

Instructional Design of active online learning through Serious Games

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"Het is heel hard nodig!"

"Differentiatie???"

"Studenten klagen enorm"... "Hoe zorg je ervoor dat de studenten mee gaan doen?"

"Welke activerende werkvormen werken?"

"Hoe zorgen we ervoor dat docenten de kennis en vaardigheden behouden"

"Docenten spannen zich enorm in, maar weten niet wat werkt"

"Studenten klagen enorm"... "Hoe zorg je ervoor dat de studenten mee gaan doen en mee blijven doen?"

"We zijn op zoek naar passende didactiek"

"We zitten met onze handen in het haar mbt toetsing"

Dutch students are amongst the least motivated in the world (PISA 2015-2020 reports)

Education 2030 Curriculum:

An Analysis of the Netherlands Curriculum Proposal (OECD, 2020)

More meaningful learning in authentic contexts: experiential learning

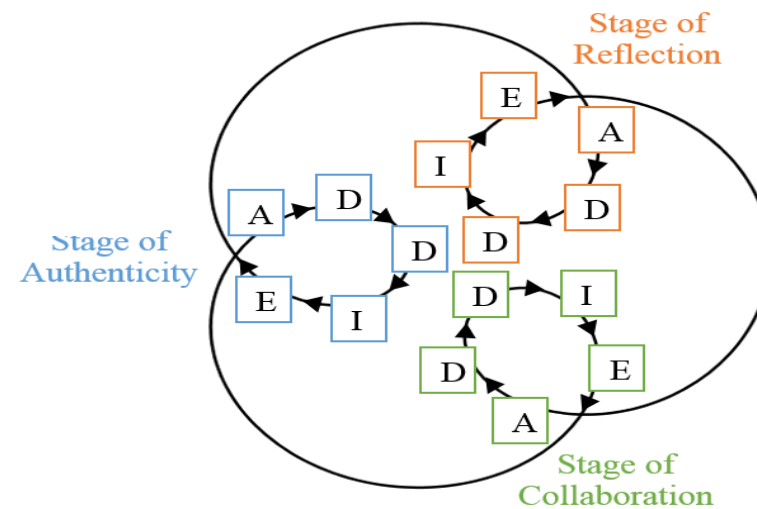
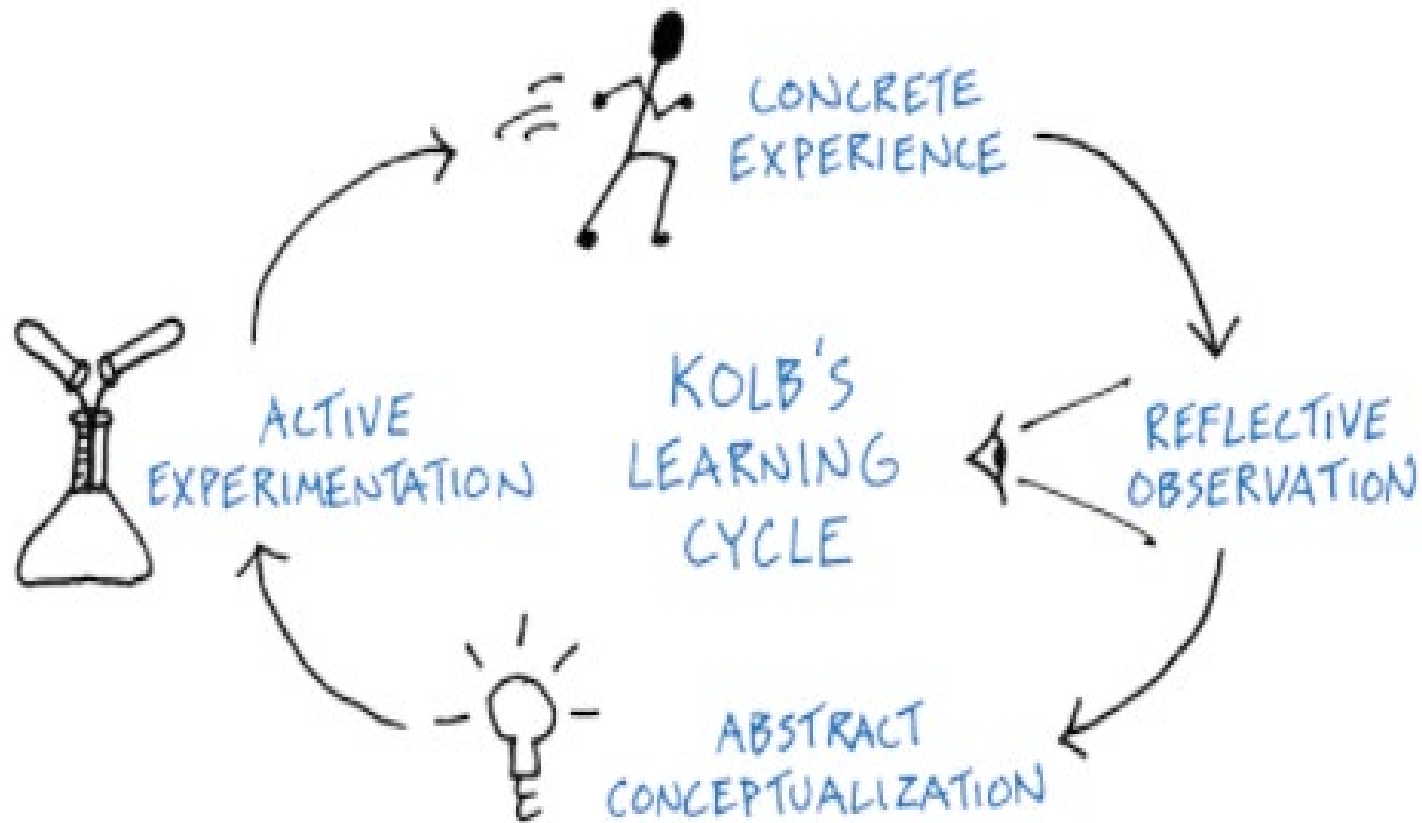
More attention for multi-disciplinary themes

(like Citizenship; Sustainability; Healthcare in the aging society)

More attention for transversal skills

(like Critical thinking; Media-literacy; Creativity and Problem solving; Self regulation and reflection, Entrepreneurship; Inter-cultural communication Skills)

(Also see: curriculum.nu)



See also: Radović, Hummel, & Vermeulen (2021). The mARC instructional design model for more experiential learning in higher education: theoretical foundations and practical guidelines. *Teaching in Higher Education*. doi:10.1080/13562517.2021.1872527

Serious gaming: what 'science' tells us (1)



Much potential, little use

Game-based learning holds much potential, has been investigated in a great variety of scientific disciplines and domains over the last two decades. A recent literature review (Zhonggen, 2019) on serious games over the last decade shows that, especially since 2015, numbers of empirical studies have been increasing. However, its uptake as a mainstream educational medium still lags far behind that academic hype (Wouters et al., 2013; Boyle et al., 2016).

