Learning Ergonomics – a practice oriented framework for enhancing learning effectiveness and learner wellbeing

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Abstract

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Despite the ever-present paradigm shift from teaching to learning, most approaches to increase learning effectiveness and learner wellbeing are driven by discourses on pedagogy and/or didactics and thus focussed on the teacher. In this paper, we propose an alternative approach to enhancing learning effectiveness, which delineates some selected contextual factors that may often be overlooked. We introduce Learning Ergonomics as a practice-oriented framework, which focusses on factors that are influenceable by either the learner or the institution. All factors included in the model show an empirically proven impact on learning effectiveness, with the empirical evidence stemming from different disciplines.

Presentation

Learning Ergonomics – a practice-oriented framework for enhancing learning effectiveness and learner wellbeing

Introduction

In the recent past, the often-invoked shift from an "instruction paradigm" to a "learning paradigm" (Barr and Tagg 1995) has gained renewed momentum. With student-centred learning being, inter alia, included in the revised Standards and Guidelines for Quality Assurance in Higher Education (2015), the focus is more than ever before on the student. And in its latest position paper on Learning and Teaching the European University Association places student learning, needs and success at the centre of universities' educational mission (European University Association, 2018).

Yet, the focus in most approaches to student-centred learning is usually on (new) forms of teaching and learning and driven by discourses on pedagogy and/or didactics (The European Students' Union, 2015). Thus, ultimately, a large number of approaches is actually again focusing on the teacher. Although this corresponds to the dominant findings in Hattie's meta-study (Hattie, 2003) and also to students themselves who judge the teacher as an important success factor (Vettori & Warm, 2017), from an institutional perspective, this focus on the way students are instructed and courses are designed can also be regarded as a handicap: Teaching is still considered a personal matter and despite the increased efforts on staff development and teaching and learning support, progress is difficult to manage and to assess.

In this paper, we therefore propose an alternative approach to enhancing learning effectiveness, which is less preoccupied with what happens in the classroom, but rather delineates some selected contextual factors that may often be overlooked, but have a considerable impact on the learners, including their wellbeing. We call this proposed framework "learning ergonomics", aiming to emphasise the strong practice-orientation as well as the strong focus on the learner's physiology and immediate surroundings, e.g. learning spaces.

Contextual frameworks for learning

Conceptually, the learning ergonomics framework is strongly built upon the premise that the student learning performance is to a substantial degree context-dependent (cf. Smith 2007: 1532). Our literature review shows that there are already different models, which take the contexts learners are working in into account – but rather sparsely. The term "Learning Ergonomics" was first introduced by Smith (2007), who embedded his model in the broader concept of educational ergonomics. It is a construct that "encompasses all modes and levels of learning-design interaction that may occur in educational environments and systems" (Smith 2007, 1532). The focus on ergonomics makes the concept appear a rather technical one, stating different "classes of educational system design factors that potentially may influence student learning" (ibid.).

Smith's model is a holistic analytical construct, which encompasses some factors that can be regulated (such as "class design" that involves size, length or starting time of classes) but also "personal factors" like native language or substance abuse, which clearly influence student learning, but cannot be regulated or managed.

"Learning ecology" is in a way similar to Smiths concept, but a bit less holistic. It is defined as a "set of contexts, comprised of configurations of activities, material resources and relationships, found in co-located physical or virtual spaces that provide opportunities for learning" (Barron, 2004, p. 6). Context is defined as "a unique configuration of activities, material resources, relationships and the interactions that emerge from them" (Barron, 2006, p. 195). The learning ecology perspective emphasises the different contexts and settings learners are embedded in (school, home, peers etc.) with a strong focus on informal learning outside the institution.

"'Learning environment' , a concept that is regularly used to refer to the social, psycho- logical and pedagogical contexts in which learning occurs and which affect student achievement and attitudes" (Fraser, 1998, p. 3). The concept is deliberately broad, including learning environments outside school (such as museums or television) as well as multimedia learning environments.

Within all these concepts, context is treated as something that is influencing learning, but is still very complex and vague and rather difficult to shape and influence. Therefore, even though borrowing the term "learning ergonomics" from Smith and acknowledging some of his dimensions, we use it differently here, proposing a framework that is on the one hand more eclectic, but on the other hand provides far more orientation for practical purposes.

