

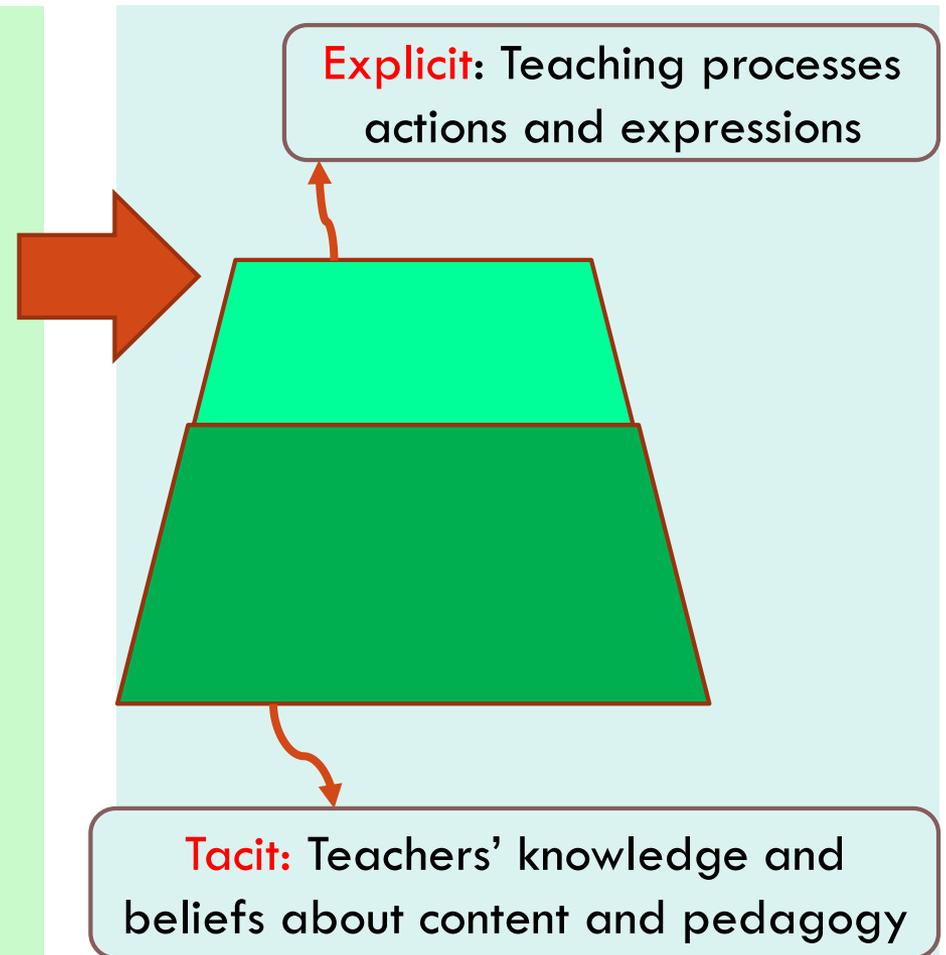


DEVELOPING TEACHER PD USING DESIGN RESEARCH METHOD: DEVELOPING TEACHERS' PCK

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PCK and Teaching

- The way teachers teach represent their understanding and beliefs about content and teaching.
- Teachers' professional development should be addressed to develop teachers' PCK



Pedagogical Content Knowledge

Initial conception: “the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction” (Shulman, 1987:8)



Lee S. Shulman, 1938 -

<https://ed.stanford.edu/sites/default/files/faculty/172086dda7ff455effa6a8d5c7fc8294.jpg>

