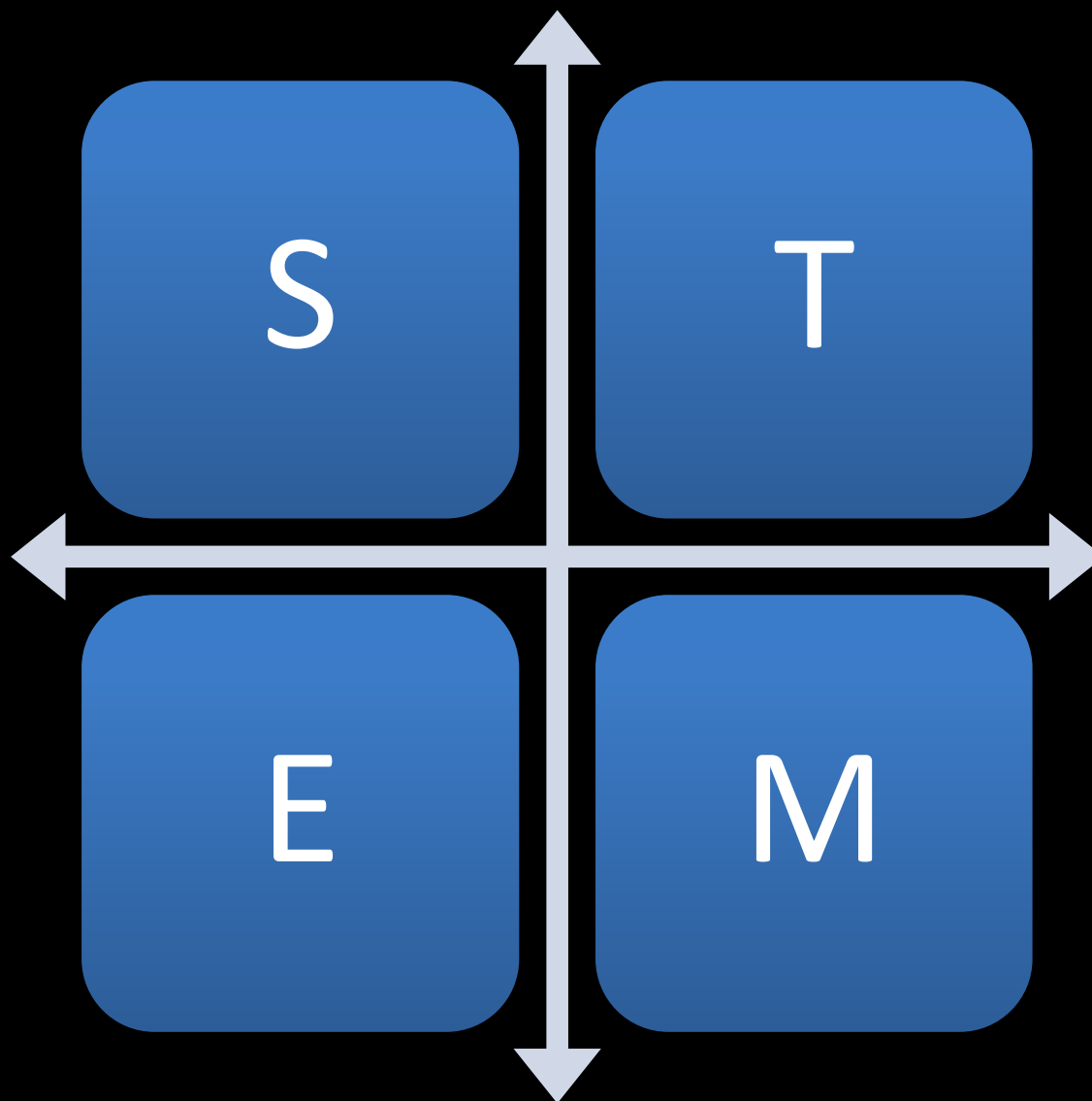


STEM Education

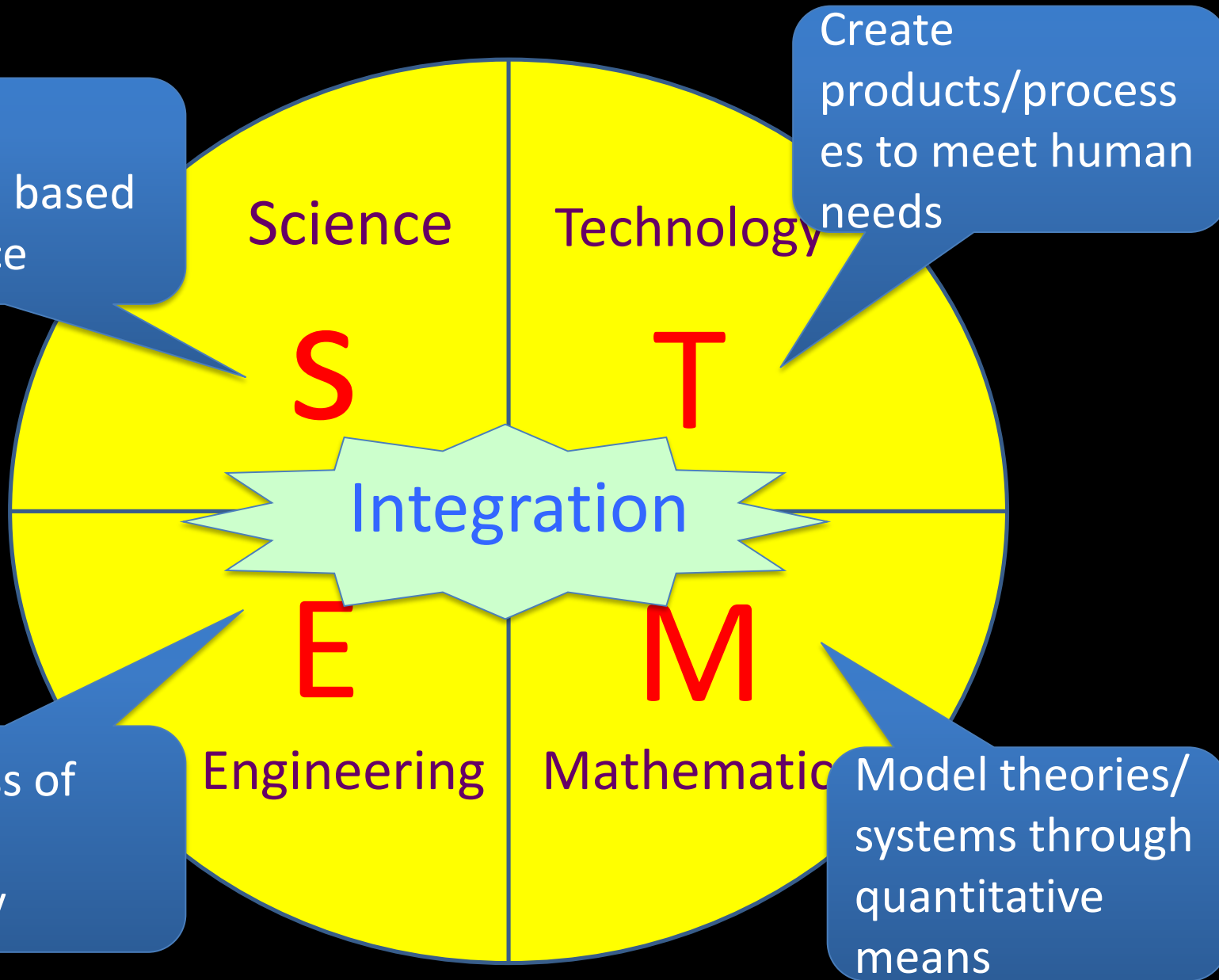
Issues about Planning & Implementation