Learning Ergonomics – a practice-oriented framework

Learning Ergonomics is meant as a practical framework for institutions, which want to focus on improving learning effectiveness rather than a holistic analytical model listing all possible influencing factors.

We approach the goal of improving learning effectiveness from the institution's perspective and hence focus on factors which are manageable or influenceable by the institution. In addition, to be included in the model, the factors needed to show an empirically proven impact on learning effectiveness, with the empirical evidence stemming from different disciplines (including medicine, ergonomics or architecture).

We identified the four dimensions "Body", "Mind", "Space" and "Time" which subsume contextual factors influencing learning effectiveness and learner wellbeing. Two of the factors concern the learning context (time and space) whereas the other factors relate to the learner as a person (body and mind). As indicated in the model below by the arrows, the contexts of learning – space and time – can be influenced directly by the institution, for example when self-study-areas or classrooms are planned and designed or when courses and exams are scheduled. Factors which concern body and mind can only be influenced by the learner him/herself. As indicated by the dotted arrows, the institution can influence those factors only indirectly, i.e. via the learner. Institutions can for example raise awareness regarding the benefits of exercise or a healthy diet or invite the learner to different activities.

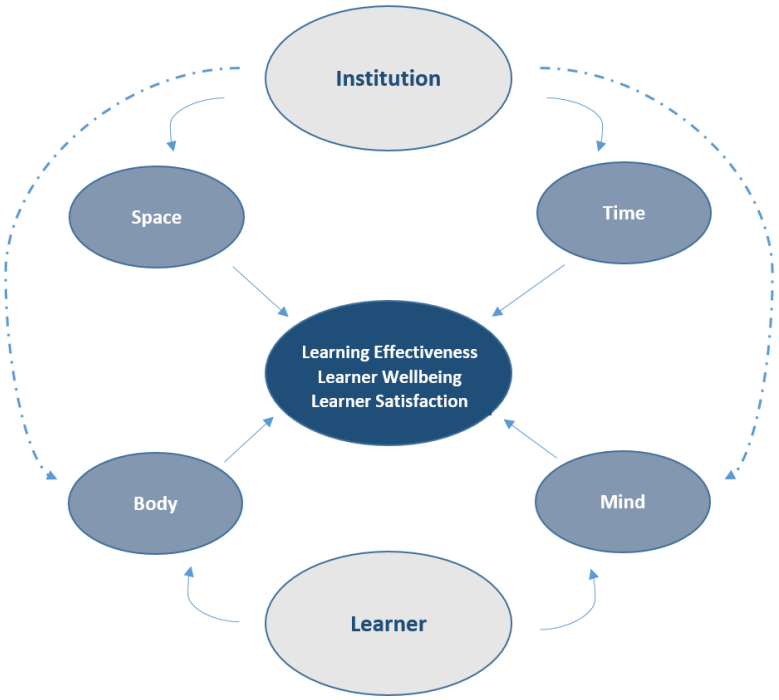

Figure 1: Learning Ergonomics

Body (directly influenceable by the learner, indirectly manageable by the institution)

This dimension is one that most universities do not tackle actively in the context of increasing learning effectiveness – probably because they can influence physical factors at the learner's end only indirectly. Nevertheless there is evidence that factors attached to this dimension, such as physical activity, exercise, relaxation or sleep influence learning.

Sleep quality and quantity are closely related to student learning capacity and academic performance (Curcio, Ferrara, & Gennaro, 2006): poor sleep quality or sleep loss are associated with poor declarative and procedural learning in students (Gilbert & Weaver, 2010). The results of Medeiros et al. (2010) suggest that irregularities of the sleep-wake cycle influence the learning of college students. In a larger study (Gomes, Tavares, & Azevedo, 2011), different factors related to sleep quality were associated with academic performance measures.