Inflation of terms: gamification or 'chocolate covered broccoli'

To design integrated serious games is rather different from 'gamification' of education, whereby just one or some gaming elements (like badges, a Kahoot quiz, or videoclip) are added to existing education for a more playful appearance (Shaffer [2007] referred to this as 'chocolate-covered broccoli').

Gamification has indeed been found to initially motivate learners (it is more fun for a while), but not to contribute to sustained learning of complex skills. **Enjoyment and motivation were *not* found to be *influencing* factors for learning effects**, although this often is thought to be the case. But the other way around, increased **enjoyment and motivation *are* reported as *resulting* factors** improved learning and efficiency through gameplay (All, Nunez Castellar, & Van Looy, 2015).

Serious gaming: what 'science' tells us (2)



Garbage in garbage out

➔ Serious game design is a serious profession

Conceived *paradox* between wanting more active and meaningful learning on one side, and practical limitations for high quality online learning on the other. Courses offered in response to crisis or disaster are meaningfully different from well-designed online courses (Hodges, Moore, Lockee, Trust, & Bond, 2020). Need to professionalize teaching staff on 'digital didactics'.

➔ Need for dedicated ID models and support: 'garbage in, garbage out'

Overall, researchers report the need for a general evaluation framework for quality assessment of serious games, and some dedicated design methods have been suggested (eg, Hailey & Connolly, 2010; Mayer, 2012; Nadolski et al., 2008). Adequate relationships between learning attributes and gaming mechanics were found to be critical for the quality of instructional (game) design and desired learning outcomes, and some models for their mapping have been elaborated (eg, Arnab *et al.*, 2015; Carvalho *et al.*, 2015).

Potential for transversal skills

Positive effects of acquiring more transversal (or generic) skills (that are not specifically related to certain jobs or domains, like media literacy, negotiation, entrepreneurship, critical analysis, problem-solving or research skills) on both awareness and commitment during academic and professional careers, have been reported. When students have more concrete ideas of their own interests and preferences, they can better engage with future careers.

Serious gaming: what 'science' tells us (3)

Importance of meaningful, authentic ('whole') learning tasks and scenarios

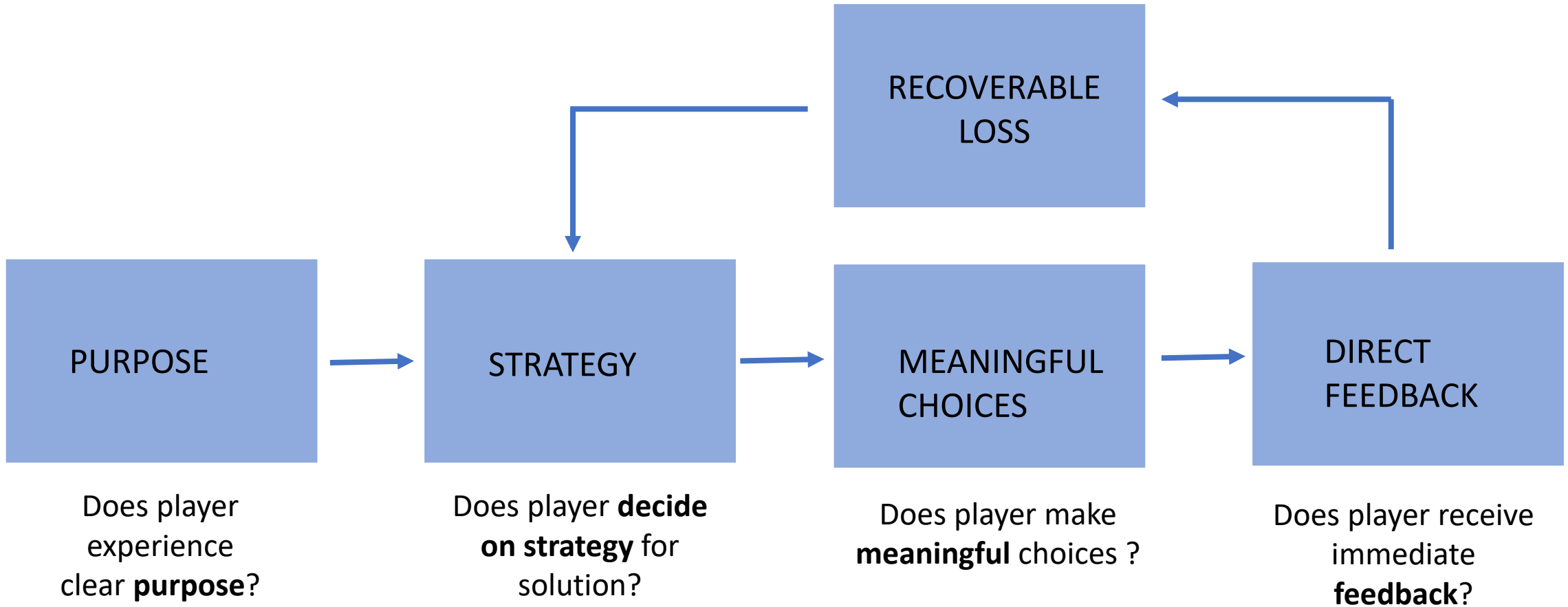
Active learning through meaningful and playful practice has shown to positively influence students' professional awareness and skills (e.g., Boersma, ten Dam, Volman, & Wardekker, 2010; Meijers, Kuijpers, & Gundy, 2013; Sherman, Sebor, & Digman, 2008; Hummel et al, 2011; 2015; 2017; 2019; 2021).

Importance of 'rich' learning environments

"Professional games" provide learning context that simulates the context in which students will apply their learning. Learning activities become more relevant and motivating, and increase the likelihood that acquired skills will actually transfer to real-world situations (Herrington, Oliver, & Reeves, 2003; Hoekstra, 2011). Such gaming or playful learning in context is recognized as an activity that can enhance students' motivation to learn and lead to better learning results when compared with more traditional learning (e.g., Boyle *et al.*, 2016; Garris, Ahlers, & Driskell, 2002; Wouters & van Oostendorp, 2013).

Direct feedback loop

Can player **try out new strategies or choices** without 'instant karma'?

