

EXPLORING SPATIAL SKILLS IN ENGINEERING EDUCATION

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OVERVIEW OF WORKSHOP

The ability to think spatially broadly involves being able to: understand concepts of space (such as 2D and 3D), think in different ways about spatial information, and communicate understandings of space using a variety of techniques and media. Researchers have discovered a strong positive correlation between spatial abilities and success in STEM fields internationally in recent years (for example, Cheng & Mix 2014; Lowrie et al. 2017). The development of spatial skills, however, continues to be a significant "blind spot" in many educational systems despite significant research, and many students around the world enter college and university with underdeveloped spatial skills. Over the last decade or so, we have learned that spatial skills are malleable and that they can be taught and improved in formal education settings. During this two-hour workshop, participants will participate in some challenging spatial activities, learn about the most recent advances in spatial research, and engage in discussions about spatial learning strategies to improve student retention and skill. Finally, the workshop will provide an opportunity to form collaborations in the future to investigate the role of CDIO in enhancing spatial learning around the world.

KEYWORDS

Spatial, Education, Teaching & Learning, Standards: 2, 3, 4, 6, 8, 9, 10, 11, 12

DURATION

120 minutes

ACTIVITIES

1. General introductions of presenters and participants (*10 mins*)
2. **Spatial Skills Icebreaker** (*15 mins*)
 - A short problem-solving activity in which participants are divided into groups of 4-5 people and challenged to complete the task as a team in the shortest amount of time.
3. **Group Discussion 1** (*10 mins*): **Setting the Scene**
 - What links does the introductory activity have with Spatial Skills?
4. **Introduction of Workshop** (*5 mins*)

- Aims:
 - i. Identify how spatial skills are perceived by engineering educators.
 - ii. Explore how/if we can influence spatial skills to improve academic achievement.
5. **Group Discussion 2 (35 mins): Fundamentals of Spatial Thinking**
 - Establish a definition of spatial skills (group feedback)
 - Establish how important it is seen to be in Engineering Education (group feedback)
 - Present definitions and observations from our studies in the University of Limerick to date and indicate importance (presenter)
 - Present international findings (presenter)
 6. **Group Discussion 3 (35 mins): Teaching & Learning**
 - How do you develop spatial skills in your teaching and what are the most effective approaches? (group feedback)
 - How do you identify students that struggle with spatial skills? (group feedback)
 - Present intervention examples (presenter)
 7. **Closure, thanks, and discussion for potential follow up (10 mins)**

TARGET AUDIENCE

Anyone teaching concepts relating to spatial skills who feel that they would like to learn more about the current international thinking in this area should attend this workshop. Spatial thinking is a lifelong learning skill which is taught across the education system and beyond. With that, we should be aware of any areas in which our instruction may fall short in promoting the development of these skills. We should also know how to address these areas of weakness so that students can succeed in their academic endeavors.

OUTCOMES

Participants will engage in deep reflection whilst exploring their own understanding of spatial concepts in their teaching and learning. As educators, it is crucial that we allow ourselves to engage in this to ensure continued development of spatial skills for all. Both present and future challenges and opportunities will be explored in relation to spatial learning across the engineering disciplines and in turn, effective pedagogical approaches will be introduced and discussed at length to identify what works best in our subject areas.

SPECIAL REQUIREMENTS

Projector & Screen, Flip Charts, pens and Whiteboard (If not standard)

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BIOGRAPHICAL INFORMATION

Meryn McNea is a PhD student at the University of Limerick. With a Technology Education background, she has an interest in researching the Gender Gap found in Engineering Education through the lens of Spatial Skills.

Reena Cole is a Lecturer in Mechanical Engineering and Assistant Dean Academic Affairs for the faculty of Science and Engineering at the University of Limerick. Her research is in the Energy field but based on her work as Athena SWAN champion for the School of Engineering she is developing research to support female engineering students.

David Tanner is an Associate Professor in Manufacturing Process Technology at the University of Limerick. He undertakes research in the areas finite element analysis of metal working processes, additive manufacturing and investment casting as a member of the faculty's Bernal Institute. Prof. Tanner has been an active member of CDIO since 2009 and has developed engineering modules based on the principles of CDIO.

Diarmaid Lane is a Lecturer in Technology Teacher Education at the University of Limerick. His research spans the areas of spatial thinking, design communication, cognition, and teaching quality in Higher Education. Diarmaid has received numerous national and international awards for excellence in both his research and teaching.

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