Physical activity has repeatedly been linked with improvements in brain function and cognition (Hillman, Erickson, & Kramer, 2008, p. 58) and it is known that exercise causes changes in brain structure and function. Winter et al. (2007) found that vocabulary learning was 20 percent faster after intense physical exercise, which shows that not only regular exercise shows effect, but that physical activity also has immediate effects on learning. Interestingly the effect of exercise is larger on executive control, i.e. processes involved in the selection, scheduling and coordination of complex cognitive functions. Greater amounts of physical activity and/or fitness might thus lead to increased top-down control during task execution (Hillman et al., 2008, p. 61). Hence, students who exercise might be better at planning and organizing their study-time and more successful in sticking to their tasks.

It has been shown in literature that ***nutrition*** influences learning. Diets that are low in saturated fats and refined sugars are beneficial to cognition and might thus also affect cognitive performances (Deliens, Clarys, Bourdeaudhuij, & Deforche, 2013, p. 2). Switching to a balanced diet improves learning and behaviour in children (Dani, Burrill, & Demmig-Adams, 2005). Florence's et al. (2008) study showed that students with decreased overall diet quality are significantly more likely to perform poorly on the assessment.

Although the institution cannot directly influence these factors, a beneficial behaviour of the student can be supported: raising awareness about the importance of an adequate diet or beneficial sleeping habits or offering sports courses for students are possible initiatives which can be furthered by the institution.

Mind (directly influenceable by the learner, indirectly manageable by the institution)

Stress and ***concentration*** are important factors, which have an impact on learning effectiveness. Different studies have shown that a high stress level in students is associated with lower course grades and poor academic performance (Felsten & Wilcox, 1992, Struthers, Perry, & Menec, 2000, Akgun & Ciarrochi 2010). It has also been shown that students with adequate coping strategies achieve better results (Struthers et al., 2000). Techniques to reduce stress can be taught. Mindfulness exercises for example, are proven to reduce manifestations of stress and anxiety caused by exams in students **(**Gallego, Aguilar-Parra, Cangas, Langer, & Mañas, 2015, Galante et al., 2018).

There is also evidence that training in mindfulness improves skills related to concentration, such as cognitive function and attention (Chambers, Lo, & Allen, 2008) or attending tasks without distraction (Mrazek, Franklin, Phillips, Baird, & Schooler, 2013). A recent study (Mrazek et al., 2013) showed that a two-week meditation training led to increased skills in reading comprehension and to reduced mind-wandering.

As with the factors from the "body" dimension, initiatives in this category focus on the learners, i.e. inviting them to mindfulness trainings or even embedding meditation in the curricula (as proposed in the "Munich Model" (de Bruin, 2017).

Space (directly manageable by the institution)

The ***architecture of buildings*** of higher education institutions has a strong influence on teaching and also research within the institution (Kunze & Schmitt, 2012). The planning of the campus, including spaces for studying, integrating personal life and work life and also designing working spaces in order to foster communication can support new modes of learning and teaching. Although the literature on the subject is still rather scarce, there have been several publications in the recent past (see e.g. the contributions in the special issue of ZfHE 7/1 (2012)).

The ***design of teaching rooms and learning spaces*** also impacts student learning (cf. e.g. Report of the Scottish Funding Council). Mirroring changing pedagogical styles, formal teaching spaces for large groups with a "sage on a stage" design are becoming less common in universities and are to a certain extent replaced by classroom designs that allow students to learn from their peers as well as from their teachers. Well-equipped libraries, group-work spaces with daylight and adjustable furniture and in-between spaces that can be used by students before and after class contribute to learner wellbeing and satisfaction (Report of the Scottish Funding Council).

The institution's opportunities to influence space might be limited with regard to the architecture of buildings, but are manifold when it comes to classroom or learning space design. Supporting diverse didactic settings or providing adequate self-study zones for students are possible initiatives related to this dimension.

Time (directly manageable by the institution)

There is evidence that block courses lead to better grades and more motivated students (Metzger & Haag, 2013). Moreover, a ***carefully planned student workload*** throughout the semester leads to less stress for students and increases self-study time and student satisfaction (Groß & Aufenanger, 2011). Including these considerations in the planning of schedules for the study programmes is likely to have an impact on learning effectiveness and learner wellbeing. Although these factors seem at first glance rather easy to manage by the institution, there are some obstacles that have to be surmounted: in many universities, courses have to be scheduled pragmatically due to a lack of teaching rooms and the distribution of block courses and course time often relies on the preferences of the teachers.