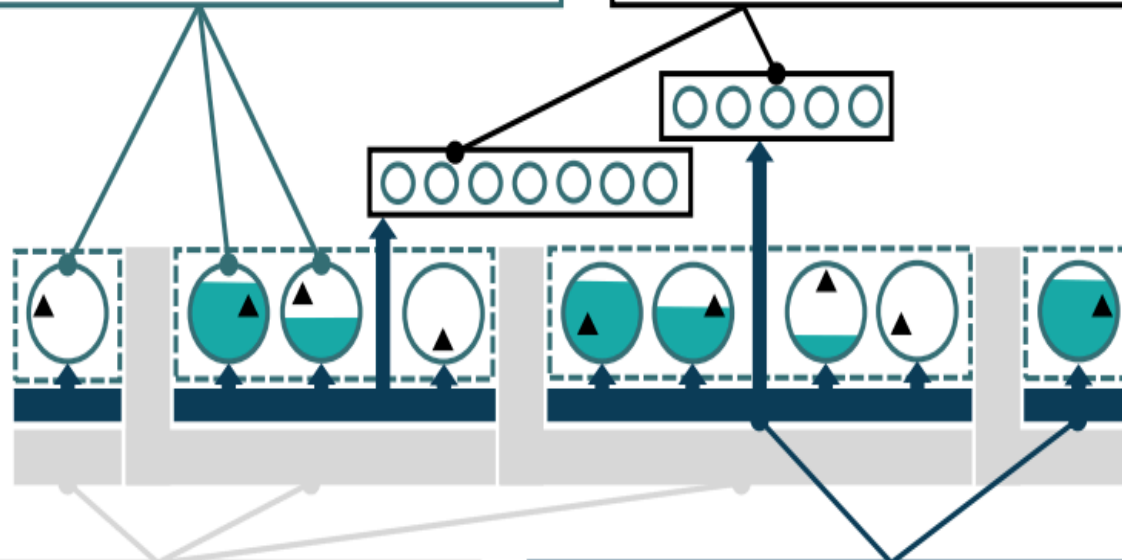


LEARNING TASKS

- aim at integration of (non-recurrent and recurrent) skills, knowledge, and attitudes
- provide authentic, whole-task experiences based on real-life tasks
- are organized in easy-to-difficult task classes
- have diminishing support in each task class (scaffolding)
- show high variability of practice

PART-TASK PRACTICE

- provides additional practice for selected recurrent aspects to reach a very high level of automaticity
- provides a huge amount of repetition
- only starts after the recurrent aspect has been introduced in the context of the whole task (i.e., in a fruitful cognitive context)



SUPPORTIVE INFORMATION

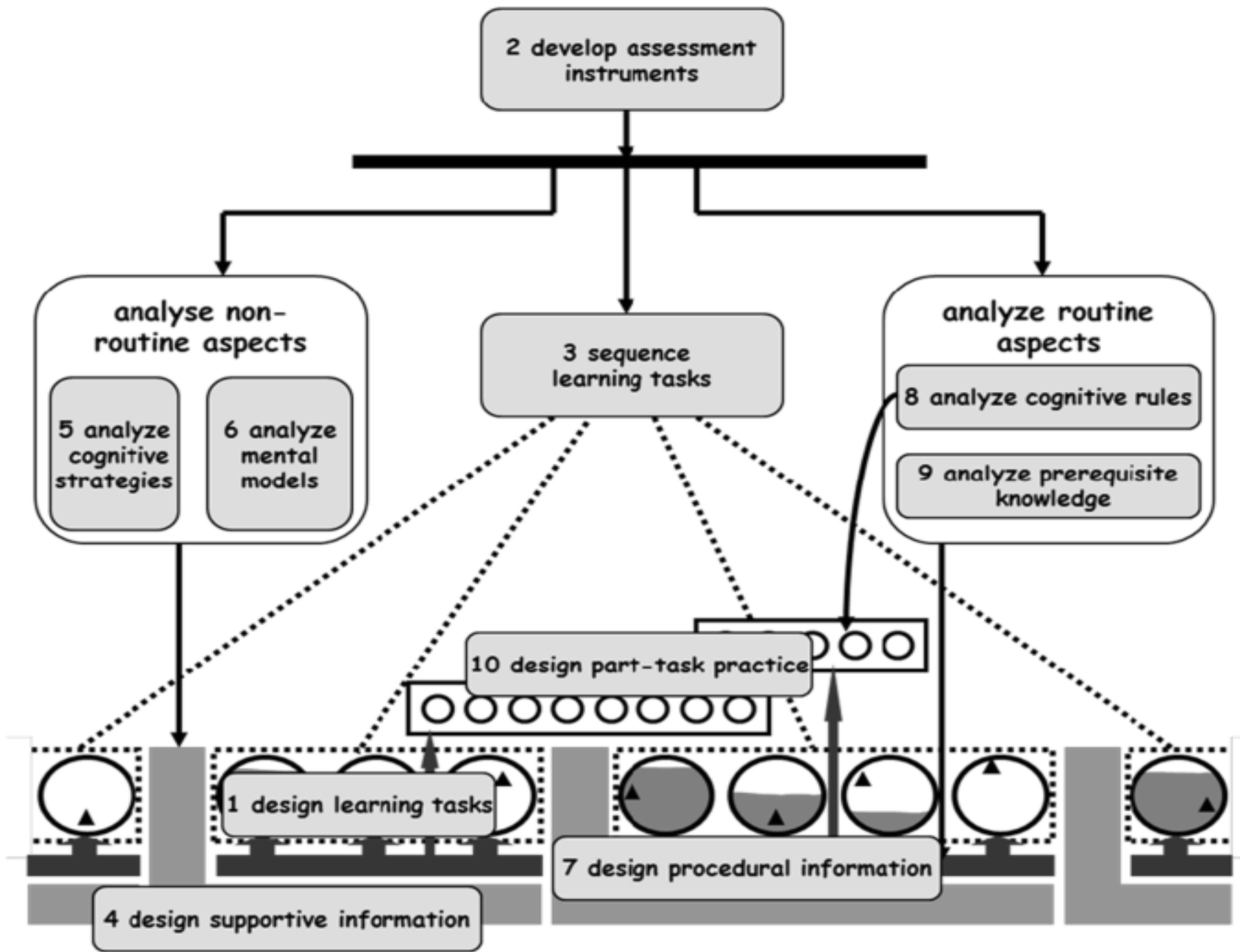
- supports the learning and performance of non-recurrent aspects of learning tasks
- explains how to approach problems in a domain (cognitive strategies) and how this domain is organized (mental models)
- is specified per task class and always available to the learners

