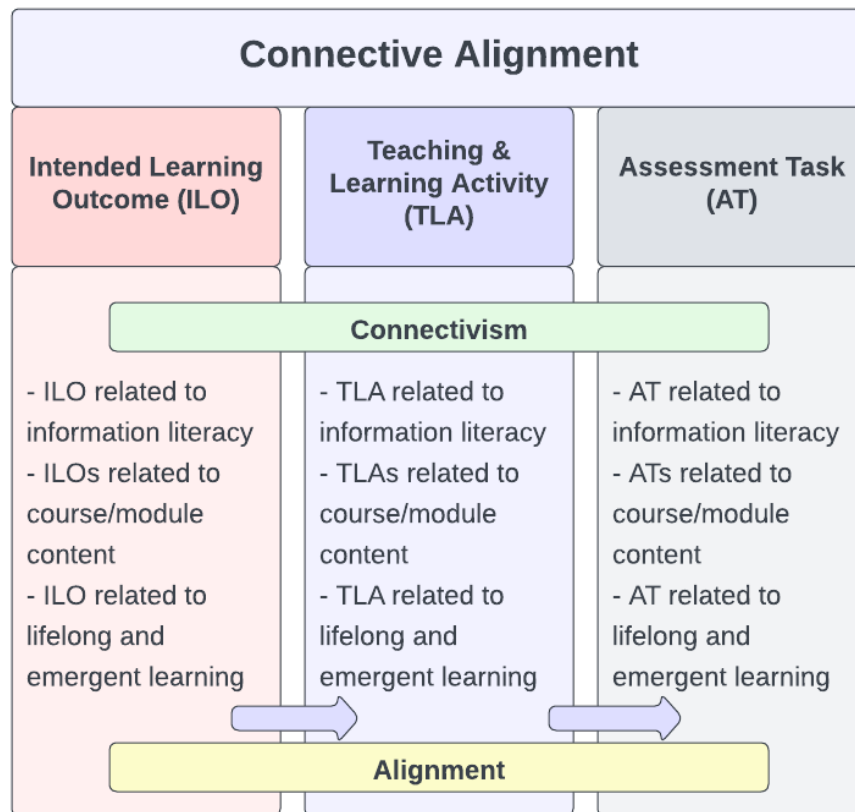
Connective Alignment

Intended Learning Outcome (ILO)	Teaching & Learning Activity (TLA)	Assessment Task (AT)
Connectivism		
- ILO related to information literacy - ILOs related to course/module content - ILO related to lifelong and emergent learning	- TLA related to information literacy - TLAs related to course/module content - TLA related to lifelong and emergent learning	- AT related to information literacy - ATs related to course/module content - AT related to lifelong and emergent learning
Alignment		

Figure 1: Connective Alignment

Table 1: Principles of Connectivism

Principles of Connectivism	Meaning
1. Learning and knowledge rests in diversity of opinions	Learner should connect to various information sources to learn. Connecting to more information sources means more the learning will be.
2. Learning is a process of connecting specialised nodes or information sources	Learner should identify to which information sources to get connected and should make appropriate connections.
3. Learning may reside in non-human appliances	Devices such as, computer, smart phone and information sources such as, website, database, journal, etc. may involve in learning.
4. Capacity to know more is more critical than what is currently known	Knowing where to find more knowledge and building connections to those, is more important than what the learner currently knows.
5. Nurturing and maintaining connections is needed to facilitate continual learning	Building connections to information sources to acquire knowledge and to update knowledge is required to continuous learning.
6. Ability to see connections between fields, ideas, and concepts is a core skill	To identify which connections to be made, the learner should be able to recognise connections among different fields, ideas and concepts.
7. Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities	Learning should be a continuous process in order to get access to up-do-date knowledge.
8. Decision-making itself is a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision	Learner's decisions should be made upon, most updated information. As information is rapidly evolving, the decisions which are made upon those information, also should be updated.

Connective Alignment to Inculcate Skills Required for Digital Learning

When defining the ILOs, apart from the ILOs related to the content of the course, connective alignment proposes to integrate ILOs related to the specific skills required for the success of learning in this digital age. Technology has enabled students to use diversity of information sources in their learning. Therefore, there is potential for students to reach false or invalid information in their learning, especially in the digital environment. Hence, it should be assured that students have competency in information literacy, which enable them to obtain, critically analyse, evaluate and effectively use information required for learning (Sparks et al., 2016). Accordingly, an ILO to enhance the information literacy skills, a TLA to enhance information literacy skills and an AT to evaluate information literacy skills of students is proposed in

connective alignment. Moreover, self-regulation skills in learning are mandatory for the success of learning in this digital age (Senadheera et al., 2022). Connectivism promotes self-regulation of learning (Siemens, 2005) and therefore designing teaching and learning according to principles of connectivism is proposed in connective alignment to inculcate self-regulation skills of students.