Apart from that, there are also ***individual circadian preferences*** which also have an impact on the ideal study times. The scheduling of lectures and tests may have a positive or negative effect on the individual learner's performance, depending on whether or not the starting time corresponds with his/her individual biological rhythm (Beşoluk, Onder, & Deveci, 2011). If students know about their own chronotype they can plan their self-study time accordingly. Especially if parallel courses have to be offered, institutions could adjust the scheduling of classes in a way that students are able to choose according to their individual chronotype.

Learning Ergonomics at WU: Translating the framework into practice

From the very beginning, the Learning Ergonomics Framework was not intended to be a mere analytical framework, but a multidimensional structure to guide actions and indicate areas for improvement. The first phase of related initiatives was started in spring 2018 and aimed for creating low threshold offers for students that could be easily integrated into their daily student life. In WU's undergraduate studies, students have three exam weeks each semester (one at the beginning, one in the middle and one at the end of the semester). During the week before the exam week (the so called "study week") there are no lectures scheduled and the library is highly frequented by students who prepare for the upcoming exams. It seemed prudent to take these phases of high learning activity and stress into account when launching the offers.

The most important elements of this first phase are: A ***web portal*** which is integrated in the Student Support Area at Learn@WU, WU's much used online learning environment (https://learn.wu.ac.at/student-support/Learning_Ergonomics). The portal introduces the students to the framework and the related activities and contains all articles that have so far been published within the context of the initiatives. Articles on the web portal are all written as short advice or reflection pieces, partly by WU's learning and student support experts and partly by renowned experts from outside the university, e.g. trainers, nutrition experts, coaches etc. The articles are organised in different rubrics that on the one hand mirror the dimensions of the model and on the other hand signal the text genre. The editorial team makes sure that all dimensions of the model are equally covered. Previous articles, for example, focussed on the influence of light on learning, the campus learning zones, yoga and physical exercises for stress relief, mindfulness or the most suitable time windows for learning.

A ***newsletter*** sent to all students enrolled at the university, which is issued three times per semester about two weeks before the nearest exam week. The online newsletters teaser articles, provide learning tips and inform students about the physical exercise program. The newsletter was designed in a way that it sets itself apart from the more administrative types of newsletters and student mailings. By making use of the university's official communication channels (the program is also advertised via flyers in the library, the university blog and social media and is supported by the institutional Student Union), it could be achieved that up to 1000 students access the content per issue.

A ***physical exercise program*** composed of short courses that are offered in the last week before each exam week in close proximity to the main library and learning zones where several thousand students study for their exams in this period. The courses are intended to create "active breaks" during study time and were specifically designed for the purpose of stress relief, brain activation and concentration support. Previous courses include "learning yoga", "mindfulness yoga", Qi Gong, meditation and "dancing as mental training". The trainings are offered by experienced and specially briefed trainers and coaches. Students can register for the courses free of charge and take a 45-minute break from their learning. The courses are scheduled throughout the week at different times, but experience so far suggests that the evening courses are the most popular ones.

The first phase of the Learning Ergonomics Initiative will continue until the end of the year and is currently undergoing a first evaluation. It will then be decided how the program will be continued and adapted for the next phase. For the immediate future, it is planned to add another range of offers that is primarily catering to the needs of student beginners and first year students, e.g. in the form of trainings on effective learning strategies, or dealing with exam anxiety and writer's block.

Mid-term plans include analyses on how to better align the way courses are scheduled with evidence on effective learning as well as the construction of additional recreative facilities on the campus.

Conclusion

The Learning Ergonomics model is a framework for practice presenting factors which influence learning effectiveness and learner wellbeing and proposing measures that can be implemented by higher education institutions wishing to support their students. The approach allows to shift the focus from pedagogical concerns to contextual factors when trying to impact students' learning effectiveness. It therefore also allows to focus on factors that are often overlooked in "conventional" interventions. As stated before, the framework is deliberately eclectic as it focusses on manageable contextual factors.

The initiatives that have already been implemented have not been thoroughly evaluated and tested for their impact on the students' learning or wellbeing so far. This will be the next step, before other offers for the students will be implemented in the near future.

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