Current situation

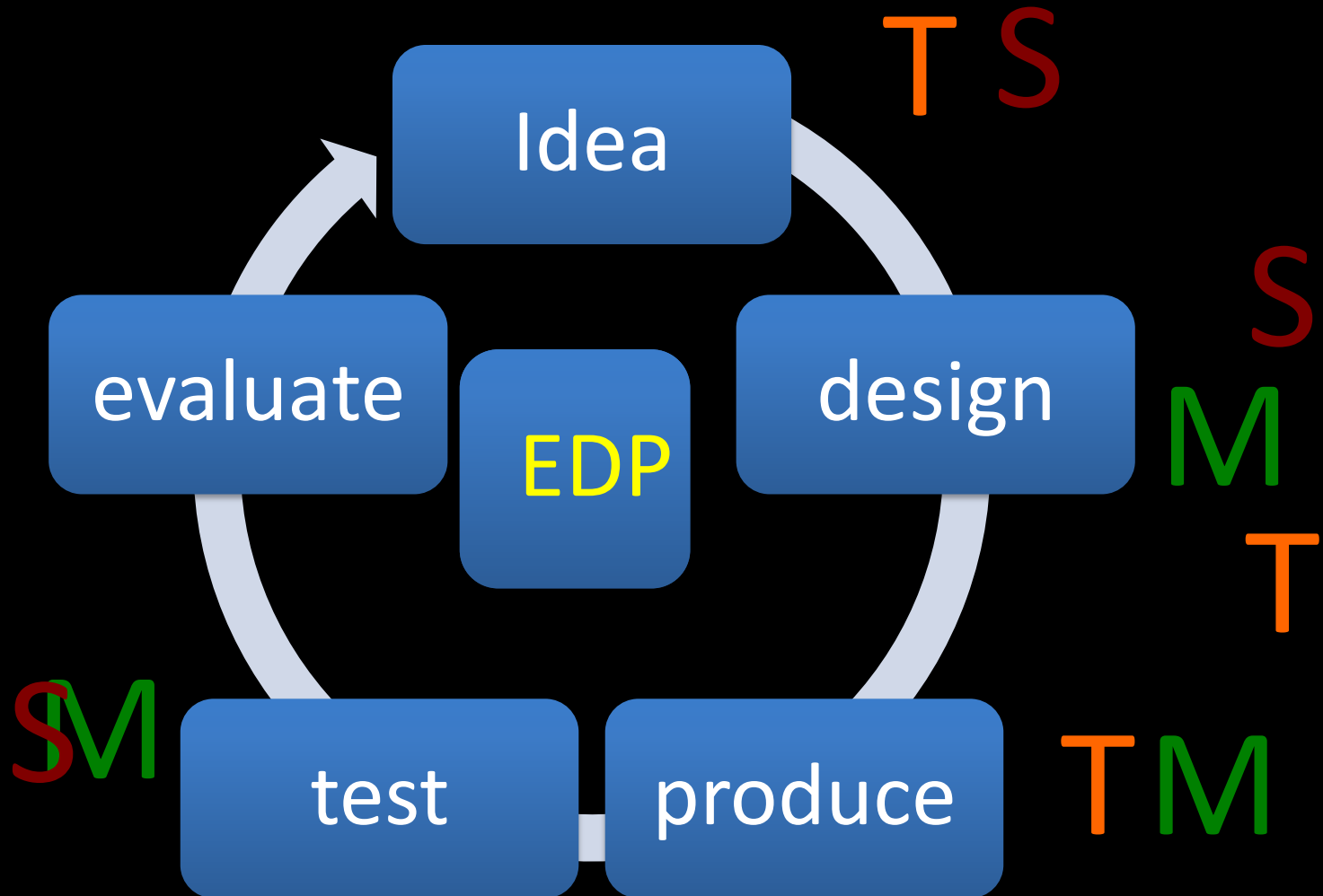
- Compartmentalized curriculum
- Learning out of context
- Teacher-centred
- Conceptual learning rather than problem-based learning

What is STEM ?



How to integrate?

