####/Title: A New Model for Developing Students' Deep-Learning Skills

####/Stand-first:

Online education has recently experienced a surge in popularity, and this trend is set to continue. Through online learning, individuals who are unable to take courses on campus, due to family, work or financial pressures, now have the opportunity to pursue university degrees. However, one shortfall of online education is that it often fails to develop students' deep-learning skills, which are required for effectively tackling complex problems. In a recent study, Dr Yianna Vovides of Georgetown University investigated this issue. To support the development of students' deep-learning skills, she developed a new 'learning analytics' model, which has the potential to dramatically improve online learning environments.

####/Body text:

College graduates are often expected to be adept at tackling complex, poorly-defined problems, both in their professional and personal lives. However, several studies have found that students often fail to apply refined reasoning when they are presented with such poorly-defined ethical dilemmas. Such problems often involve a certain level of uncertainty, perhaps due to conflicting perspectives or a lack of 'right answer' solutions.

Throughout their lives, humans encounter many problems that have no clear-cut answers and they often approach them differently, depending on their ethical and philosophical beliefs. It is therefore important for students to learn how to deal with such complex issues effectively.

By engaging in a reflective sensemaking process, students can dissect a given problem, and make sense of the various issues that surround it. In this context, deep learning involves acquiring knowledge about a particular subject, as well as an understanding of how, why and when this knowledge can be applied in real-world situations. When students apply deep learning, their ability to effectively tackle complex problems dramatically improves.

Developing deep learning within the context of poorly-defined ethical dilemmas requires a form of reasoning that Dr Yianna Vovides of Georgetown University calls 'reflective sensemaking', which challenges students to integrate different perspectives with their own values or ethical judgements.

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In a recent study published in *Future Internet*, Dr Vovides and her colleagues focused on how students acquire deep-learning skills in the context of online learning, which has gained increasing popularity over the past few years. They observed that most online learning environments make it harder for students to develop reflective-sensemaking skills, as they do not prepare them to deal with poorly-defined, complex problems.

Dr Vovides also points out that online learning involves a much lower degree of social learning, since students have fewer discussions with classmates and teachers compared with traditional learning environments. In other words, in online environments, it is harder for students to engage in interactions that help them to develop deep-learning skills, as well as for instructors to spark debate about curricular material.

In their study, Dr Vovides and her colleagues used an open-source online tool, called Cohere, to test whether online learners engage in discussions and create connections between different conceptual perspectives. By generating concepts and social networks based on learners' discussions and interactions, Cohere allowed the researchers to explore two issues associated with online education

that they had identified: learning with poorly-defined problems and the interaction between social and individual learning.

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An area of research that holds great potential for transforming online learning experiences is learning analytics, which involves the collection, measurement, analysis and reporting of data related to learning. Learning analytics can provide valuable insight, helping to improve academic outcomes, as well as the environments in which learning occurs.

According to Dr Vovides, merging learning and analytics can ultimately help to minimise the abstract nature of concepts such as deep learning, allowing researchers to identify areas that have not yet been addressed in past studies.

So far, learning analytics has primarily been used to model learner activity and identify students who are 'at risk' of failing online classes, due to their poor attendance or lack of engagement. According to Dr Vovides, while this application of learning analytics is helpful, there are far more transformative possibilities that have not yet been explored.

In their study, Dr Vovides and her colleagues proposed a new learning analytics model that could help to capture and support students' reflective sensemaking in the context of solving poorly-defined ethical problems. This model is based on the findings of an exploratory research project that she carried out in 2012, which examined how learning analytics could help to guide learners in applying reflective sensemaking.

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Reflective sensemaking is a process that allows humans to understand particular issues though their interactions with others. When applied to the poorly-defined problems that many students struggle with, reflective sensemaking entails the exploration, identification and processing of information, ultimately allowing a learner to dive deeper into a particular subject and integrate differing perspectives.

Dr Vovides and her team's learning analytics model captures this reasoning process by outlining a series of cognitive processes related to exploration, identification, reasoning and judgement of relevant information. The team's hypothesis states that the depth at which a student interacts with a given poorly-defined problem will determine how she will process the next issue that comes her way.

Preliminary evaluations carried out by Dr Vovides and her colleagues suggest that their model could help to design more user-friendly and learner-managed online environments. For example, the team used their model to drive the design of a learner-managed dashboard, which enables interactions between students and encourages further exploration of the subject matter.

Their proposed dashboard could encourage deeper online interactions and analyses, helping students to integrate multiple perspectives. Such a dashboard would also allow instructors to offer guidance and prompts to learners, helping them to develop their reflective-sensemaking skills.

The new model developed by Dr Vovides and her colleagues has the potential to improve how students tackle poorly-defined problems and the interaction between social and individual learning – two key issues associated with online education. Their model holds the key to dramatically transforming online education, and thus, improving student outcomes.

Meet the Researcher

Dr Yianna Vovides
Director of Learning Design and Research
Georgetown University
Washington, DC
USA

Contact
E: yv11@georgetown.edu
W: https://cndls.georgetown.edu/people/yv11/

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