



iv4j



GAMIFICATION AND STORYTELLING FOR VOCATIONAL EDUCATION AND TRAINING



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Gamification and Storytelling for Vocational Education and Training

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Preface

At the outset of innovating Vocational Education and Training (VET), we as members of the IV4J project team asked ourselves: What directions of innovation look promising in terms of 'perceived needs' and 'meeting endemic values'. From pure scientific point of view, operationalizing "Quality of Learning" is one of the hardest nuts to be cracked; Once listing all relevant dimensions of learning processes and outcomes, there is no end. Similar to listing qualities in fashion, gastronomy, music, every new trend in socio-economic era, brings its own new desires and ideologies. The list of quantifiers for qualities of learning: the speed of, easiness for the student and the teacher, endurance of what is learnt, the depth of it, its flexibility, its authenticity, its pedagogical soundness, self-efficacy and Indeed, the students' capacities to become a successful entrepreneur. For those VET teachers who admit that entrepreneurship is key in future societies, there might still be hurdles before arriving at confirmation on how to nurture entrepreneurship: "Are there dependencies between pure knowledge, craftsmanship and entrepreneurial mindset?" And also: "To what extent is entrepreneurship a generic factor? Or, should entrepreneurship be seen as essentially escaping from any formal recipes?" Taking gamification and developing narrative talents as major sources of VET innovation is a bold statement. First of all, as it implies that these two excel in its innovative effects. But also, as they pretend to be feasible candidates in terms of its adaption by VET stake-holders (incl. the students and their potential clients, their business partners, etc.) The best way to label gamification and story-telling is "catalytical" to the ongoing evolution of VET and its surrounding society. Gamification and Storytelling seem to be strong triggers for changing the school-culture in VET towards breeding ground for young entrepreneurs. Is the traditional teacher-student paradigm in conflict with entrepreneurial - oriented VET? We think not; a large part of the entrepreneurial mindset relies on the apprentice's eagerness to learn from anybody who can demonstrate competencies that may lead to solutions for unexpected problems. However, this very 'transfer-paradigm' (from teacher to student), though very much needed, is not enough as students in a receptive attitude are slow and even averse from 'changing themselves'. The classical teaching-learning paradigm is that students are supposed to adapt in order to comply with the assessment criteria. In order to create a life-long entrepreneurial learner it is more the 'willingness to change oneself', in order to grow where your customers are going to. In this sense Entrepreneurial is more than adapting your competences; it is developing a sharp eye for 'what is needed by others' rather than obeying your superordinate. A good entrepreneur does not follow what his/her customers wants now. It is a matter of narrating to your potential customer in order to create his/her need of tomorrow. Here is where gamification and narrification come in: It helps VET students to open and additional mindset. The real job for IV4J now is to find effective design ration-ales on how to weave gamification and storytelling in existing curricula. Rather than delivering hard-core recipes, we claim that VET trainers need to go through a set of experiences how gaming and telling opens additional genres for our mentor roles in entrepreneurial stages of VET.

A Priori Partner Opinions on IO5' Measures

Three main questions were posed to each of the part-ners. Their answers have been elaborated in Appendices 3-7. The essentials in each partner's responses have been formulated below.

Three main questions to each of the IV4J partners

- A.** From your current good practices, does the choice for PBL (**Problem-Based Learning**) as framework for gaming, storytelling and simu-lations look as an appropriate one?
- B.** What do you see as the most important steps to be undertaken before PBL can be integrated in courses throughout your organization?
- C.** What additional elements would you like to be articulated sharper in the coming version of IO5?

Partner-wise responses to the three main questions can be found below. Its overall tendency is that already techniques like storytelling, gamification, creative prob-lem solving and problem-based learning have been recognized as valuable ingredients of instruction and students' project work. Most of the partners do not see them as obligatory formats for vocational education, however; The 1. subject matter, the 2. students' stage of socio-/cognitive skills and 3. development and the 4. mentor's actual pragmatic preferences should have a need for them in that particular situation. This overall conclusion leads us to the common-sense criterion of "fit for purpose"; It implies that the diversity of learn-ing/teaching processes needs diversity in applied meth-ods and tools as well. Throughout this IV4J project, each of the partners has admitted that the proposed new methods/tools need to be integrated as candidate ingre-dients in an overall instructional design approach as generally endemic to ECVET.

OMNIA:

Ad A. Quite often PBL goes within these examples of gaming and storytelling. But not always; as example about Minecraft Äänekoski I would group it on models like project based learning or cooperative learning. About simulations – it is considered as a framework itself (see picture from Page 29).

Ad B. Most important steps are teacher education, good examples about PBL.

Ad C. Maybe overlapping of different models could be expressed too?



