Samenvatting Artikelen 2020

VOCUS heeft deze samenvatting te danken aan Mette Reurink.

Het gebruik van deze samenvatting is bedoeld als studeerhulp na het lezen van de verplichte literatuur. Gebruik van deze samenvatting is geheel voor eigen risico.

Soms wordt er verwezen naar bladzijden of tabellen in het originele boek.

Succes met studeren!

Inhoud

Bakker & Akkerman (2014)

A boundary-crossing approach to support students' integration of statistical and work-related knowledge
- *https://link-springer-com.proxy.library.uu.nl/article/10.1007/s10649-013-9517-z*

Integrating mathematics and statistics learned in school → work-related knowledge
Reflection using for transformation

Transfer = application of general principle in new situation when confronted with a task → mostly used for unidirectional processes, oriented toward individuals performing tasks

Boundary crossing = more complex efforts by people who move back and forth

→ bidirectional and dynamic
→ oriented towards both personal and collective

In this review study:
→ **boundaries =** sociocultural differences that give rise to *discontinuities* in action and interaction → **boundary crossing =** efforts by individuals or groups at boundaries to establish or restore *continuity* in action or interaction across practices
→ **boundary objects =** both inhabit several intersecting worlds and satisfy informational requirements of each of them (for ex. portfolio's that help workplace supervisors track students' development) → focus on learning mechanisms of reflection and transformation

- *Perspective making* = communication that strengthens unique knowledge of community
- *Perspective taking* = communication that improves its ability to take knowledge of other communities into account

→ *research question:* How, and to what extent, did students in a boundary-crossing approach learn to integrate statistical and work-related knowledge in their reasoning about work tasks?

TEBOs = *technology-enhanced boundary objects,* reconfigurations of workplace designed to help employees understand relevant maths or statistics behind these artifacts (computer tools to facilitate boundary crossing)

Two principles formulated for operationalizing integrating knowledge between internship and school:

1. Involving school-taught and workplace-related knowledge in reasoning → indicates higher level of knowledge integration (than involving one of them)
2. Reasoning or explaining → indicates higher knowledge level than making statement (cause-effect or if-then)

Research: intervention of five 1-h meetings following aforementioned boundary-crossing approach, in laboratories and laboratory education.

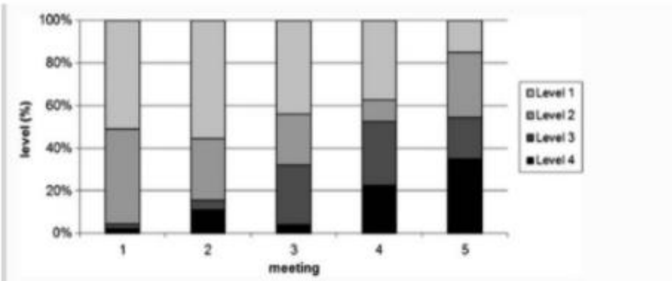
In research → no validated measurement scales found in previous studies → developed one

Level	Characterization
1	Statement about something statistical-mathematical (school-taught) *or* work-related but without explanation or reasoning
2	Reasoning or explanation with only statistical-mathematical *or* only work-related (non-statistical) knowledge
3	Statement in which a statistical-mathematical fact *and* a work-related fact are combined
4	Reasoning with both statistical-mathematical *and* work-related knowledge

Following first principle → levels 3 and 4 are defined higher than 1 and 2

Following second principle → level 2 is considered higher than 2 and level 4 considered higher than 3

Results:



Stacked percentages of knowledge integration levels during group interaction per meeting

Stimulated boundary crossing in terms of reflection, in hope of propelling transformation (in form of knowledge integration). Boundary-crossing approach characterized by principles (second and thirds being corollaries of the first):

- Stimulating students to reflect as basis for transformation of knowledge
- Involving teachers and students with workplace supervisors to support students in efforts to integrate different types of knowledge
- Using boundary objects (report, as example of what they were going to do)