Engineering Design Process (EDP)





- Scientific knowledge for application
- Scientific inquiry for discovering knowledge
 - Focus on general principles
 - Focus on single variables



E

- Engineering design process (EDP)
 - Require application of S, T, and M
 - Situate in specific contexts
 - Involve complex combination of variables
- Problem solving
 - Criteria
 - Constraints

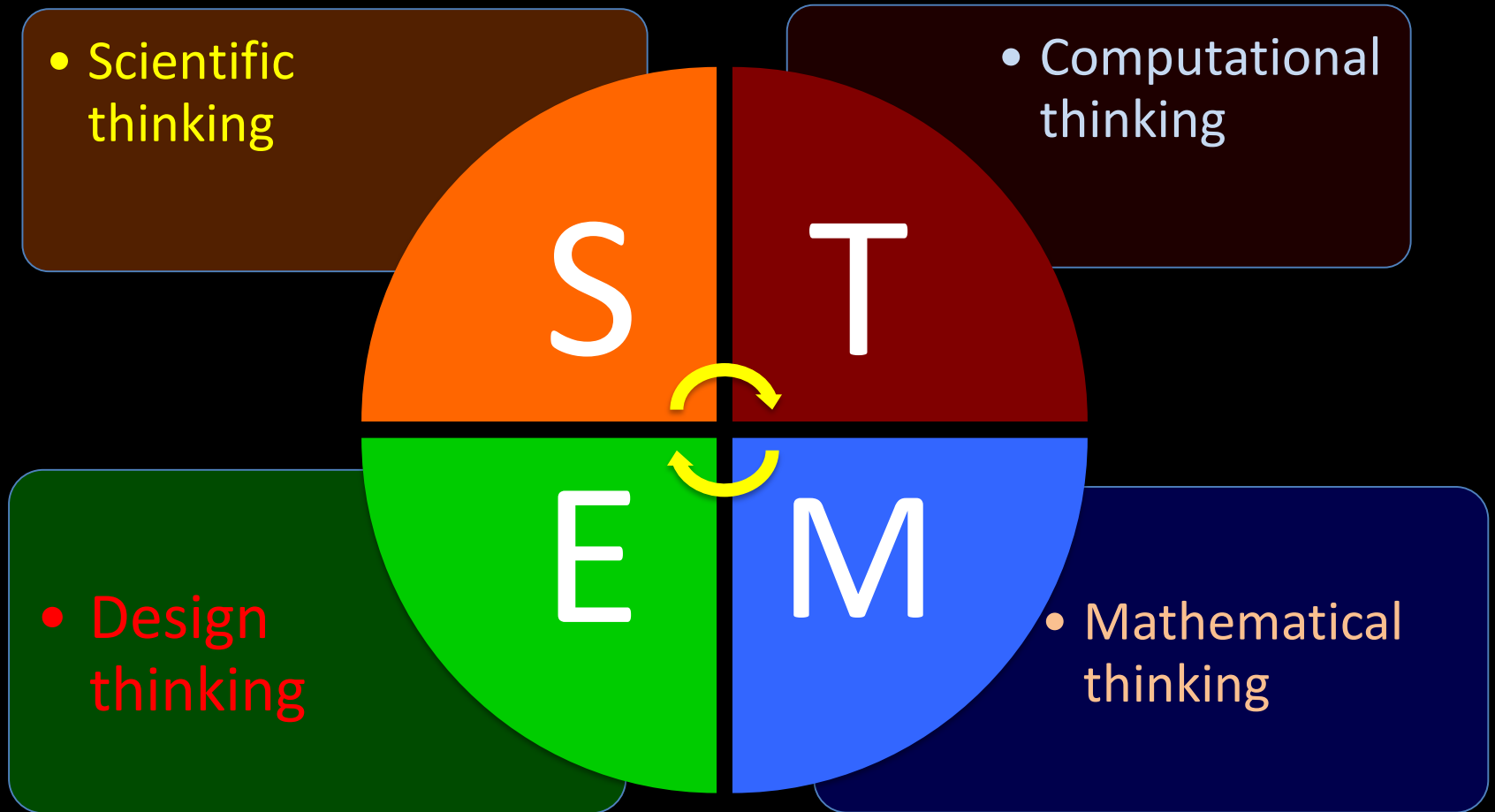


- For meeting quantitative criteria
- For more precise representation of functions/effectiveness of artifacts
- For evaluating and comparing alternative solutions
- For modeling
- Measuring
- Formulation/Application of mathematical equations (e.g., law of levers, calculation of area/volume/speed/acceleration)
- Presentation and analysis of results (e.g., percentage, graphs)



- As product of engineering design
 - as creation/solution to problem solving
- Use of technology
 - as tools for scientific inquiry and engineering design and production