PARTAS:

Ad A. Yes – we would see it as a useful tool for good trainers to be able to employ to achieve better impact. It needs to be chosen from among the range of related interactive tools to maximize the effect in the most appropriate circumstances.

Ad B. We would need to introduce this methodology into a training session for our trainers together with examples of how it can improve the effectiveness of the training program

Ad C. None particularly come to mind – perhaps some insights may come during the staff training event in Utrecht.

FA-MD:

Ad A. FA Magdeburg is using PBL as practice for the students in the IT field. As we are practice company in dual system, we involve our trainees into the daily tasks what means to solve real problems. PBL can be a frame-work for gaming, storytelling and simulations to make the training more attractive and increase the enthusi-asm and engagement of our trainees. Using PBL in our organization it increases the motivation of the students. The student assumes the role of a specialist to solve the problems and will take the responsibility of the solution. The student became a self-learner and more independ-ent working. They will connect their native skills with learning skills and professional practice. Trough gaming, storytelling and simulations students can assess by them-selves first what they know, what they need to know. The teacher acting as a coach and tutor will connect direct the student with real problems and help students to organize their approach.

Ad B. Staff development to introduce innovative pro-grams/strategy for PBL Development of portfolio with "Problems." As we are delivering mostly IT training, we need more structured approach of the method and new media to create problems.

Ad C. Effectiveness of Problem Based Learning

SBH Südost:

Ad A. Problem-based learning is mainly implemented in real-life applications as a simulation project in order to implement practical problem-solving processes under predominantly school conditions. However, the selectivity between simulation and game is quite thin here. If playful elements of PBL have predominantly motivational aspects, simulations serve to transform essential learning content about PBL into action and application-oriented knowledge for the students (through this attractive form of PBL). However, this presupposes the necessity of integrating content and tasks (also in "gamification") into the PBL that are appropriate to the level of achievement, which enables the students to acquire competences in the learning process only through "learning guidance".

Ad B. Even if this learning method is already integrated in the everyday teaching concept and is already in use, it is always necessary to check the implementation - from the "problem" to a "PBL structure" in order to achieve the learning result - with regard to applicability and suitability with regard to the students and the contents. This also requires method training for the teachers ("problem-oriented learning environment" and "PBL according to McMaster"). „Teamwork“ on topics, content and media from and for PBL in the organizations is helpful for this.

Ad C. Problematic "time" for the PBL in the field of tension between knowledge and action in training for the transfer of material! Problematic "gamification, storytelling and simulation" between problem-based and problem-oriented learning!



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Euro-Net:

Ad A. I think that it is essential to teach to learners informal and not-formal context an approach to real-life problems. Because of the difficulties in teaching this topic it could be useful to use a gamified approach in order to break down the barriers and unleash creativity. In my organisation we are used to apply a Creative Problem-Solving Methodology approach and we've already introduced it in Vocational courses we are teaching at.

Ad B. An interesting element in a Problem-Based learning is connected with the collaborative approach in a classroom where it is important to be concentrated and detect the synergic power coming from the single participants. As prerequisite, I think the main problem is to break down the barriers from each student in terms of creativity (psychological and sociological) - it is possible to try to test the creativity in a gamified context or support the students to elaborate own vision of a career or of own abilities (elements that I've discovered by teaching in master classes, where the students have very limited ability to detect own career and possibilities available on the job market - the teacher are also very distant from the job market).

Ad C. It is good to introduce the vision coming from some documents attached to this email: - a 2010 IBM poll of 1,500 CEOs from 60 countries and 33 industries have identified creativity as the most crucial skill for future success and leadership competency. Creativity is a critical skill that can be taught through a specific methodology and practical exercises to test and learn to think outside the usual mental schemes. - PISA 2012 results, and: - collaborative problem solving.

Introduction

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<https://pixabay.com/photos/joystick-console-video-games-xbox-1216816/>