Limitations:

→ only 3 students, all working in same group on same project

→ first author had to teach, regular teacher did not feel at ease with statistics involved → no control group to compare with

Points of discussion:

→ distribution of knowledge: unplanned boundary crossing between supervisors and teachers → integration of different types of knowledge can be promoted in different ways → this research can also be relevant to general education, not just vocational education → many characterizations of school vs workplace knowledge are simplistic (different perspectives)

Kirschner, Sweller & Clark (2006)

Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching
- *https://www-tandfonline-com.proxy.library.uu.nl/doi/abs/10.1207/s15326985ep4102_1*

Direct instructional guidance = providing information that fully explains concepts and procedures that students are required to learn, as well as learning strategies
Learning = change in long-term memory

Different names for minimally guided approach: discovery learning, problem-based learning, inquiry learning, experiential learning, constructivist learning…

Two main assumptions underlying instructional programs using minimal guidance:
- Challenge students to solve 'authentic' problems/acquire complex knowledge in information-rich settings → learners constructing own solutions leads to most effective learning experience
- Knowledge can only be acquired through experiences based on procedures of discipline Constructivist argument for minimal guidance:

large amounts of guidance may produce very good performance during practice, but too much guidance may impair later performance

This article → goal is to suggest that minimally guided instruction is likely to be ineffective

Human cognitive architecture = manner in which our cognitive structures are organized
→ Atkinson and Shiffrin *sensory memory → working memory → long-term memory model*
We are skillful in an area because long-term memory contains huge amount of information concerning the area → quickly recognizing characteristics of situation
Aim of instruction → alter long-term memory
Working memory = cognitive structure in which conscious processing occurs
- Limited in duration and capacity

Limitations only to new information that have not been stored in long-term yet

All problem-based searching makes heavy demands on working memory → not even much is learned from it, because working load is used for searching

Shulman: understanding why less guided approaches fail in integration of content expertise and pedagogical skills
- *content knowledge* = amount and organization of knowledge in mind of teacher
- *pedagogical content knowledge* = knowledge which goes beyond knowledge of subject matter, into dimension of subject knowledge for teaching
- *curricular knowledge* = pharmacopoeia for teachers to draw tools from for teaching particular content

Kirschner: way an expert works in domain → not same as one learns in that area 3

Dehoney: mental models and strategies of experts developed through slow process of accumulating experience in their domain areas

Teaching of a discipline *as* inquiry = curricular emphasis on research process within a science **Teaching of the discipline *by* inquiry =** using research process as pedagogy or for learning No distinction between behaviors and method of researcher (expert) and students who are new to learning this information

Explorational learning → larger cognitive load, poorer learning
Problem-solving search → overburdens limited working memory, requires working memory to use resources for activities unrelated to learning
Studying a worked example → reduces cognitive load, directs attention
Conditions under which worked-example effect is not obtainable:

- When worked examples are structured in manner that implies heavy cognitive load
- Worked-example effect first disappears, then reverses as the learners' expertise increases, until when learners have enough experience → example becomes redundant (overbodig) = **expertise reversal effect**

Kolb/Kolb and Fry → learning process begins with person doing particular action, then discovering effect of action in a situation. Second step is to understand effects. Third step is understanding general principle for this particular cause and effect.

