STEM RESEARCH

Professor John Williams
STEM Education Research Group
School of Education
STEM Goals

Global competitiveness
Workforce needs
STEM careers
Attitudes toward STEM
STEM Studies
Workforce readiness
Make STEM connections
STEM literacy
21C skills
STEM Goals

Global competitiveness
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STEM literacy
21C skills

socio-economic
pre-vocational
STEM Goals

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socio-economic
pre-vocational

individual
general
STEM Goals

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21C skills
Goal related research

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long term
establish causality
Goal related research

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If future workforce needs are met, is it because of school STEM programs?
Goal related research

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Students who engage with STEM are more disposed to a STEM career (Christensen)
Goal related research

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**Attitudes toward STEM**
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After engaging with STEM experiences students are more likely to have a positive attitude (Williams)
Goal related research

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ME evidence:
More students studying STEM.
Less students dropping out.
Goal related research

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Long term goal
How to measure?
Indication that STEM and 21C skills are needed in future.
Goal related research

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Limited and inconclusive research on integration (English)
Science and maths enhance each other (Wendell)
Maths in technology enhances maths
Science and engineering – ambiguous (NAE)
Attending a NY STEM school – ambiguous (Wiswall)
Goal related research

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What is STEM literacy?
Little correlation of iSTEM education with student outcomes (Honey)
Goal related research

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Skills: critical thinking, innovation, collaboration, complex problem solving, etc
How to measure?
STEM engineering improves higher order thinking (Fan)
Goal related research

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What about the student?
Goal related research

The primary drivers of STEM in schools remain economic (‘increasing the return on investment and driving future prosperity’ (Australia’s National Science Statement, 2017)) and workforce planning.
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Research follows the primary drivers
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Research follows the primary drivers

Is this enough for educators?
What about the student?

- Personal individualized development
- Ability to transfer concepts between disciplines
- Development of student interest and engagement
- Ways of knowing
- Development of representational fluency
- Personal attributes
What about the student?

- Need to evaluate all STEM initiatives
- Think about student personal development
Proposed ME research

Does participation in an integrated STEM activity enhance disciplinary learning and enable complex problem solving more than non participation?

Year 9-10
Pre and post treatment and control group research structure
Data: grades and COMPRO test scores


In the 2008 *Melbourne Declaration on Educational Goals for Young Australians*, it was recognised that schooling should support the development of skills in cross-disciplinary, critical and creative thinking, problem solving and digital technologies.

These 21C objectives lie at the core of the national science, technology, engineering and mathematics (STEM) school education strategy.
# Trends in research

## Focus of the research studies

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## Research method

(Brown, Mizell)

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Silos, pigeon holes, and boundaries

In the corporate world silos are considered a sign of organisational dysfunction; but in education?
School re-organisation

Some tough questions:

• **Timetabling** - How does it enhance the ability to work in an interdisciplinary mode?
• **Access to resources** – as required or according to schedules?
• **Vertical limits** – are students enabled to exceed teacher expectations?
• **Learning Design** - Who decides about learning?
• **Motivation** – what drives learning; curriculum or curiosity?