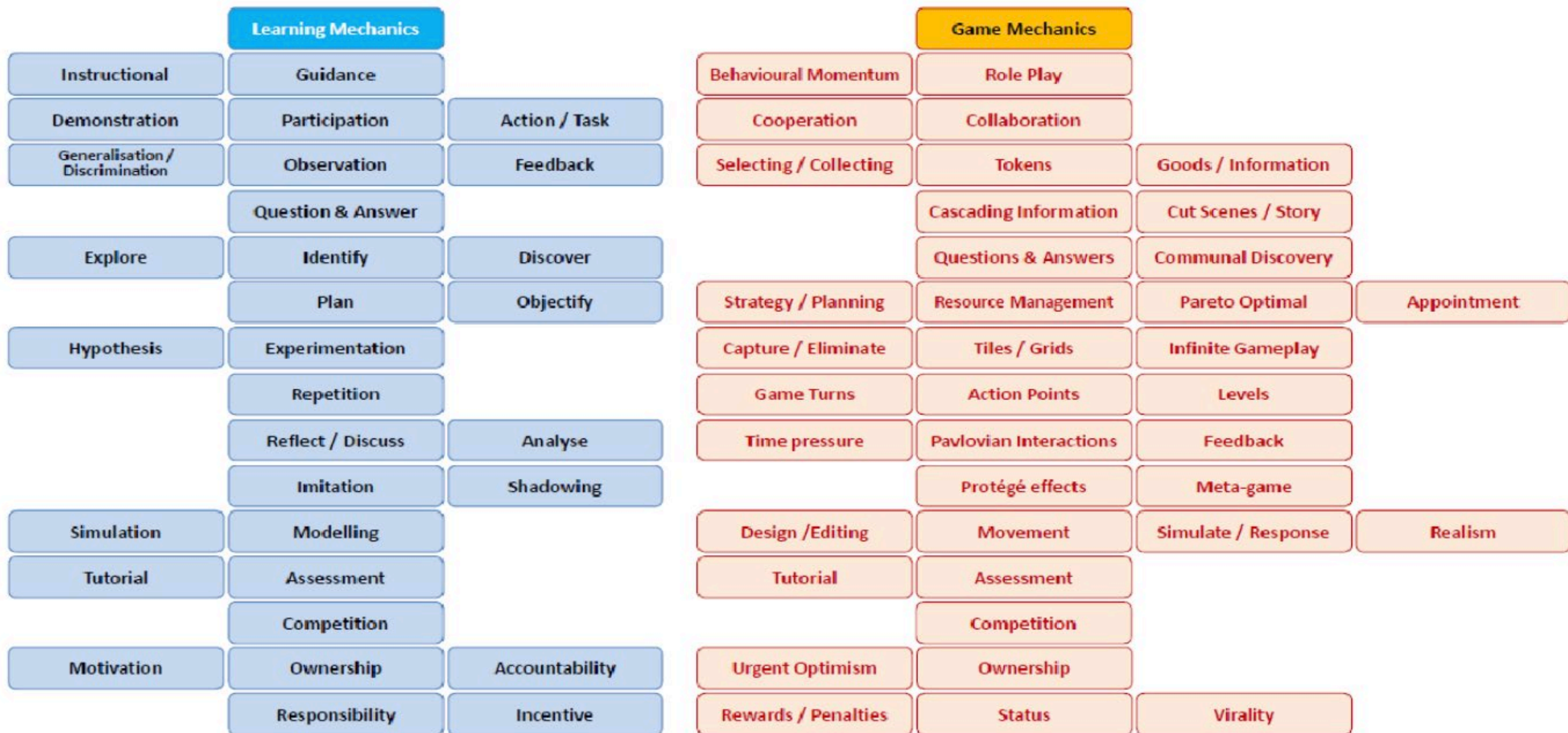
PROCEDURAL INFORMATION

- is prerequisite to the learning and performance of recurrent aspects of learning tasks (or, practice items)
- precisely specifies how to perform routine aspects of the task, e.g., through step-by-step instruction
- is presented just in time during work on the learning tasks and quickly fades away as learners acquire more expertise

4C/ID model

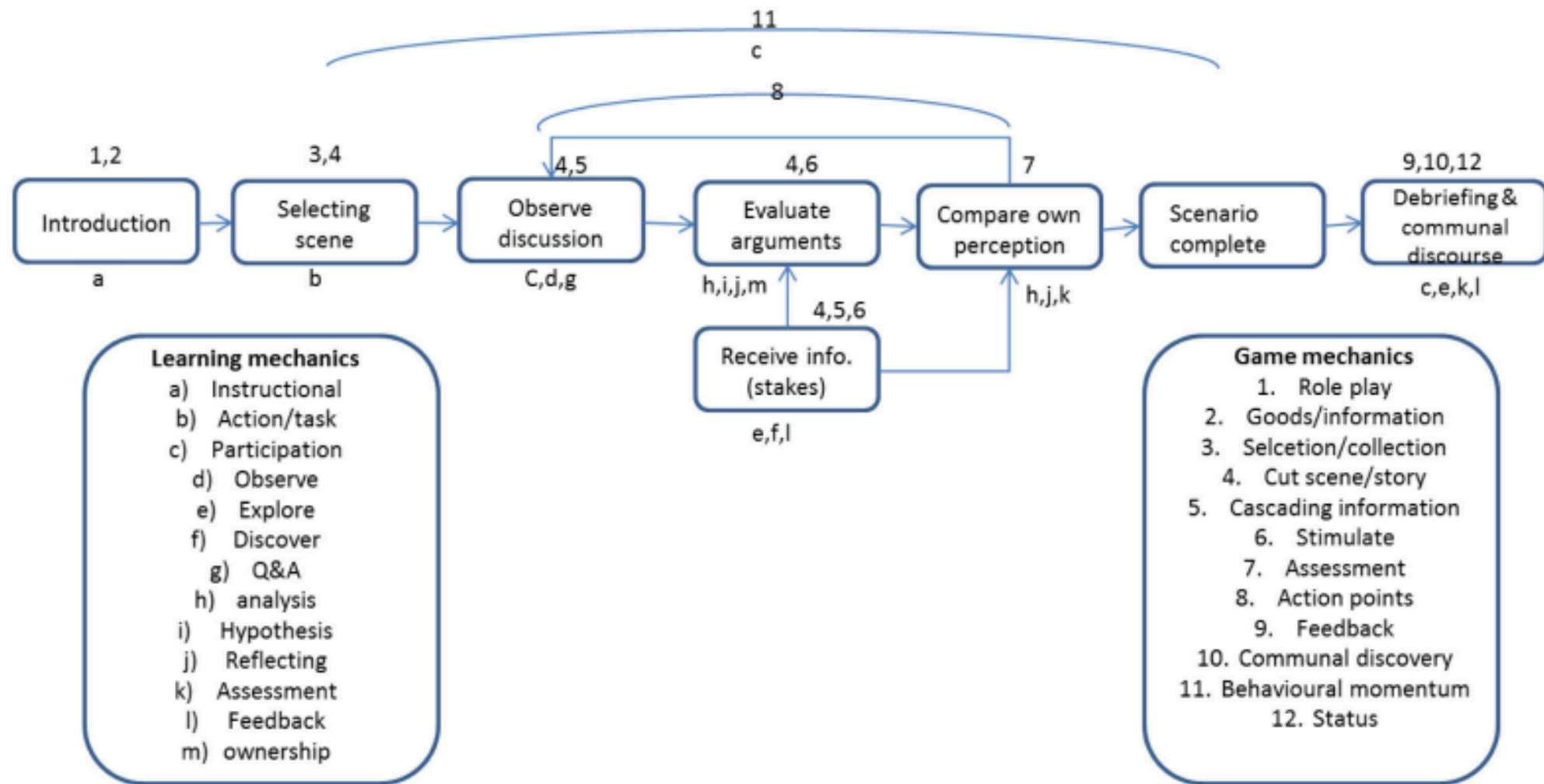
Van Merriënboer J.J.G (1997). *Training complex cognitive skills: A four-component instructional design model for technical training*. Englewood Cliffs, NJ: Educational Technology Publications.