Connective Alignment for Lifelong Learning and Emergent Learning
In the rapidly changing information climate in this digital age, the information students reach today could be outdated by tomorrow. Hence, students should continuously update their knowledge base by forming connections with new information (i.e., lifelong learning). Therefore, lifelong learning skills and emergent learning (learning whenever a need arises) skills should be inculcated in higher education students while they are in university itself. Thus, connective alignment identifies lifelong learning and emergent learning as crucial components that should be incorporated into higher education in this digital age. A scoping review has shown that using connectivism to design teaching and learning in higher education has promoted lifelong learning in students (Senadheera et al., 2022). Together with promoting self-regulation of learning, connectivist learning environments have fostered creative thinking, enhanced interactions, promoted collaborative learning, provided open and flexible learning environments, facilitated action learning, improved problem solving and decision making skills and promoted reflective practice; all of which are crucial to promoting lifelong learning in higher education (Senadheera et al., 2022). Therefore, in connective alignment, an ILO to teach lifelong learning and emergent learning, a TLA to inculcate skills required for lifelong learning and, finally, an assessment task to evaluate lifelong learning in students is proposed.

Discussion

Constructive alignment is widely practiced as an educational approach in higher education at present. This is mainly because of the adoption of constructive alignment by higher education policy makers across European countries and in many others as a quality assurance tool (Loughlin et al., 2021). This adoption has made the 'constructive' part of the model a component of curriculum construction rather than an underlying theory of learning (Loughlin et al., 2021). Due to this adoption, the constructive component is read as 'constructive' (as in positive and valuable) or 'constructing' (structurally) and not 'constructivism' as originally conceptualised by Biggs (Loughlin et al., 2021). However, according to the constructive alignment as an educational approach, constructive element stands for the constructivism learning theory. According to constructivism, students construct meaning in their learning through relevant, specifically designed meaning-making learning activities (Biggs & Tang, 2011). Since it developed and evolved during a time where learning was not influenced by technology, constructivism cannot explain how learning occurs in modern age learners, even in the absence of specific meaning-making learning activities such as informal learning. Furthermore, constructive alignment lacks two crucial skills required for students' success in learning, which are lifelong learning and emergent learning. All these factors made it evident that constructive alignment is not suitable as the educational approach for this digital age. In order to fulfil the need for an updated educational approach for this digital age, 'connective alignment' was presented in this paper.

Connective alignment is based on the connectivism learning theory and alignment principle. An ILO to promote information literacy skills of students is integrated in connective

alignment as it should be assured that students are competent to obtain, critically analyse, evaluate and effectively use information required for learning from the abundant information in this digital age. Connectivism in connective alignment plays a vital role in lifelong learning and emergent learning as it promotes self-regulation of learning, fosters creative thinking and improves problem solving and decision-making skills (Senadheera et al., 2022), all of which are skills required for lifelong learning and emergent learning. Therefore, an ILO to enhance the skills of lifelong and emergent learning is integrated in connective alignment, which strengthens connective alignment against major two drawbacks of constructive alignment on lifelong learning and emergent learning. All these factors justify using 'connective alignment' instead of 'constructive alignment' as the educational approach for higher education in this digital age.

Conclusion

'Constructive alignment', which is the most widely adopted educational approach globally, is based on the constructivism learning theory, which states that students construct meaning in their learning through relevant, specifically designed meaning-making learning activities. However, as 'constructivism' learning theory was developed at a time when learning was not influenced by technology, it cannot explain how learning occurs in learners in this digital age even in the absence of specific meaning-making learning activities such as informal learning. Moreover, constructive alignment lacks a strategy to promote lifelong learning and does not accommodate emergent learning, both of which are crucial for the students' success in learning. Thus, the educational approach 'constructive alignment' cannot fulfil the learning needs of this digital age, which creates a need for an updated educational approach. The educational approach presented in this paper, 'connective alignment', has its theoretical roots in connectivism learning theory, which explains how learning occurs in this digital age. Consequently, it can cater to the learning needs of modern-age learners, which have arisen due to the influence of technology. Moreover, connective alignment promotes lifelong learning and accommodates emergent learning by acting through the principles of connectivism and alignment. Future studies can be conducted to investigate the quantitative and qualitative impact of 'connective alignment' in relation to academic performance and satisfaction of students by using it to design the teaching and learning activities in higher education.

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