Lajoie (2003): *"that strong treatments benefited less able learners and weaker treatments benefited more able learners"* → **scaffolding**
Clark (1989): failure of providing strong learning support for less experienced/able students can produce loss of learning

Conclusion: no body of research supporting instruction using minimal guidance. Unguided instruction is normally less effective, but it also may have negative results (causing misconceptions or incomplete or disorganized knowledge)
Instruction minimal guidance → origins might be found in post-*Sputnik* science curriculum → educators shifted away from teaching a discipline as body of knowledge, idea that knowledge can only be learned through experience

Marshall (2017)

Montessori education: a review of the evidence base

Maria Montessori (1870-1952)

Central to Montessori education: Dynamic triad of child, teacher and environment One of teacher's roles → guide child through *'prepared environment'* = classroom and way of learning that are designed to support child's intellectual, physical, emotional and social development through active exploration, choice and independent learning

Two of its important aspects:

- Learning materials
- Way in which teacher and design of prepared environment promote children's self-directed engagement with materials

Montessori developed set of manipulative objects objects designed to support children's learning of sensorial concepts

Montessori goal of education = to allow child's optimal development to unfold

Aims of this review:

1) Identify some key element of Montessori educational method

2) Review existing evaluations of Montessori education

3) Review studies that do not explicitly evaluate Montessori education but which evaluate key elements identified in (1)

Some key elements of Montessori educational method:

- Learning materials

Practical life curriculum → developing skills for independent living

Sensorial materials → each isolates just one concept for the child to focus on, not bombarding stimuli Literacy curriculum → introduction of writing (how, techniques) before reading Mathematics curriculum → symbols introduced separately before combining, concrete materials

- Self-directed engagement with materials

Aiming to promote concentration

Internal work cycle = cycle of activity surrounding use of material

External work cycle = cycles of activity take place during 3-h period of time, kids are free to select activities on their own, own rhythm and moving freely where they want

Few methodological limitations in body of research about Montessori education:

- Few studies are longitudinal in design
- No good quality randomised control trials (often participants been matched)
- What can cause differences in results between children from Montessori education and regular education? How can specific elements be isolated?
- Studies rarely include more than one Montessori school, sometimes not more than one class
- *Treatment fidelity:* what counts as a Montessori classroom?
- Children's experiences in Montessori education vary on years spent in Montessori education
- Number of children participating in studies are usually small in terms of demographics, making generalizations of any results problematic

Found that young adolescents in Montessori middle schools show greater intrinsic motivation that peers in conventional middle schools

Using phonics to teach children to read → explicit teaching of letter-sound correspondences that allow child to crack the alphabetic code
Phonic programmes have greatest impact on reading accuracy when they are *systematic* = letter-sound relationships are taught in organised sequence, only two very different approaches: → *synthetic phonics* = starts from parts and builds up to whole
→ *analytic phonics* = starts from whole and drills down to parts
Montessori → synthetic

EF = executive functions → critical for academic success

Subotnik, Olszewski-Kubilius & Worrell (2011)

Rethinking Giftedness and Gifted Education: A Proposed Direction Forward Based on Psychological Science
- https://journals-sagepub-com.proxy.library.uu.nl/doi/10.1177/1529100611418056

Advancing set of interrelated arguments:
→ Abilities of individuals do matter, particularly abilities in talent domains → Different talent domains have different developmental trajectories that vary in start, peak and end
→ Opportunities provided by society, crucial in talent-developmental process
Society must promote opportunities, but individual also has responsibility to develop

Giftedness = manifestation of performance that is clearly at upper side of talent domain even in relation to other high-functioning individuals in that domain
→ potential is key variable
→ later, achievement is measure of giftedness
→ finally, eminence (*uitmuntendheid*) is basis for granting label

Giftedness:

- Reflects values of society
- Typically manifested in actual outcomes (especially in adulthood)
- Specific to domains of endeavor (*streven, inspanning*)
- Result of fusion of biological, pedagogical, psychological and psychosocial factors
- Not just gifted for ordinary, but even for extraordinary