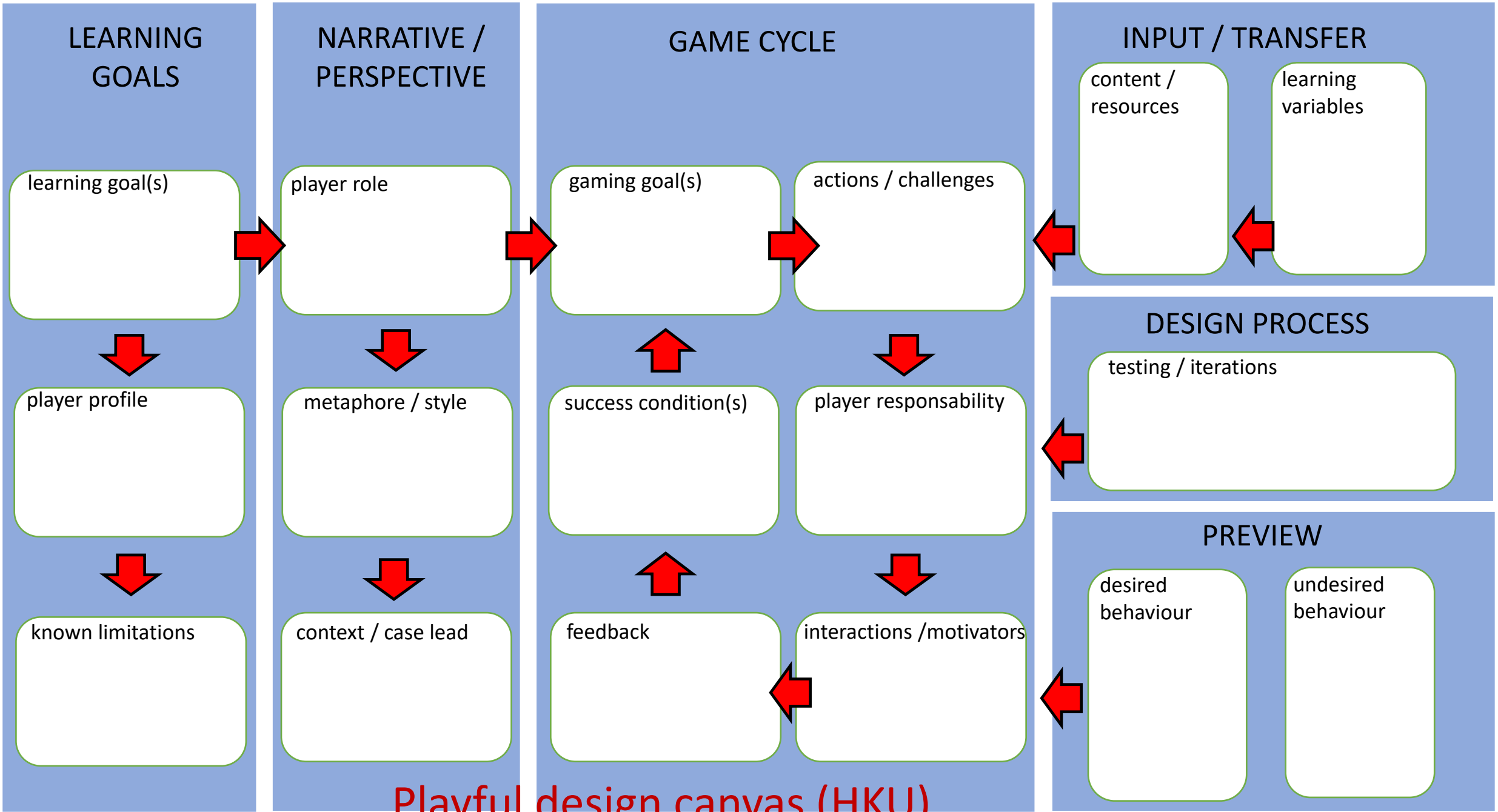




LM/GM model

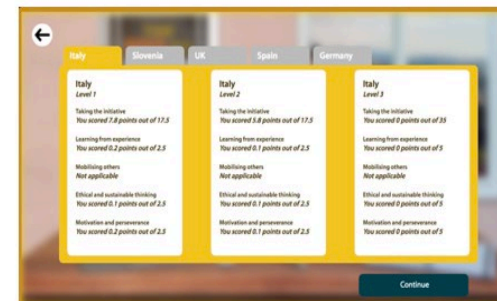
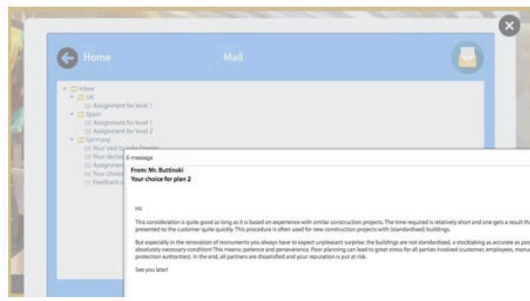
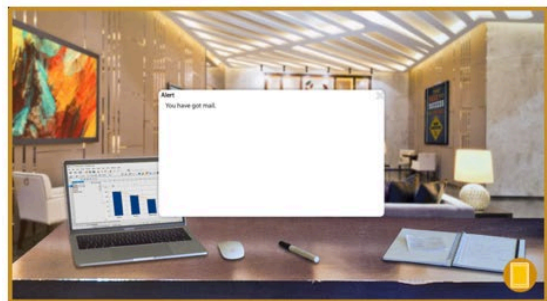
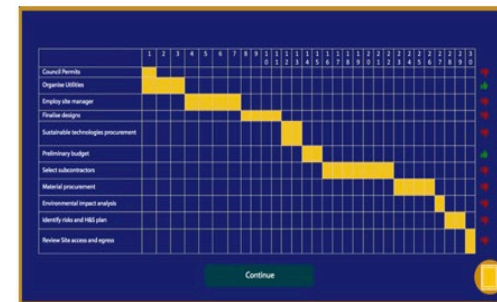
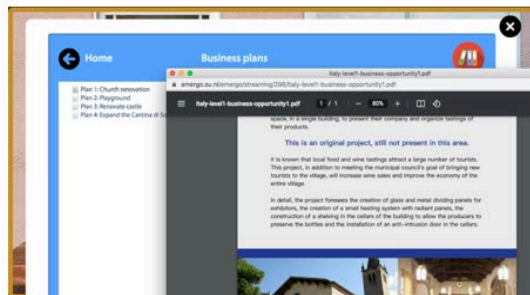
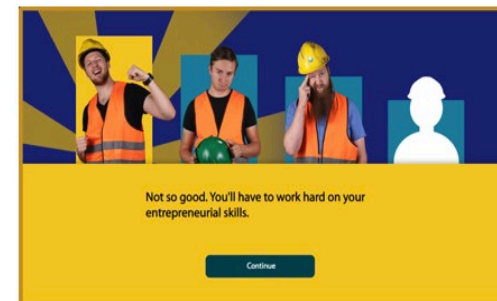
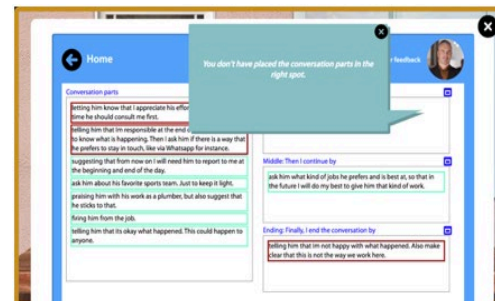
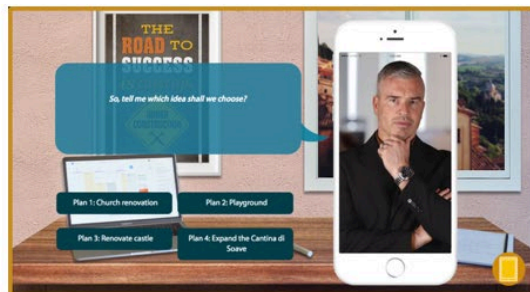
Arnab, S. et al. (2015). Mapping learning and game mechanics for serious games