Entrepreneurship is the core target for future VET in this IV4J project. As will be elaborated further in this IO5, entrepreneurial-oriented learning is as multi-faceted as businesses itself. However, it is worth to see a common denominator of an “entrepreneurial mindset” that may serve as a more generic driver for VET and even for middle and higher education in general. In order to make entrepreneurial-oriented VET tangible a subset of the recent didactic repertoire will be high-lighted in this IO5. There are many avenues for inno-vating VET that have not been fully exploited yet: 1. Gamification, 2. Playing, 3. Collaborative Learning, 4. Storytelling and 5. Simulations are just the most obvious ones. However also Mobile Learning, Virtual Reality and the many more techno-driven innovations to come are essentially promising candidates for the future of VET. In order to make learning in VET more effective, efficient and sustainable we need a strong foundation for its embedding in the actual educational situations and further consolidation. Seen the recent scientific litera-ture and good practice examples, this envelope is PBL (**Problem-Based Learning**): The method to place the apprentice at the very core of his/her learning process; (s)he (re)gains full ownership of the start of a life-long learning process. For the sake of innovative VET it means that apprentices who typically have a less favora-ble earlier school experience, they need to be encour-aged by being welcomed and empowered through a **student-centered pedagogy**. Problem-Based Learning should not be confused by **Project-Based Learning**. The essence of the PBL approach is to learn about a subject through the experience of solving open-ended prob-blems found in trigger material; prototypical questions that orient the learner towards understanding what PBL questions ideally are. The PBL process does not focus on problem solving with a defined solution, but it allows for the development of other desirable skills and attributes. This includes knowledge acquisition, enhanced group collaboration and communication. As overall recom-mendation: Motivate VET trainers to see the elegance and sustainability of PBL; (Smyrnova et al, 2017). It is a powerful paradigm before adopting and integrating the new ICT-based tools as presented before. Main driver behind the integration of PBL in VET is that it fit very well with the type of motivation of young apprentices “to make a difference” and “find a job” or “start a com-pany”. More in general, we see a recent policy towards preparing VET students for “**Smart Jobs**”; (Issa et al, 2017). It preludes a more active learning approach and ready for the post-industrial era where men and ma-chine face new complementary skills and autonomous life-long learning. This inherent trend not only holds for including ICT skills; it is a much more intricate shift from technical-, via communicative- to conceptual skills. According to “**Balance-Careers**” the Top-Five conceptu-al skills are: Analysis, Communication, Creative Think-ing, Leadership and Problem-Solving. According to “**Business-Directory**”, conceptual skills can be delineated as: The ability to think creatively about, analyze and understand complicated and abstract ideas. Using a well-developed conceptual skill set, top level business manag-ers need to be able to look at their company as a holistic entity, to see the interrelationships between its divi-sions, and to understand how the firm fits into and af-fects its overall environment. Until very recently these ‘conceptual skills’ were supposed to belong to the reper-toire of corporate leaders and top managers. We see now that very rapidly these skills are seen as essential for labor force throughout the enterprise pyramid.

Chapter 1. Gaming Elements in Education

Before exploring the potential of Gaming and Story-telling it is useful to provide two main reasons for our searching in the next directions. The first is that, complementary to our day-to-day classroom efforts for converting students into better learners, the main question is to make educational systems better by rephrasing Kenneth Dunn (Kaufman et.al. 1997): “If students don’t learn the way we teach the, let’s teach them the way they learn”. The second one is the notion that VET faces a moving target; enterprises and economies are shifting due to globalization and new technologies. The third direction is that employees face more and more demand for strategic thinking. Though the term “conceptual skills” may suggest that it belongs to high level managers, there is a growing understanding that for a large class of jobs conceptual thinking is needed in order to promote problem solving and creative approaches. This trend goes together with the growing need for knowledge- rather than industrial workers. Conceptual skills are the next step after we mastered factual and procedural knowledge. Both knowledge and skills are consolidations after good practice has found an optimum; As our surrounding world evolves, new VET needs to be developed: Its goal is to prevent a group of youngsters to become obsolete. We hope to illustrate that gamification, storytelling and many more are indispensable in this continuous process.

Definition:

Gamification is the application of game-design elements and game principles in non-game contexts (Werbach,2014). The main reason for defining gamification as a process is that it provides a scale for gamification and not an absolute category. Gamification commonly employs game design elements to improve user engagement, organizational productivity, flow, learning, employee recruitment and evaluation, physical exercise, traffic violations, voter apathy, and more. Werbach and Hunter (2015) identified five game dynamics used in gamification:

- **Constraints** are about balancing limitations and freedom for a player as well as integrating forced trade-offs in the design of a gamified solution.
- **Emotions** aim to produce enduring player engagement and appear during an activity.
- **Narrative** is represented for a player through either an explicit or implicit storyline having its own consistent inner logic and following a certain context.
- **Progression** reports the player’s growth and development when navigating through a game and the possibilities to do so.
- **Relationships** consider the social interactions of players in a game which can create feelings of camaraderie, status and altruism.

Jayalath and Esichaikul (2016) provide a model in which the dynamics, mechanics and Element are combined (see Figure 1). This provides teachers and researchers with a framework to design engaging learning environments. Just using an element does not necessarily create an engaging gamification environment. For instance, providing points as in grading tests would not be considered an engaging gamification environment for most students as they are used to this. Creating teams to compete in an engaging set of problems to be solved and keeping a leaderboard scoring system might be challenging and create intensive team cooperation.