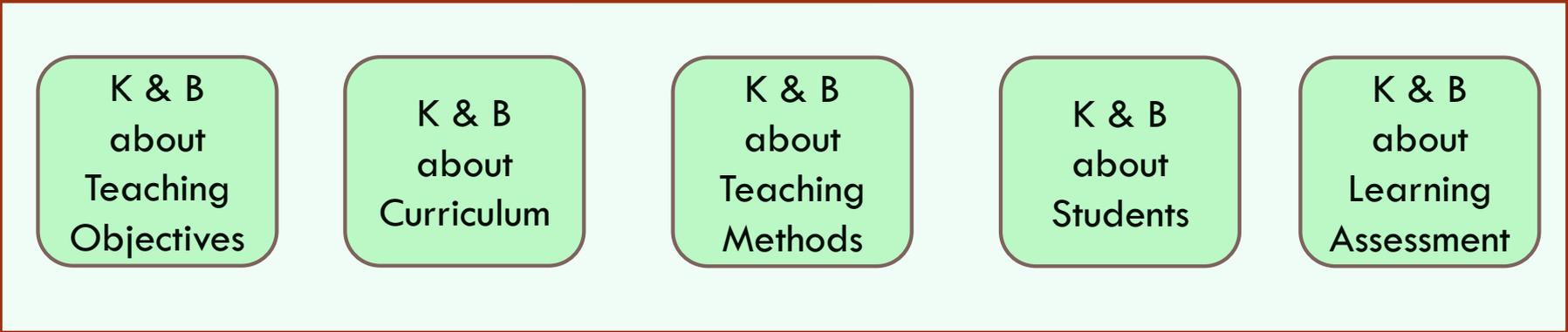
It's composed of knowledge and beliefs

All beliefs have a cognitive component representing knowledge (Rokeach, 1968)

Knowledge and beliefs are two interwoven systems. They are inextricably intertwined (Parajes, 1992: 21).

PCK is not only formed by a set of teachers' knowledge but also by their beliefs related to that knowledge (Magnusson, et al. 1999)

Pedagogical Content Knowledge (PCK)



(Source: Sarkim, 2005:59)

integrating academic excellence and humanistic values

Pedagogy...

- Pedagogy comprises teachers' ideas, beliefs, attitudes, knowledge and understanding about the curriculum, the teaching and learning process and their students, and which impact on their 'teaching practices', that is, what teachers actually think, do and say in the classroom. Teacher beliefs are contextually based.

- Alexander R.J. (2001) *Culture and pedagogy: International comparisons in primary education*. Oxford and Boston: Blackwell.p.540

Teachers PD -

“teacher educators must provide opportunities for teachers to examine, elaborate, and integrate new knowledge and beliefs about teaching and learning science into their existing systems of knowledge and beliefs “
(Magnusson et.al. 1999: 122)



Teachers’ professional development should be addressed to develop teachers’ PCK

Design Research - PD

“a series of approaches, with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings” (Akker, Gravemeijer, McKenney & Nieveen, 2006: 122)