analysis. *British Journal of Educational Technology*, 46(2), 391-411.





Playful design canvas (HKU)

EMERGO games



(Also see: <https://www.ou.nl/-/emergo>)

Voorbeelden EMERGO games

Tycoonstructor (2021)

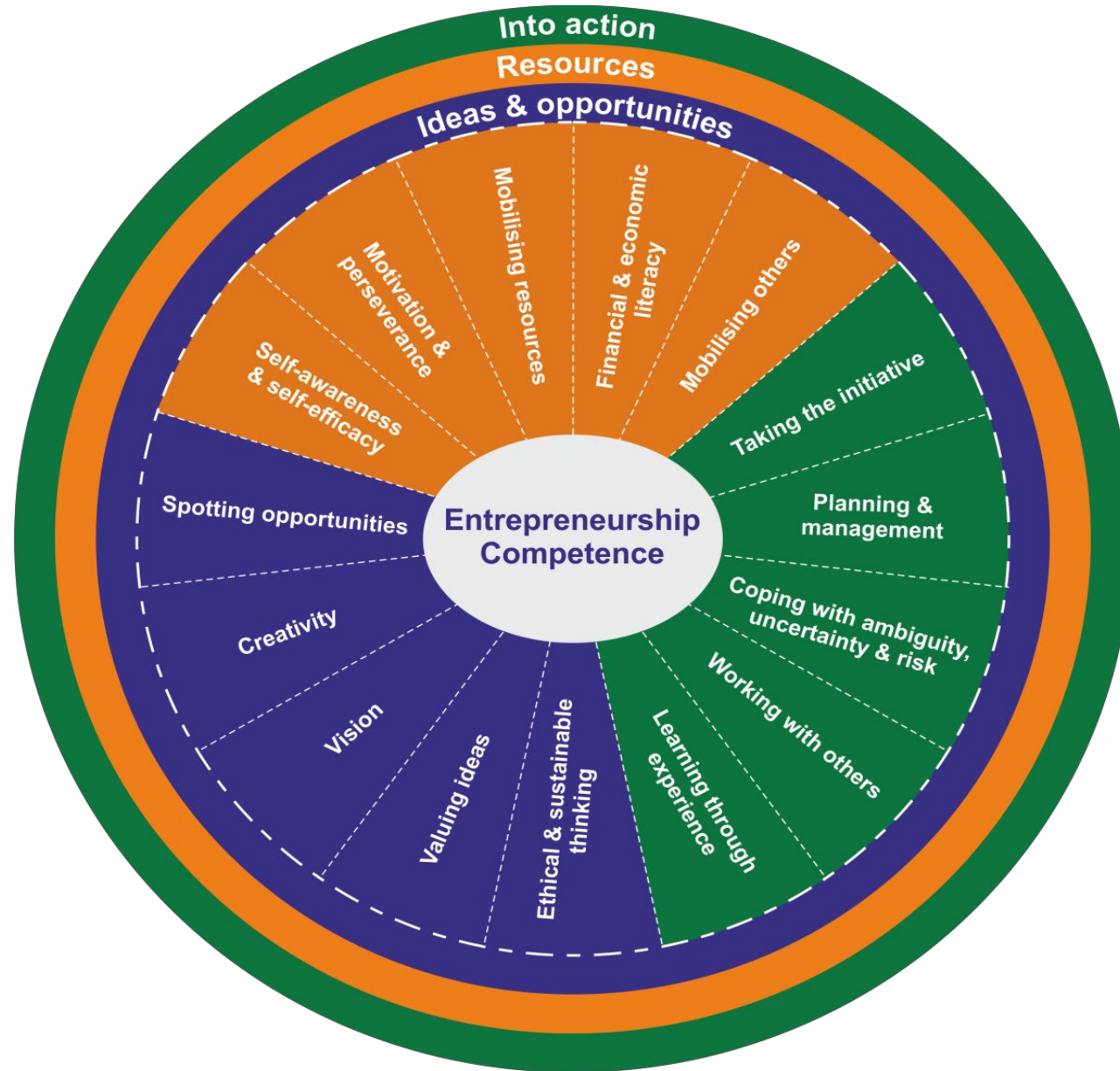
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Snuffelstage psychologie (2019)

https://emergo.ou.nl/emergo/skins/ounl2/run.zul?cacId=8773&tagId=1&runstatus=previewreadonly&rgald=8966&rutId=&lang_lang (NL)