Conceptions giftedness:
→ ***high IQ:*** *Primary* and still most concentrated attention to giftedness → high intellectual abilities, giftedness seen as generic, recognized and revealed through IQ test (or something like) Gifted individuals presumed to be successful across all academic domains and *remain gifted*
→ ***emotional fragility:*** giftedness clinical in nature, concern of *emotional fragility* as result of born sensitivities coming with high IQ
Many findings that children with high IQ are also *socially stronger*, still many people adhere to idea of high sensitivity of intelligent children
→ ***creative-productive giftedness:*** *Renzulli:* **schoolhouse giftedness** (manifested by high testscores) and **creative-productive giftedness** (manifested in high level performance and innovative ideas). Task persistence, creativity and motivation just as important as academic abilities
→ ***talent development in various domains:*** giftedness outside academic domains, such as sports. Training improves abilities, psychological strength training and coaching
→ ***unequal opportunities and practice:*** dismissing role of ability, outstanding performance because of practice and unequal access to opportunities

Focus here:
Giftedness as *developmental process* that is *domain specific* and *malleable*. Giftedness must be *developed* and *sustained* by training and interventions in *domain-specific skills*. Individual's *conscious decision* to engage fully in domain. Goal of developmental process to transform potential talent during youth *into outstanding performance and innovation* in adulthood.

Why new framework giftedness needed? *Current inability to identify who'll be gifted in long term*

Process of talent development two stages:

1) Talent identification

2) Talent promotion

Creative *performance* = athletes, musicians, actors, dancers

Creative *producers* = playwrights, choreographers, historians, biologists, psychological scientists

Ability, interest, commitment needed for development of giftedness. Gifted achievement depend on teaching/coaching

"Gifted students will make it on their own", high achievers often ignored in American education, negative stereotypes, unequal chances and educational issues
Cultural, environmental and past-experienced factors affect expression of giftedness and talent

Giftedness ability trait that separates those who are gifted from the rest VS giftedness does not exist and is merely outcome of appropriate opportunity and sufficient practice
→ data supports neither of the two extreme claims

Enrichment = extending regular curriculum, offers access to topics students would normally not study in regular school settings, allowing students to engage with subjects more depth
Acceleration = increasing speed and depth of subjects in school, earlier access to info

Talent-Development Models

All models recognize general and specific ability as factors, and role of expert instruction and mentoring in development, central role of personal commitment and drive to excel

- **Tannenbaum's talent-development model**
  - Giftedness = potential for becoming excellent performers
  - Five components which must be in place to transform early potential into exceptional contributions in adulthood
    - General ability
    - Special or domain-specific ability
    - Psychosocial abilities
    - External support
    - Chance
  - Person also needs interpersonal skills, motivation and perseverance
  - Appreciating joys and persist through challenges of development

- **Wisdom, Intelligence, Creativity Synthesized (WICS)**
  - Giftedness: development of expertise, requires demonstration of productivity
  - Outcomes of talent development should serve common good, balance
- **Co-incidence model (Feldman)**
  - Prodigies = individuals who perform at extremely high level at young age ○ This model does not address adult eminence
  - Biological tendency to domain, access to master teachers, family recognition and support, deep passion for domain