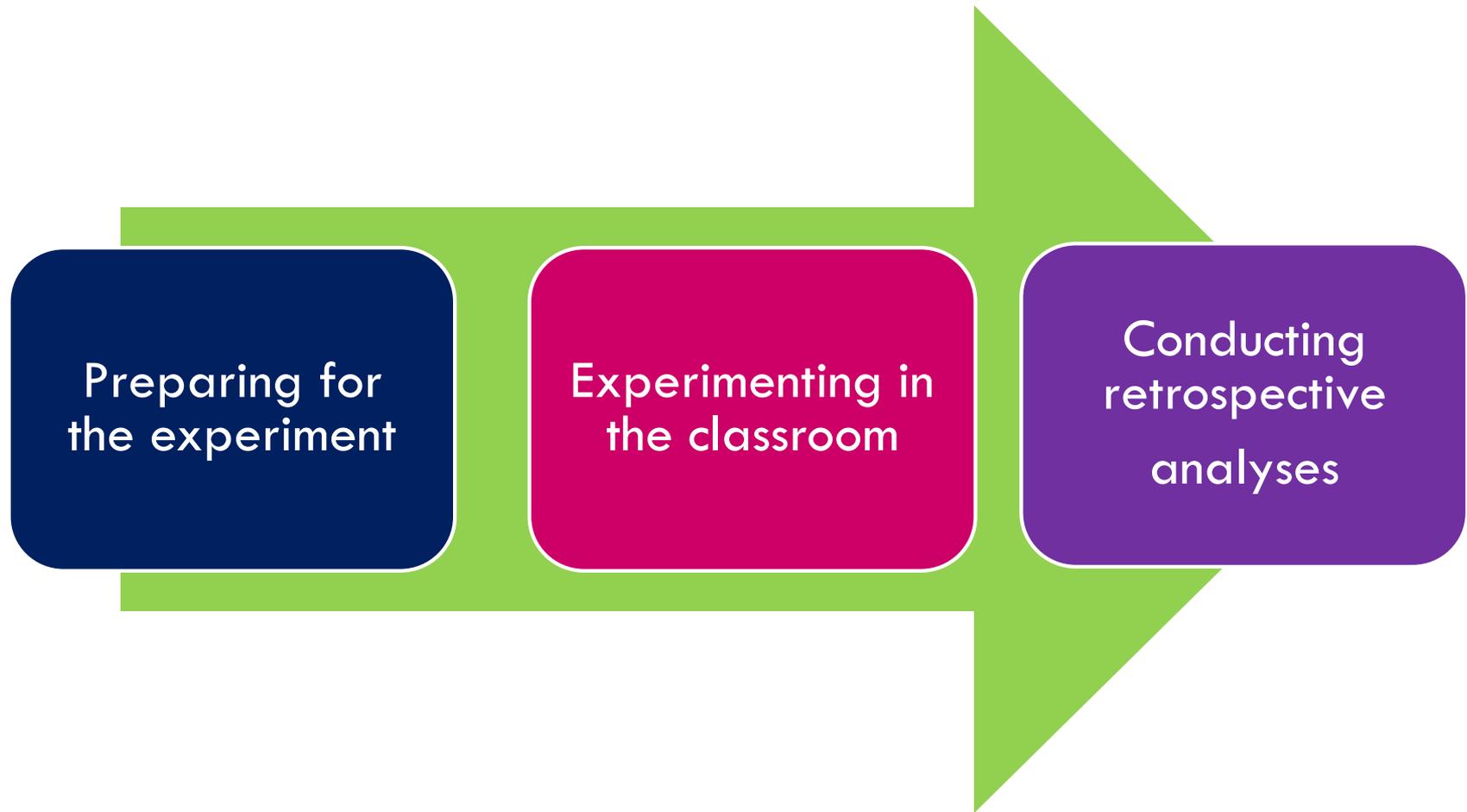
*“if you want to change something, you have to understand it, and if you want to understand something, you have to change it” (Gravemeijer * Cobb, 2006: 17)*