De aanslag (2020)

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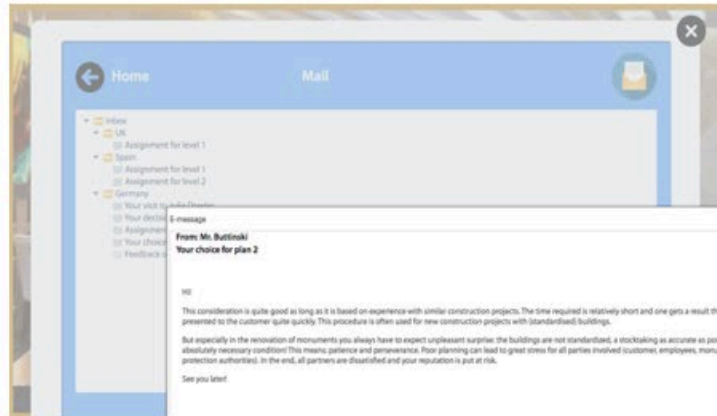
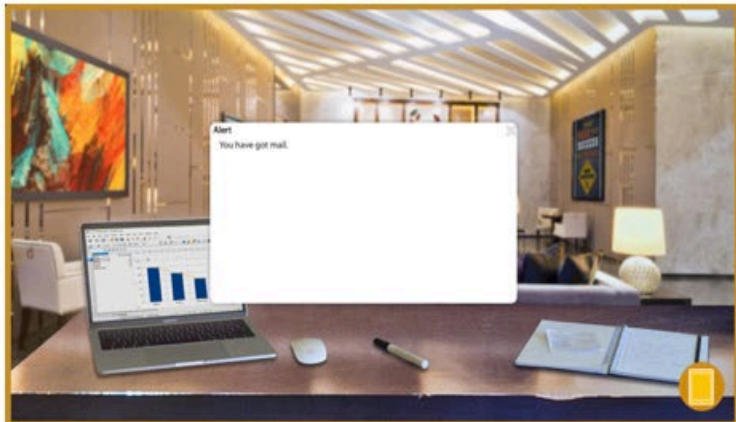
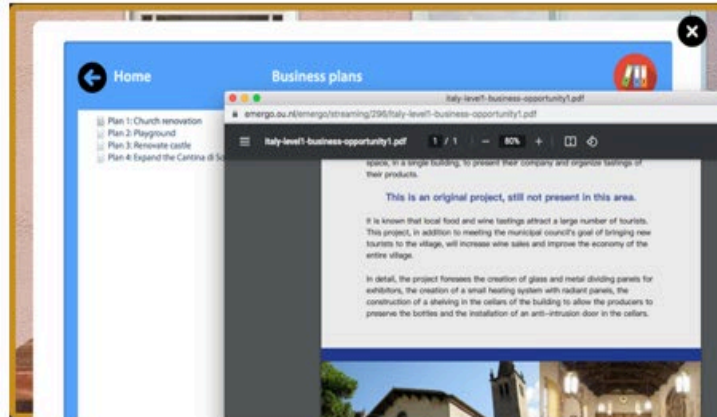
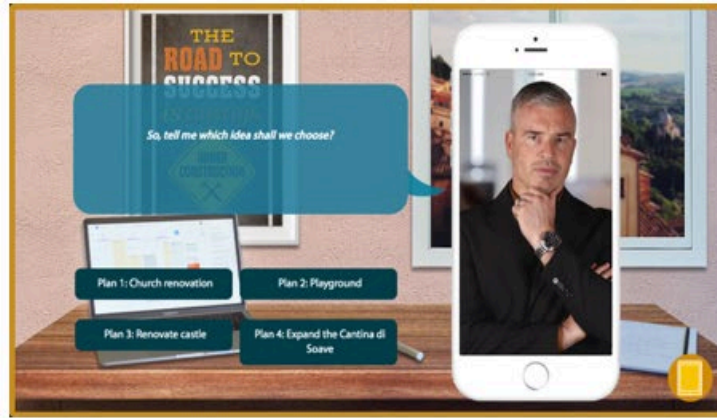


| Entrepreneurial (sub)competences as identified (by EntreComp and SOCCES projects) | | | | |
|---|---|---|---|---|
| 1. Ideas & opportunities | 2. Resources | | 3. Into action | |
| 1. Creativity and innovation | 2. Teamwork and collaboration | 3. Communication | 4. Critical and analytical thinking | 5. Positive attitude and initiative |
| Spotting opportunity; Creativity; Valuing ideas; Vision; Ethical and sustainable thinking | Self-awareness and efficacy; Working with others; Financial and economic literacy; Motivation and perseverance | Mobilising others; Mobilising resources | Planning and management; Learning through experiences | Taking an initiative; Coping with ambiguity, uncertainty and risks; Working with others |
| Entrepreneurial competences for construction as identified and selected (by our survey) | | | | |
| Be accountable; Assess consequences and impact of ideas, opportunities and actions; Ethical and sustainable thinking | Inspire, engage and get others on board; Communicate effectively; Motivation and perseverance; Stay focused and don't give up; Be determined; Mobilizing resources; Believe in yourself and keep developing; Self-awareness and self-efficacy | | Learning through experience; Learn by doing; Planning and management; Taking the initiative; Working with others Take responsibility; Prioritize, organize and follow up. | |
| 4. Ethical and sustainable thinking | 5. Motivation and perseverance | | 1. Taking the initiative; 2. Learning through experience; 3. Working with and mobilizing others | |



