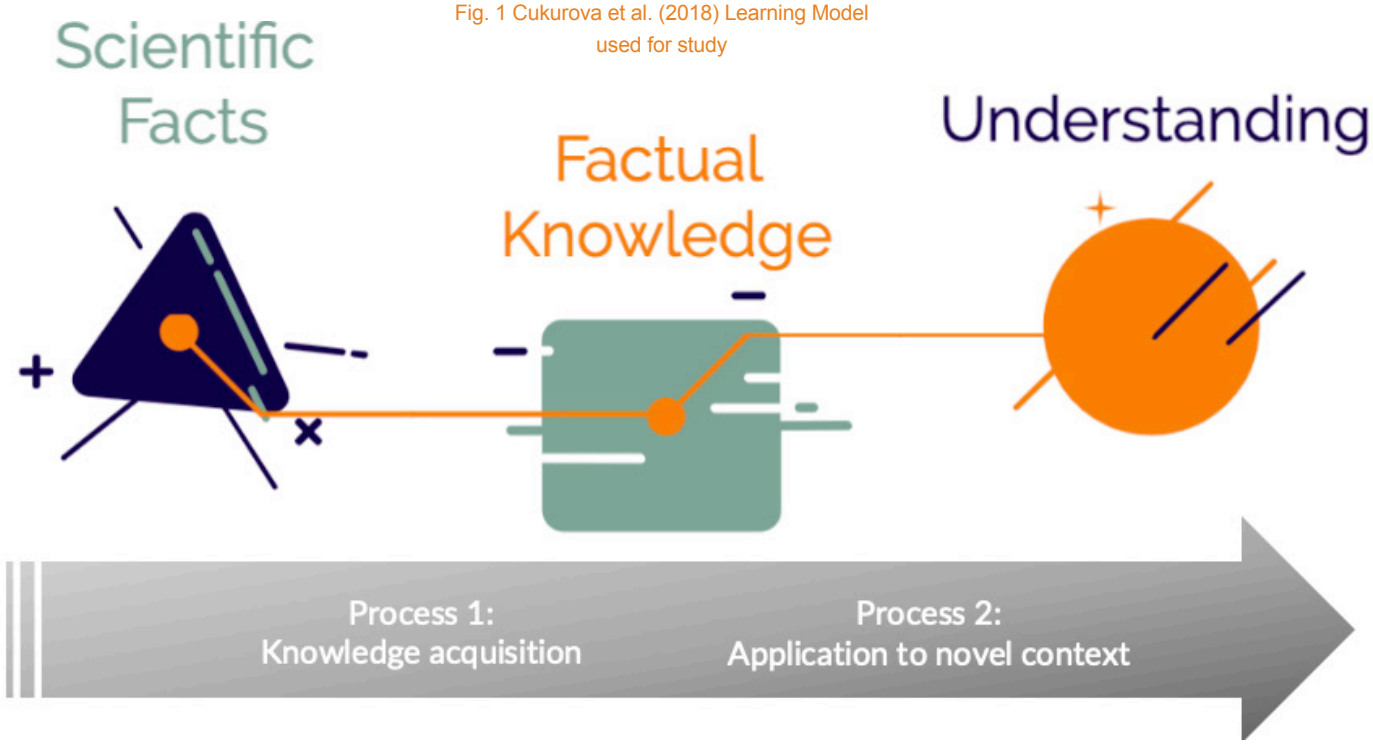
Byte-sized edtech research

Guidance is not a luxury but a necessity for independent learning

Fig. 1 Cukurova et al. (2018) Learning Model used for study



- Independent learning is defined as that learning in which the learner, in conjunction with relevant others, can make the decisions necessary to meet the learner's own learning needs.
- Independent learning's principles are reflected in the design of several instructional approaches, such as problem- and project-based learning, inquiry learning, learning through information and communication technologies, online learning, and flipped classrooms.
- Previous studies investigating these instructional approaches show that when independent learning is applied, there can be an increase in academic achievement (Albanese and Mitchell 1993; Davies, Dean, and Ball 2013; Vernon and Blake 1993), improved motivation and confidence (Alvarez 2011), and they can provide, as reported by learners, a more satisfying learning experience.
- There is little agreement, however, on how independent learning activities should be implemented, and they are often considered to be hard to manage by teachers (Abrahams, Reiss, and Sharpe 2014).
- Although the usual teaching approach at university has been traditional, didactic and lecture-based (Berrett 2012), which promotes dependence of students to their teachers, for the last 30 years there has been an extensive movement to change tertiary level instruction through innovative strategies involving independent learning activities.
- Cukurova, Bennett and Abrahams (2018) conducted a study involving 144 Chemistry undergraduates on a macromolecules course, exploring the impact of guided and unguided independent learning activities on students' learning.
- The findings of this study support the view that independent learning activities, when supported with guidance, can be beneficial in increasing students' knowledge of subject content and their ability to apply knowledge in different contexts.
- It was found that students' knowledge acquisition (**process 1 above**), as well as their ability to apply knowledge (**process 2**), had increased, following guided independent learning, and that this increase was statistically significant. In contrast, it was found that following the unguided independent learning there had been *no statistically significant change* in terms of either students' knowledge acquisition or their ability to apply knowledge.