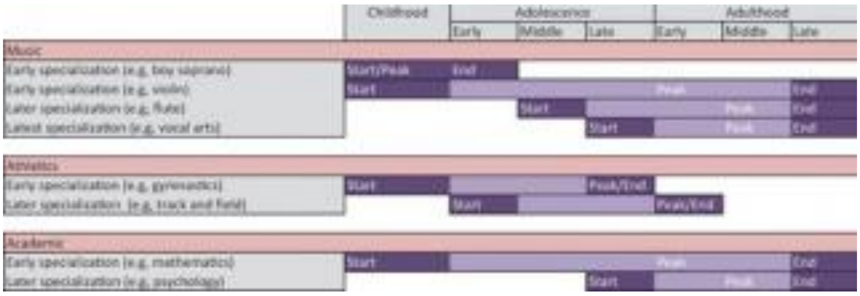
- **Enrichment triad model (Renzulli)**
    - Features talent trajectories
    - Focus on developing talent in childhood
    - Variables that provide basis for developing giftedness:
        - Above-average cognitive ability
        - Creative ability
        - Task commitment
    - Educational experience 3 stages:
        - Enriched activities in number of domains
        - Specific and advanced instruction in domain of interest
        - Experiences that foster creative productivity that may lead to career contributions to benefit society
- **Pyramid model (Piirto)**
    - Features talent trajectories
    - Foundation of abilities that come from genetics and development
    - Direction development → influenced by values held by family, school, communities and cultures
    - psychological attributes like insight, passion, persistence and creativity → outweigh intelligence in determining likelihood gaining recognition by peers
- **DMGT (Gagné)**
    - Features talent trajectories
    - Similar set of variables as *Tannenbaum*, but placed in sequence framed in transformation of natural gifts into high level expertise
    - Intellectual, creative, socio-affective and sensorimotor abilities → foundation for developing process
    - Learning and practice drive development (environmental and intrapersonal catalysts) ○ Chance prominent role, chance affects a lot
    - Successful transformation → level op accomplishment above 90th percentile of same-age peers with similar investment in field
- **Talent-search model (Julian Stanley)**
    - Features talent trajectories
    - Instruments above-grade-level to accurately measure abilities of gifted children ○ Optimal match between tested ability and educational program provided, in- and out-school learning
    - Students' interest, passion and abilities change over time, so nature of career path should also change
- **Bloom's model**
    - Features developmental changes over time
    - Teacher plays central role in every stage of model
        - Playful engagement with domain, reinforced by parents and teachers
        - Playful engagement becomes insufficient, start with peers for more in depth
        - Talented young people persist in domain of choice
        - Third type of teacher guides development
- **Scholarly productivity/artistry (SP/A) model**
    - Features developmental changes over time
    - Builds on Bloom's and Sternberg's conceptions of transforming abilities into expertise
    - Three stages to apply to musical and mathematical domains
        - Transformation of abilities into competencies

■ Transformation of competencies into expertise (self-promotion and learning how everything works)

■ Transformation of expertise to scholarly productivity and artistry

Developing mega-model:

→ principles



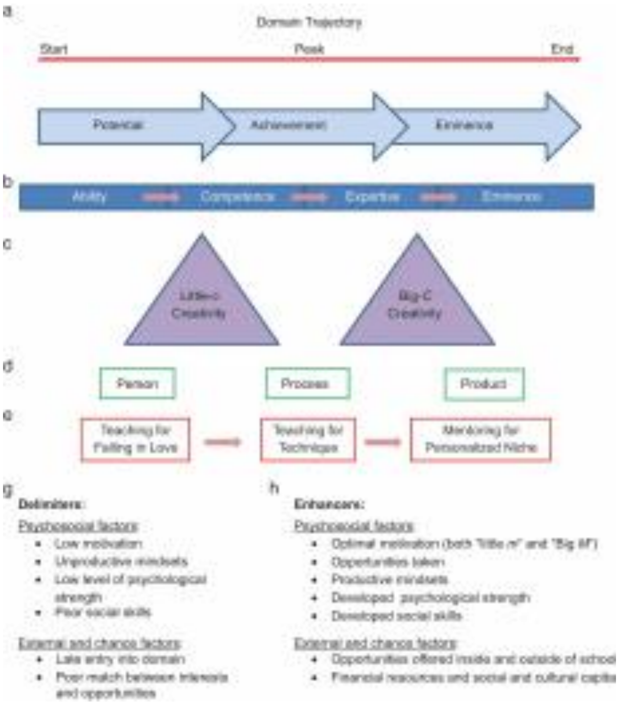
Abilities (general and special, can be developed)

Domains of talents having varying developmental trajectories

Opportunities provided to and taken by young people

Psychosocial variables

Eminence is intended outcome of gifted education



a) Trajectories with different start, peak and end

b) Giftedness domain evaluated in relation to others

c) Transitions distinguish by levels of creativity

d) Shifting emphasis person-process-product

e) Different strategies and goals of instruction

f) .