| Competences / case leads | Learning goals | Criteria |
|--|---|---|
| Ideas and opportunities | | |
| 1.5. Ethical and sustainable thinking (Case lead 4: Spain) | Be able to assess the consequences and impact of ideas, opportunities and actions in an ethical and sustainable way | Assess the consequences of ideas that bring value and the effect of entrepreneurial action on the target community, the market, society and the environment; Reflect on how sustainable long-term social, cultural and economic goals are, and the course of action chosen; Act responsibly |
| Resources | | |
| 2.2. Motivation and perseverance (Case lead 5: Germany) | Stay focused and don't give up | Be determined to turn ideas into action and satisfy your need to achieve; Be prepared to be patient and keep trying to achieve your long-term individual or group aims; Be resilient under pressure, adversity, and temporary failure |
| Into action | | |
| 3.1. Taking the initiative (Case lead 1: Italy) | Go for it when you see the chance | Initiate processes that create value; Take up challenges; Act and work independently to achieve goals, stick to intentions and carry out planned tasks |
| 3.4. (and 2.3.) Working with and mobilizing others / resources (Case lead 3: UK) | Team up, collaborate and network; Inspire, enthuse and get others on board | Work together and co-operate with others to develop ideas and turn them into action; Network; Solve conflicts and face up to competition positively when necessary; Inspire and enthuse relevant stakeholders; Get the support needed to achieve valuable outcomes; Demonstrate effective communication, persuasion, negotiation and leadership |
| 3.5. Learning through experience (Case lead 2: Slovenia) | Learn by doing | Use any initiative for value creation as a learning opportunity; Learn with others, including peers and mentors; Reflect and learn from both success and failure (your own and other people's) |

| Case leads | Name mini-game | Game Mechanisms | EQF 3-5 level (complexity) | Support level | Difficulty causes |
|-------------------|-------------------------------|---------------------------------------|----------------------------|---------------|--|
| 1 Italy | 1.1 Business opportunities | Simple selection game | 3 | ***** | Easy estimation of business opportunities with a relatively large amount of support from sources |
| | 1.2 Ayusha | Interactive dialogue | 4 | **** | Relatively simple dialogues. The consequences of choices can be foreseen |
| | 1.3 Padua Housing Project | Interactive dialogue + selection game | 5 | **** | Limited support information on which business choices have to be made. |
| 2 Slovenia | 2 Smart House | Interactive dialogue + assignments | 3 | **** | Increase in factors that play a role in business choices (when compared to scenario 1) |
| 3 UK | 3.1 Project planning | Drag-and-drop game | 3 | **** | Trial and error project planning |
| | 3.2 Team | Ranking game | 4 | *** | Limited support in making choices. Own input becomes more important. |
| | 3.3 Suppliers | Complex calculation | 5 | * | Complicated calculations on the basis of which a business strategy must be drawn up. |
| 4 Spain | 4.1a Target Groups | Selection game (simple) | 3 | *** | Relatively simple statements |
| | 4.1b Impacts | Selection game (medium) | 3 | *** | Average statements |
| | 4.2 The Logic Model | Selection game (complex) | 5 | ** | Complex assignment in which earlier knowledge must be combined in order to estimate impact |
| 5 Germany | 5.1 Project Planning | Medium selection game | 3 | *** | Follow up game on 1.1, but with less support and instruction |
| | 5.2 Heritage Authority | Interactive dialogue | 4 | ** | Complex questions |
| | 5.3 Incidents at the worksite | Interactive dialogue with assignments | 5 | * | Increased amount of complex questions |



Home

You don't have placed the conversation parts in the right spot.

Feedback

Conversation parts

Setting him know that I appreciate his effort and that next time he should consult me first.

Telling him that I'm responsible at the end of the day to know what is happening. Then I ask him if there is a way that he prefers to stay in touch, like via Whatsapp for instance.

Suggesting that from now on I will need him to report to me at the beginning and end of the day.

Ask him about his favorite sports team. Just to keep it light.

Praising him with his work as a plumber, but also suggest that he sticks to that.

Firing him from the job.

Telling him that its okay what happened. This could happen to anyone.

Middle: Then I continue by

Ask him what kind of jobs he prefers and is best at, so that in the future I will do my best to give him that kind of work.

Ending: Finally, I end the conversation by

Telling him that im not happy with what happened. Also make clear that this is not the way we work here.

Not so good. You'll have to work hard on your entrepreneurial skills.

Continue

The correct answers

Hello, nice to meet you. Thank you for this opportunity

To be fair, we're still a young company. But that means we are extra motivated. How can we make this project a success for you?

We are with 5 people, we always communicate clearly with our clients and I'm confident we will build your beautiful wine estate within time and budget

True, but we always work with local advisors but I will personally supervise all inquiries

Definitely! Completing it in time has the highest priority for us

Im sorry to hear that. What can I do to prove otherwise?

We think 100k is a fair price, and we are worth it: high quality on time. Is there anything that really important to you that we can work with?

Yes. What would it take for you to do business today?

Your answers

Hello, nice to meet you. Thank you for this opportunity

We have loads of experience, deliver great work and are cheap. Nothing more, nothing less

We have got the latest and best equipment! This makes us much better and faster than all other companies. Did you know that our excavator has three power settings?

True, but we always work with local advisors but I will personally supervise all inquiries

Definitely! Completing it in time has the highest priority for us

What? Why? I dont know how you got that idea. Who do you think you are?

No problem. We'll go down to 85k. We will just use cheaper materials and take some more time. Deal!

Yes. What would it take for you to do business today?

Continue

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|--------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Council Permits | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Organise Utilities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Employ site manager | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Finalise designs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sustainable technologies procurement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Preliminary budget | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Select subcontractors | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Material procurement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Environmental impact analysis | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Identify risks and H&S plan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Review Site access and egress | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Continue

Complete all levels to reach the max. score of 100

ENTREPRENEURIAL SKILLS

Taking the initiative 100

Learning from experience 100

Mobilising others 100

Ethical and sustainable thinking 100

Motivation and perseverance 100

DETAILS

Continue

Italy Slovenia UK Spain Germany

Italy Level 1

Taking the initiative
You scored 7.8 points out of 17.5

Learning from experience
You scored 0.2 points out of 2.5

Mobilising others
Not applicable

Ethical and sustainable thinking
You scored 0.1 points out of 2.5

Motivation and perseverance
You scored 0.2 points out of 2.5

Italy Level 2

Taking the initiative
You scored 5.8 points out of 17.5

Learning from experience
You scored 0.1 points out of 2.5

Mobilising others
Not applicable

Ethical and sustainable thinking
You scored 0.1 points out of 2.5

Motivation and perseverance
You scored 0.1 points out of 2.5

Italy Level 3

Taking the initiative
You scored 0 points out of 17.5

Learning from experience
You scored 0 points out of 2.5

Mobilising others
Not applicable

Ethical and sustainable thinking
You scored 0 points out of 2.5

Motivation and perseverance
You scored 0 points out of 2.5

Continue

PhD position Serious Game Design

PhD position AI in Education