STEM Teaching Approach

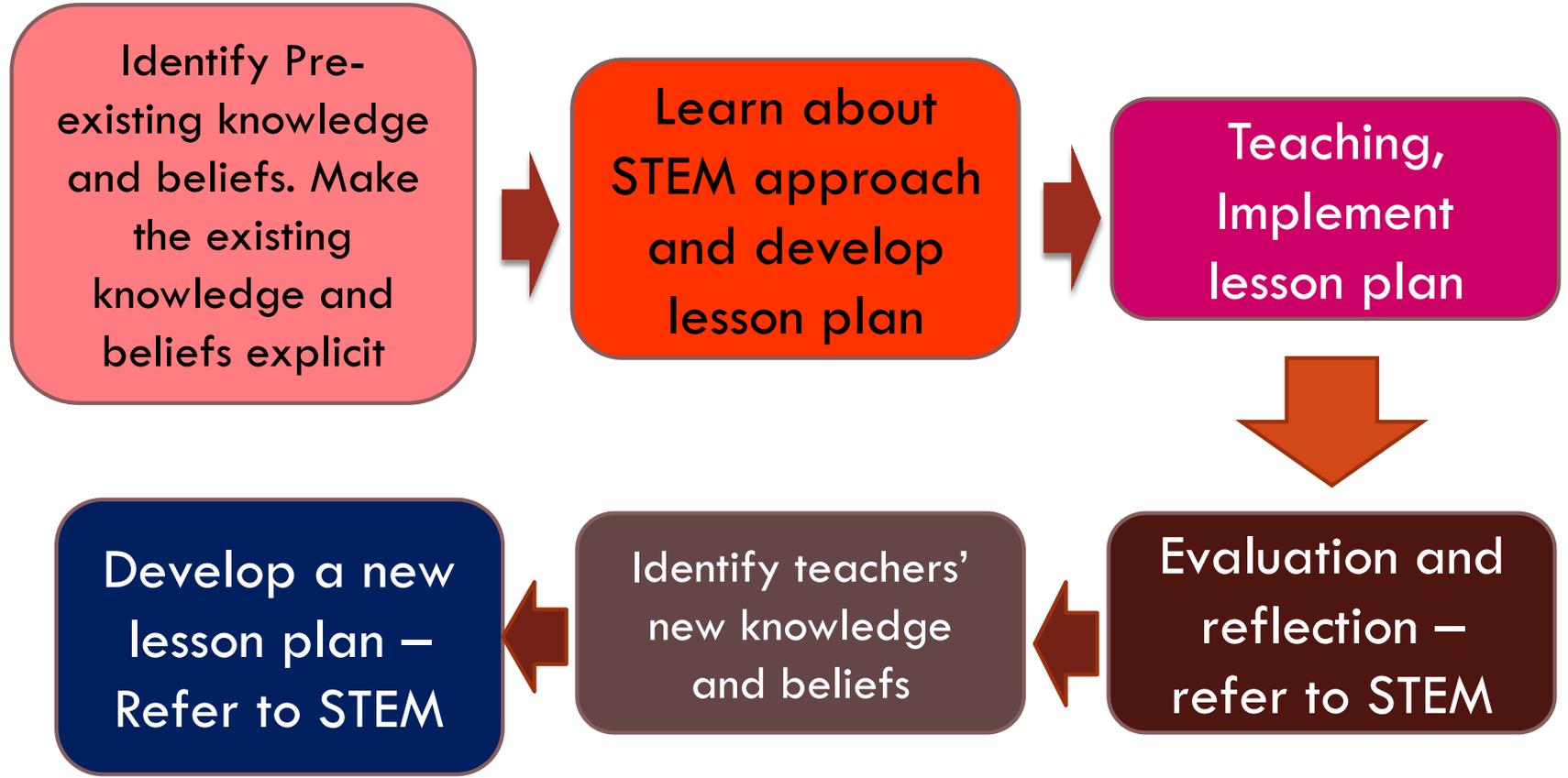
STEM approach: the teaching of the disciplines within its umbrella – science, technology, engineering, and mathematics – and also to a cross –disciplinary approach to teaching that increases student interest in STEM relative fields and improves students' problem solving and critical analysis skills.
(Rosicka, 2016: 17)

STEM Teaching approach: A vehicle to improve science and mathematics teaching in secondary schools to meet new standar of teaching quality