Thinking processes behind STEM



FOUR main characteristics of STEM

- Real world context
- Problem solving
- Engineering design
- Integrated application of disciplinary knowledge and skills

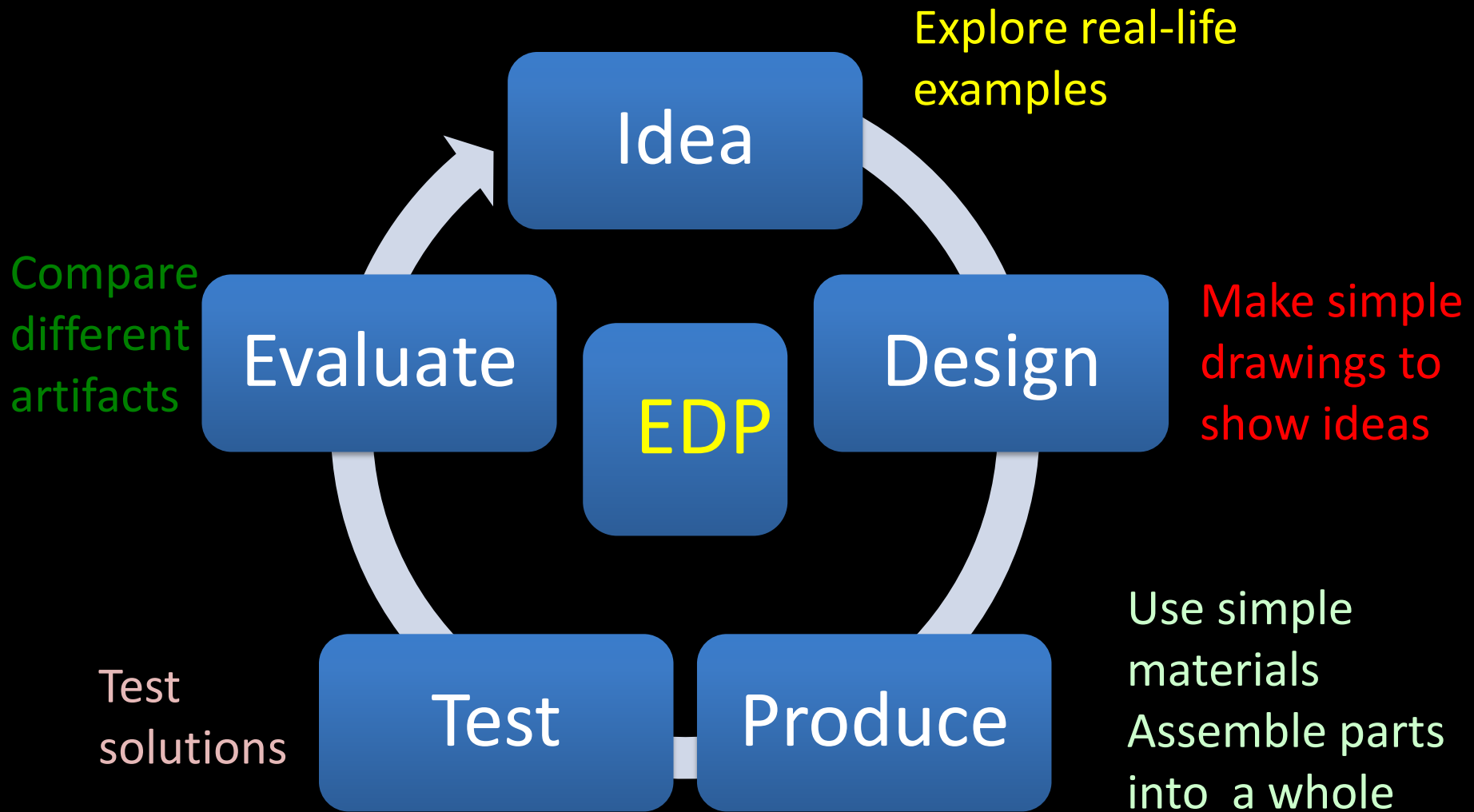
Seven criteria for STEM programs

1. EDP for integrating S, M and T
2. S and M is grade-appropriate and applied
3. Focus on real-world problems/engineering challenges
4. Students work in teams in EDP
5. Reporting using communication approaches
6. Inquiry-based, student-centred learning involving hands-on investigation
7. Failure is a part of learning