g) Movement from ability to eminence delimited

h) Progress enhancing, maintained or accelerated

Factors shift over time

Talent-development driven by expert teachers, mentors

→ first engaging in interests to domain

→ critical to help individual develop needed skills

→ help develop niche in field, personal style, unique

	High Opportunity	Low Opportunity
High Motivation	Greatest likelihood of eminent outcome with appropriate educational dosage, psycho-social supports, and environmental supports Best "bang for the buck"	Enhanced likelihood of eminent outcome with teaching resources and insider knowledge plus appropriate educational dosage, psycho-social supports, and environmental supports Most important societal responsibility
Low/Undetermined Motivation	Eminence not likely unless motivation is enhanced by programs that assist with changing mindsets and matching to appropriate domains and mentors Limited investment to generate motivation	Outcome depends on provision of opportunities to reveal interests and abilities and enhance motivation Greatest challenge to society; worthy of investment in opportunity With opportunity, motivation may or may not develop

Influence of motivation and opportunities

Giftedness is intended to apply across domains

Abilities matter

Domains of talent have unique developmental trajectories across life span

Effort and opportunity are important at every stage of talent-development process

Psychosocial variables are important contributors to outstanding performance at every stage of development Eminence should be the goal of gifted education

Van Gog, Rummel & Renkl (2019)

Learning How to Solve Problems by Studying Examples

STEM domains = science, technology, engineering and mathematics → problem solving important

Problem solving tasks = from A (given information on initial state) to B (described goal state) without knowing series of actions to perform to get there
→ learning *what* actions to perform, *how* to perform the actions and conceptual knowledge of *why* to perform those actions

Example based learning = learning by observing solution procedure of someone else who is solving similar problem
→ similar to **observational learning**, but observational learning can apply to all kinds of skills, attitudes or behaviors (including negative ones)
→ also similar to **vicarious learning =** refers to learning by observing someone else being taught

this study → *example based learning* limited to to-be-learned tasks or skills, in academic contexts mostly cognitive → focus on **abstract modeling =** acquisition of cognitive skills based on underlying rules or principles exemplified or verbalized by models

Worked examples = show students full and correct solution procedure in writing
Modeling examples = students observe live or video demonstration of problem being solved by someone else
Self-efficacy = confidence of person in own ability to successfully influence their environment **Novice learners =** in early stages of skill acquisition on a task

Worked example effect = replacing a substantial part of conventional practice problems with worked examples is more effective (higher posttest performance) and/or efficient (higher or equal posttest performance reaching with less time investment or mental effort)

Four phases in **analogical reasoning** (= thinking that relies upon an **analogy** = metaphors and comparisons to make some sort of explanatory point) :

1) Encoding of examples (*initial schema construction*)
2) Activating relevant analogs from memory for solving new (transfer) problem
3) Mapping new problem onto analog, determining similarities and differences between known problem (analog) and new problem
4) Inducing abstract schema out of mapping process

Rehearsal (imitation), either mentally or physically, is considered to play important role in retention (= remembering) and improvement of performance
Motivational processes determine whether or not learner will actually exhibit learned behavior Both *cognitive load theory* and *social learning theory* emphasize need for focused processing of demonstrated task or skill
How to implement example-based learning (by educators)?

All been proven effective, but nog compared to each other to see which works best

- Replace all practical problems by examples
- Alternate example study and practice problem-solving in different manners
  - Example-problem pairs proven more effective than practice problem-solving only
- Allowing learners to first experience what to do and what they do not know yet, before providing examples

→ Van Gog, Kester and Paas (2011) compares effectiveness of:

- Example study only
- Practice problem-solving only
- Alternating example study and practice problem-solving by providing student with example-problem or problem-example pairs

Results: example study only and example-problem pairs required less effort and led to significantly higher test performance that other two
Other findings:

- No difference in effort investment or test performance between examples only and example-problem pairs
  - Example-problem pairs may be preferable for metacognitive perspective
- Problem-example pairs did not outperform practice only condition
  - Self-efficacy → frustration, skipping example that follows because it is too hard to understand in students' mind

Example studying mostly for novices with little prior knowledge
Expertise reversal effect = when students have already developed schemas that can guide their problem-solving, student need to practice to automate these skills, they benefit more from practicing Prior knowledge will moderate effectiveness of different sequences of examples and problems Novices → example-problem pairs more effective
Learners with more prior knowledge → problem-example pairs more effective

Isomorphic = problems that have same structural features as problems displayed in example, but different surface features
Far transfer → solving novel problem from a yet unknown problem category. Learner needs to be able to recognize and flexibly apply relevant parts of previously learned procedure → understanding is critical → without understanding, error prone and easily forgotten

Product-oriented examples = examples that show given state, sequence of operators and goal state Information for better understanding is missing, does not become part of learner's schema unless learners can generate explanations themselves

Design of examples crucial (Tarmizi & Sweller, 1988):

- *Split-attention* should be avoided
- *Redundancy* should be avoided (multiple sources of information only presented when both necessary for comprehension)

Effective instructional principles for enhancing transfer by fostering students' understanding in example-based learning

● **Providing (self-)explanations:**

Wittwer and Renkl (2010): Positive effects on instructional explanations in example-based learning when:

1) Conceptual knowledge is emphasized as learning outcome
2) No simultaneous self-explanation prompts
3) Provided automatically (not on learner demand)

● **Comparing problem solutions within a problem category**

Letting students engage in comparing worked examples or different representations of same solution procedure within a problem category → attention to structural features that remain constant across the different examples (some prior knowledge may be needed)

● **Comparing problem solutions between problem categories**

Demonstrated in worked examples and modeling examples, can be presented in random sequence. Tends to increase cognitive load and decrease performance during training, it does usually lead to better learning and transfer outcomes. May foster understanding of which problem features are relevant for certain procedures and which are not

● **Comparing correct and erroneous examples**

Asked to find and fix the errors in examples. Novices can benefit when correct and incorrect examples are presented side by side, otherwise this is hard for learners with low prior knowledge. Elaborate feedback on *why* step was wrong instead of indicating *that* step is wrong

● **Labeling subgoals**

Also important to know when to use single-step solutions and why they work. Helping by making subgoals, making individual steps meaningful building blocks

● **Imagining/cognitively rehearsing the procedure**

Imagining (Cooper et al., 2001) or cognitively rehearsing (Bandura, 1986) enhances learning outcomes compared with studying only, 'imagination effect' found to apply: mainly when students have at least some prior knowledge, and for complex materials

Specific to video modelling examples (model as in a person):

● **Model visibility**

Does it matter for attention and learning whether the **model** is **visible** in video? *Object demonstration examples* → model may attract substantial amount of learner's attention, it does not significantly hinder learning → 'gaze cues'

● **Establishing joint attention**

Joint attention = two people looking at the same thing at the same time → improves communication and sensemaking in social (learning) situations

Social cues can guide attention and foster understanding

EMME = eye movement modeling examples (model can not be seen, eye movement can)
Gaze cues will only affect learning outcomes when learners have low prior knowledge

● **Model characteristics**

According to model-observer similarity hypothesis, perceived similarity between model and learner in terms of characteristics will affect self-efficacy and their learning outcomes (however, on this hypothesis have been inconsistent findings)

● **Viewing perspective**

Recent study showed that learning outcomes were higher when video modeling example (demonstrating building electrical circuit) was filmed from first-person perspective than from third-person perspective

Future research

→ address effect over time in real classroom contexts

→ how students self-regulate their learning from examples and practice problems, motivational variables may play important role
→ connect research on example-based learning with research on productive failure → should failure be experienced first-hand or by observing modeling examples of others? → whether individual differences would affect the effectiveness of example-based learning