Three phases of Research Design

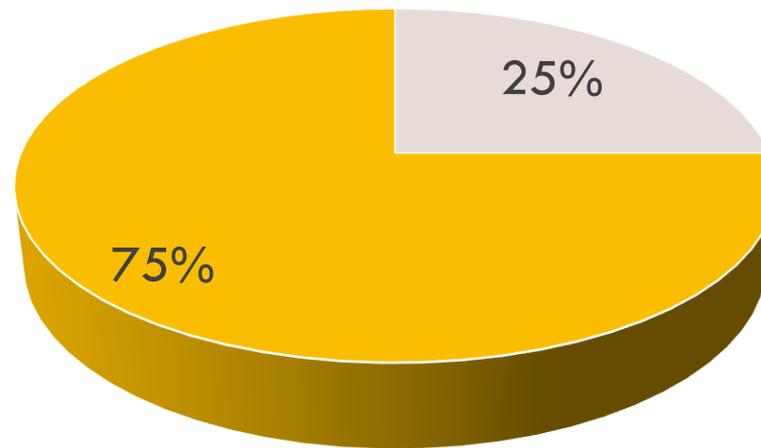


Teachers' PD – STEM Approach



Teachers' initial knowledge

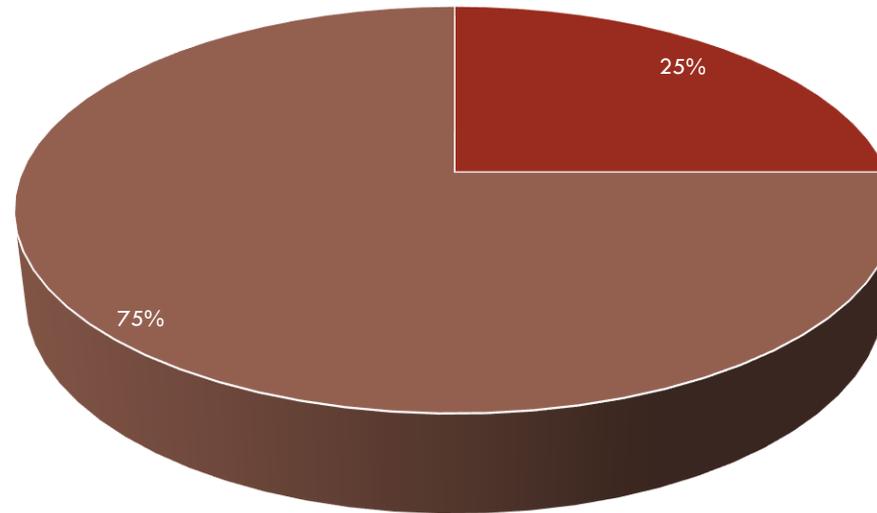
STEM Approach - Have you heard it before?



■ Yes ■ No

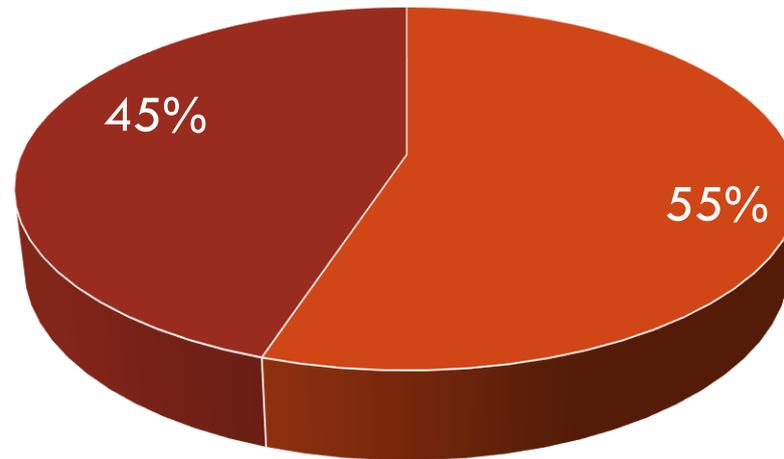
STEM Approach – initial beliefs

Science and Maths should be taught as separate subjects



■ Yes ■ No

Science and Mathematics should be taught integrated relevant to the context



■ Agree ■ Strongly Agree

Teachers' initial knowledge and beliefs about STEM Approach

"I don't know anything about STEM"

"A teaching system using current technology"

"It's combine several subject with technology"

"I don't think it would be possible because of very limited time available"

"I don't think we have capacity to do that"

Teachers' willingness to try STEM approach

I want to to try this out. I think it would help my students to develop 4Cs

I want to try it, the approach may help the students to understand a difficult concept about variable

I think this approach more interesting to my students, I will try it

Topic: Year 8 Electricity

Task: Designing electricity system to save energy

Science: Electricity concept

Mathematics: Statistics, mathematic analysis.

Engineering: To create a working model

Technology: To Create a model of a real world context

A Model of street lighting



Year 7 – Classification and set theory task



Post teaching...

STEM approach integrates math, science, and technology ... it's makes students develop comprehensive understanding and develop students' thinking skills... Is it possible to combine with other subjects?

STEM approach is a new way to see the teaching ... to meet the challenge of current society needs... I want to continue this project since it help develop students' creative and critical thinking

Conclusion

Design Research
'approach' can
be implemented in
PD-related
programs

Teachers PD programs
need to take PCK (including
knowledge and beliefs) into
account to increase the
level of success in terms of
teaching quality
improvement.

Experiential
learning may
bring more success
to PD than direct
training

TERIMA KASIH



Integrating academic excellence and humanistic values