01 Guidance in instruction strategies

- Hodson (1991, 1993) claims independent learning activities in the sciences should only be used among students already familiar with relevant concepts, otherwise they become too confusing and unproductive, with no clear linkages between activities and learning.
- Taber (2011) argues if students are left to find solutions to problems they come across, it is very likely those solutions are different from ones scientifically accepted.
- Sweller, Kirschner, and Clark (2007) suggest students should be carefully guided towards accurate constructions, understandings and solutions during independent learning activities.

Strict guidance during independent learning activities, however, undermines perhaps the most significant goal of independent learning, which is to build abilities allowing learners independence such that they can reason and think by themselves.

- Pea (2004) suggests guidance should be provided when there is 'independent evidence the learner cannot do the task or goal unaided'.
- Kirschner et al. (2006), who support strict guidance during instruction strategies, argue learners must be provided with a complete demonstration of how to perform all aspects of a task they have not learned and automated before, even if a learner could solve a problem with adequate mental effort. They argue providing a complete description of when and how is a more effective way of learning.

Most available research on this topic concluded that guided instruction strategies are more effective approaches at improving both students' knowledge acquisition and their understanding of key concepts than allowing students time to find the solutions themselves, but there is little agreement on how much of this guidance is enough to structure student learning without undermining their own regulation of learning, or to what extent this guidence can only be provided with human and/or technology interventions.

02 Student Misconceptions

It is well known students often develop ideas that are different from those accepted by the scientific community and intended by their facilitator (Ebenezer and Fraser 2001; Taber 1999). In order for understanding to be meaningful in a scientific context, the knowledge applied in novel situations should be the correct knowledge. If the knowledge applied to novel situations is based on a misconception, the answer generated would be incorrect in a scientific context.

In the Cukurova et al. (2018) study, it was found that there was no statistically significant change in student responses with a misconception during guided independent learning. However, during *unguided* independent learning, whilst there was no statistically significant change in five out of six questions, in one case there was a statistically significant increase in the number of student responses with a misconception. These ideas containing a misconception are most likely to have developed because the students used a variety of secondary and tertiary scientific information sources – particularly from unreliable resources on the internet – during their personal investigations, and they did not have enough comprehension to separate the ideas based on a misconception from those with no sign of misconception. In this study, the majority of the undergraduate students who undertook the macromolecules course appeared to fail to make the required interaction with the key ideas of the investigated topic and focused instead on the extraneous context.

Teachers should be checking that students have understood in the way teachers intended them to, in order to eliminate possible misconceptions. It may be the case that the lack of interaction between teacher and students during unguided independent learning makes it hard for teachers to check this.

Conclusions and suggestions for practice

With regard to the Cukurova et al. (2018) study, the independent learning approach applied in the second part of the course was *unguided* and was not found to contribute to students' knowledge of and understanding about chemical ideas. It has been argued by many scholars that students do not become effective independent learners on their own and independent learning should be *promoted* (this promotion can be delivered by human educators or well-designed educational technology). This study demonstrates that unguided independent student investigations may even lead to an increase in the number of misconceptions. The practice of leaving students to do their own investigations without any support should be approached with caution.

It has been the accepted practice by some teachers to consider hands-on activities as equivalent to active learning, but active instructional methods do not always lead to active learning, and passive methods do not always lead to passive learning (Mayer 2008). Chi (2009) explained that activities requiring hands-on active participation from learners (such as those from the study) guarantee a level of engagement greater than passive reception of information. However, these activities do not guarantee that this engagement will be sufficient for them to make sense of the materials for themselves. Assuming that enabling students to interact with a specific environment will lead to learning of the desired knowledge, is very unlikely to be the case. As new knowledge is channelled by current knowledge and understanding, repetition of the learning process without appropriate guidance will very possibly lead to an increasingly idiosyncratic way of understanding the world different to that of scientific acceptance (Taber 2011).

Suggestions for practice:

- Findings from the Cukurova et al. (2018) study suggest guided independent learning activities can benefit students' scientifically correct knowledge acquisition and understanding.
- Guidance should not be considered a luxury in education, and technologies, particularly those that are adaptive, and can learn from student interactions, such as AI-powered tools, have great potential to help educators provide the required guidance to every student.