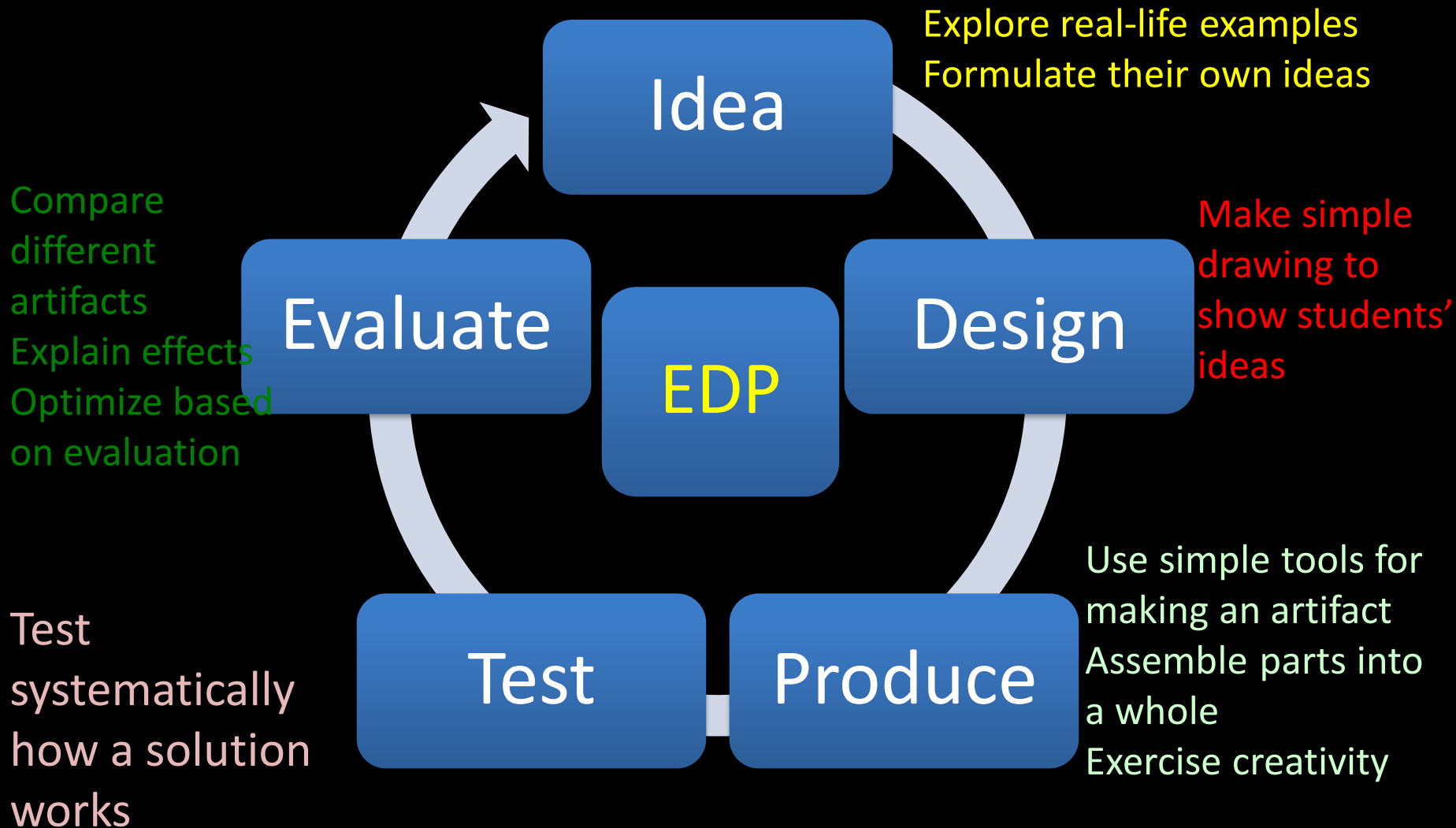
[Adapted from Jolly, A (2017)]

