

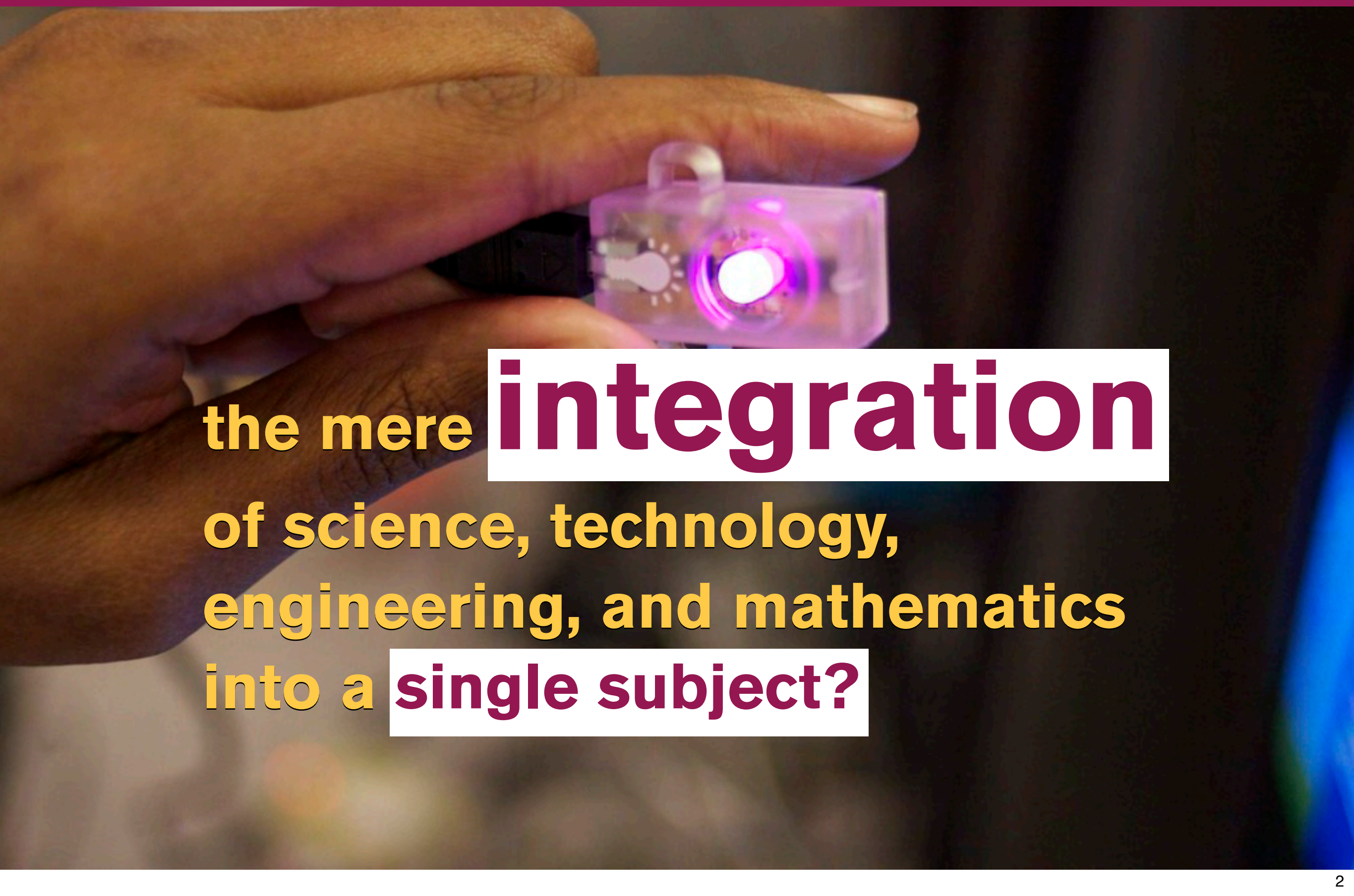
iSTEM & Diversity

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Committee on Integrated STEM Education
National Academy of Engineering

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is integrated STEM education. . .



the mere **integration**
of science, technology,
engineering, and mathematics
into a **single subject?**

k-12 students are. . .

disenchanted with
school science and
mathematics



k-12 schools are. . .

eager and desperate
to redesign/rename their buildings as
“STEM schools”



will integrated STEM education. . .

transform learning opportunities for

demotivated

learners?



will integrated STEM education. . .

enhance participation?

increase diversity?

lead to innovation?

integrated STEM education. . .

will not necessarily be more

appealing or relevant

**to k-12 students' interests than current
school science and mathematics**

unless integrated STEM education

also integrates

personal and social

relevance



unless integrated STEM education

also integrates

identity

development



relevance. . .

mastery

(experience success)

high value

science education research. . .

girls and boys may
place different values for the
same educational choice



identity development is. . .