Curriculum progression across grade levels

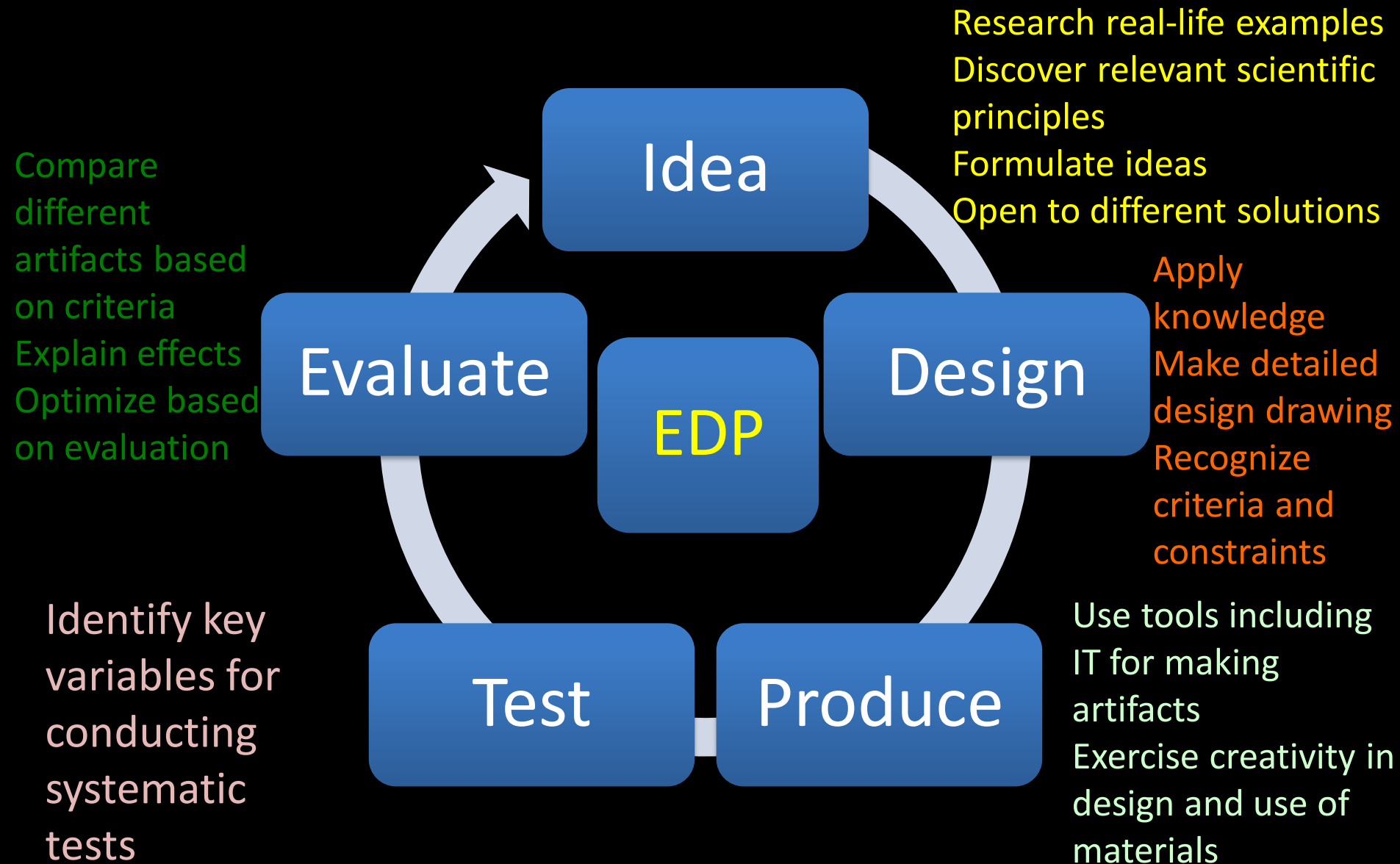
Lower Primary (EDP)



Upper Primary



Junior/Senior Secondary



Vision

Subject
collaboration

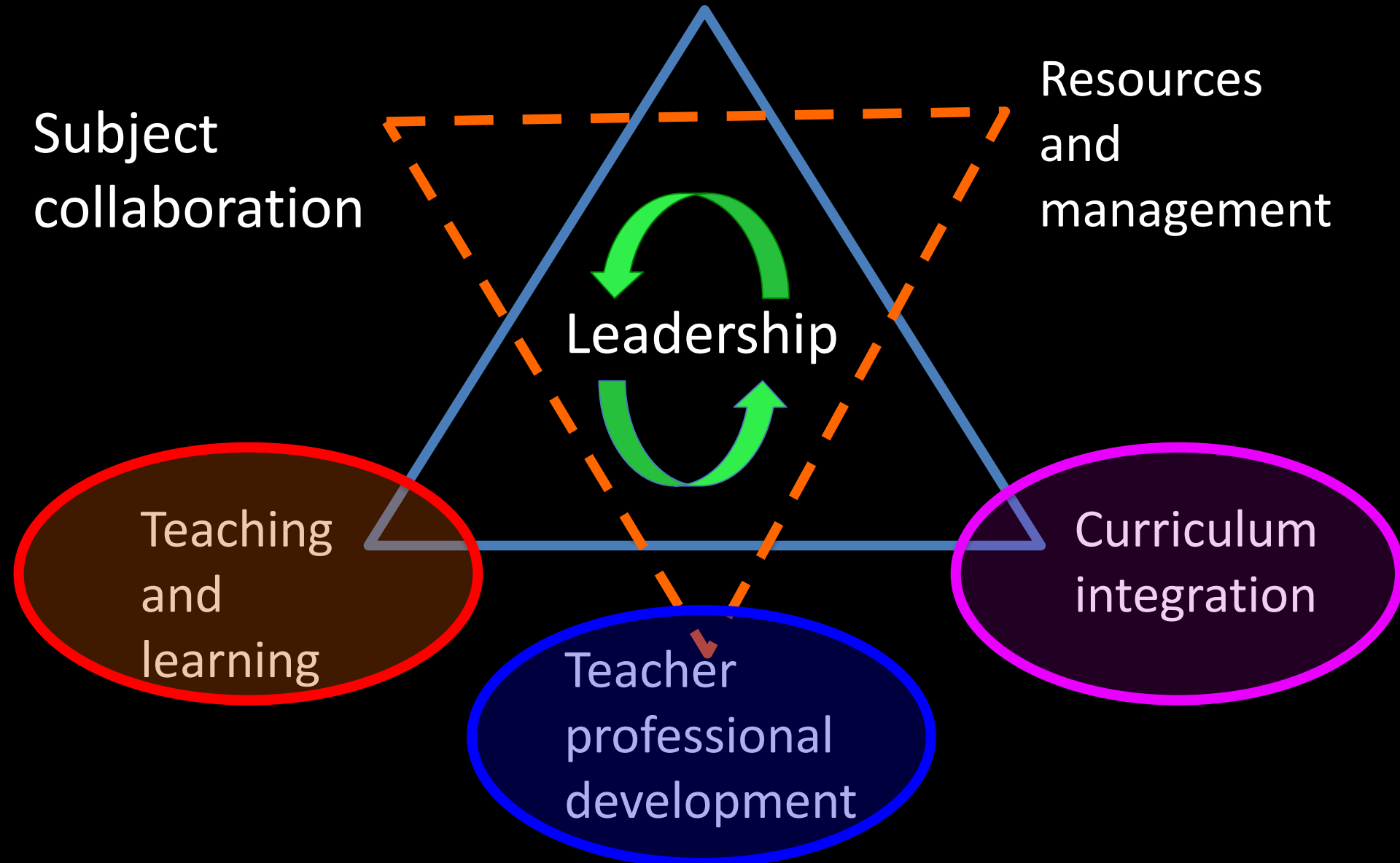
Resources
and
management

Leadership

Teaching
and
learning

Curriculum
integration

Teacher
professional
development



Organizational support

- Cross-subject collaboration
- School-based curriculum development (with differentiation and progression)
- Team teaching (including lesson planning, designing worksheets, trial of activities, preparation of materials, assessment)
- Timetabling
- Resource acquisition and management