impacted by

stereotypes related to

jobs, subjects, and activities

— these are culture dependent and

gender-specific

unless integrated STEM education

incorporates

free choice



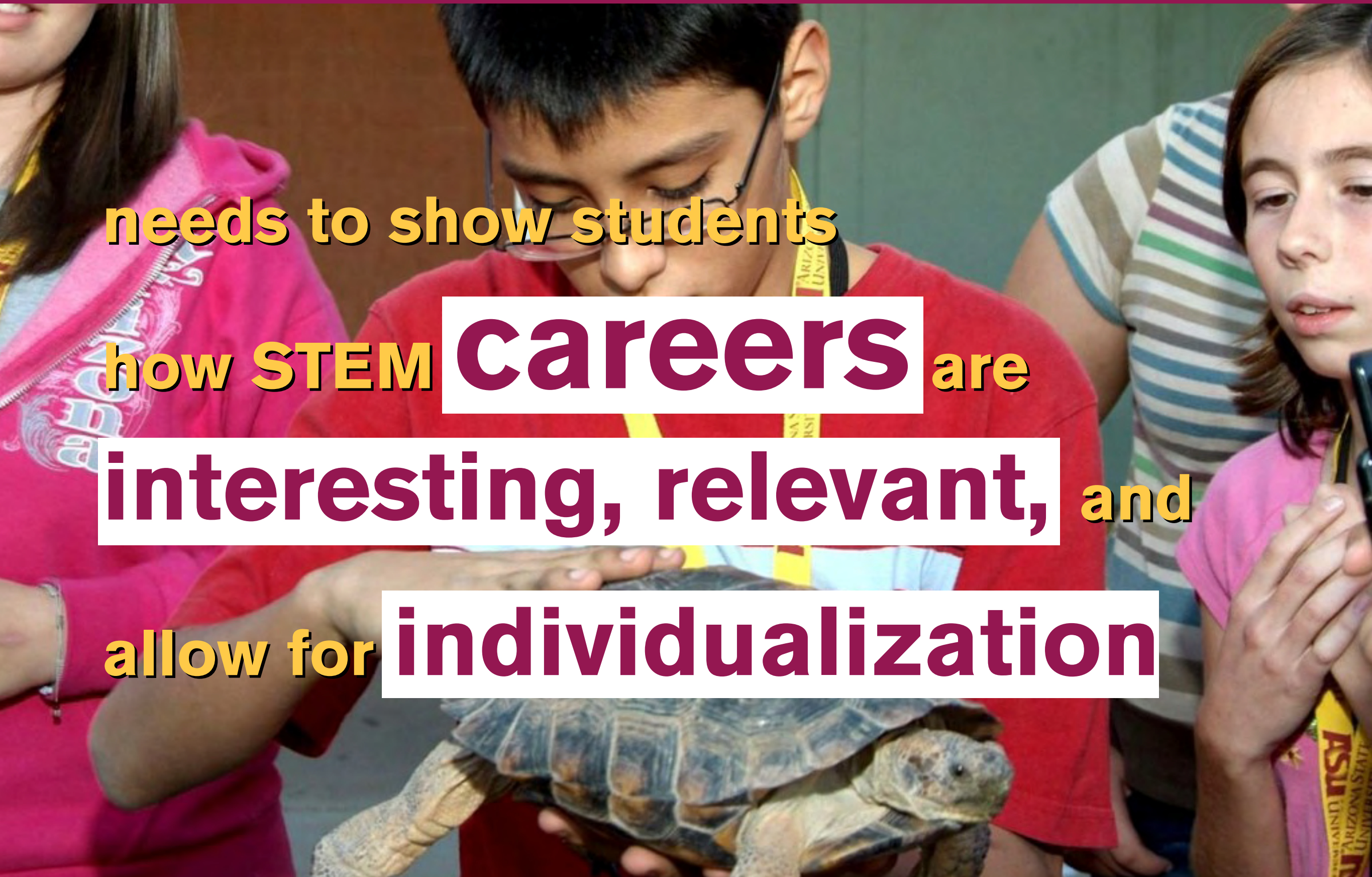
integrated STEM education

needs to show students

how STEM careers are

interesting, relevant, and

allow for individualization



integrated STEM education

A young boy with dark hair, wearing a dark blue jacket over a light-colored shirt, is sitting at a wooden desk in a classroom. He is holding a clear plastic bottle with a red Coca-Cola label and a red cap, tilted to pour water into a small white container. His right hand is open, palm up, near the container. The background shows other wooden desks and yellow chairs in a classroom setting.

is therefore not merely
interdisciplinary, but

transdisciplinary

integrated STEM education

A photograph of a classroom setting. A woman with long brown hair, wearing a beige cardigan, is leaning over a desk, looking at a project. A young man with short brown hair, wearing a blue shirt, is also looking at the project. In the background, other students are visible, including a girl with glasses and a boy in a striped shirt. The scene is set in a room with bookshelves and various educational materials.

**needs to offer multiple entry points
for learners**

**where the scientific, technical,
social, economic, and the political
interact with elements of value and
culture**

integrated STEM education

**has the potential to enhance
diversity in k-12**

**to establish evidentiary warrant,
long-term research that use
multiple approaches are needed**

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research needs to:

**move beyond describing “what is?”
or confirming “what works?” to**

deliberately designing

**“what strategy(ies) of intervention
might work better?”**

Design research

is necessary to develop, test, implement, and diffuse innovative practices to move from socially constructed forms of teaching and learning from malfunction to function or from function to excellence (Kelly, 2003)

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design research attempts to:

a) help **design** innovations

b) **explain** their effectiveness or lack thereof, theoretically

c) **re-engineer** them wherever possible

(Kelly, Lesh, & Baek, 2008)

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**more than a single
theory** will likely be required to
describe, explain, or predict the
success or failure of a specific
learning innovation

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research will unfold over multiple cycles within a study or across a program of studies

iterative in nature

assessment should act as a guide for improving the innovation's potential for learning

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**design researchers build
instructional artifacts that
improve student learning**

**underlying theory(ies) of learning
should be identified**

**(based on changes in what a learner masters,
rather than one based on achievement, which
reduces learning to an assumed terminal point)**

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design research requires

several phases from

construction of new possibilities

(innovation in education) to tests of
causality and generality

ultimately include **scaling and**

diffusion research

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