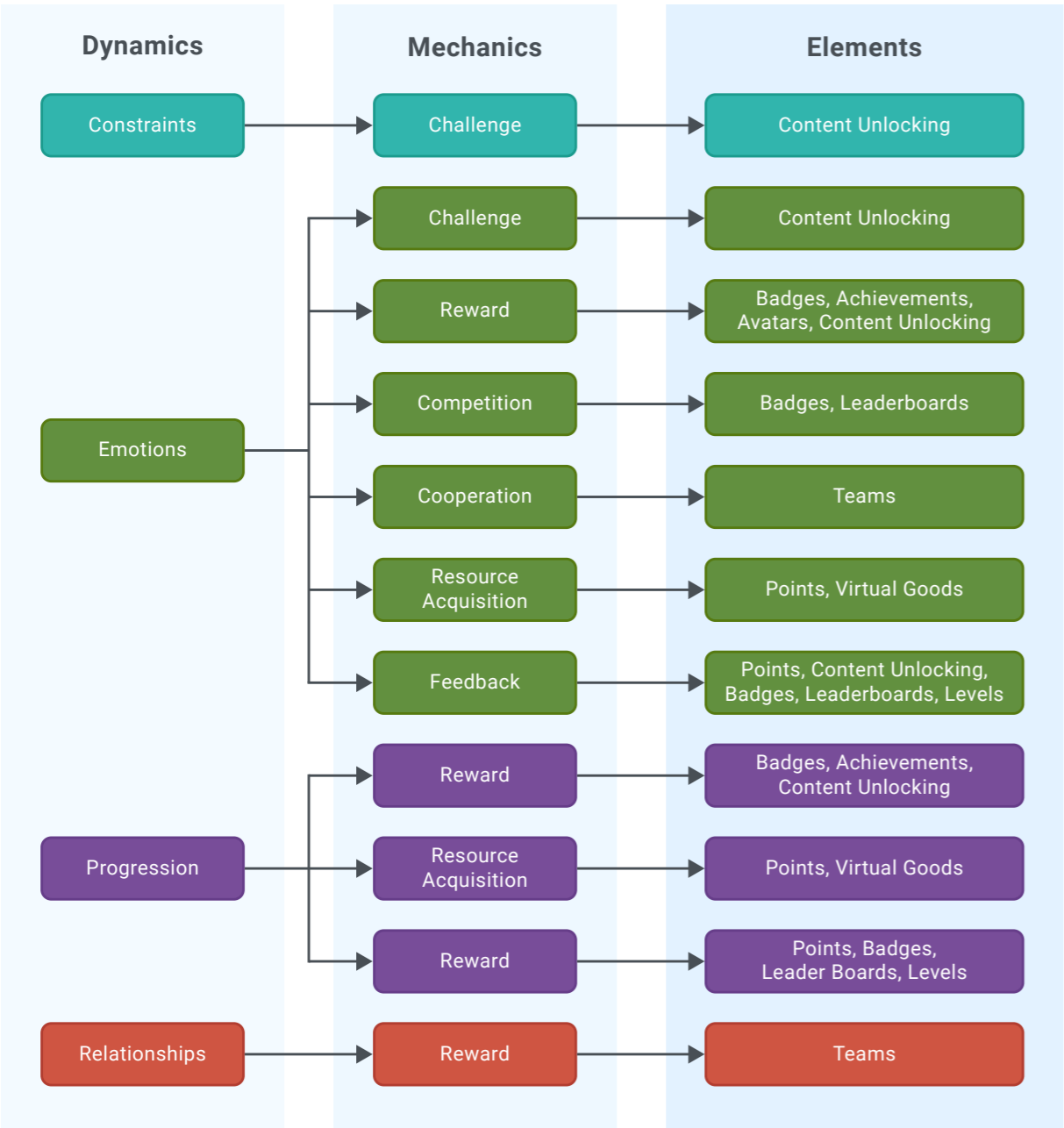


Figure 1: Linkage Diagram of Game Dynamics, Mechanics and Elements. From: Jayalath, and Esichaikul (2016)

A number of studies on gamification show that it has positive effects on individuals in terms of cognitive flexibility, changing role perspectives, etc. However, individual and contextual differences exist. Gamification can improve an individual's ability to comprehend digital content and understand a certain area of study such as music. Research into the use of gaming for learning shows that gamification penetrates all sectors of life where awareness, latent ambitions and mental growth are at stake. As such, gaming may not only increase the effectiveness of traditional learning goals like memorization and skill routinization; It may help learners to refresh their concept of what learning is about. In its deepest sense, learning can be seen as one's developing willingness to change him/herself; (Kommers, 2004).

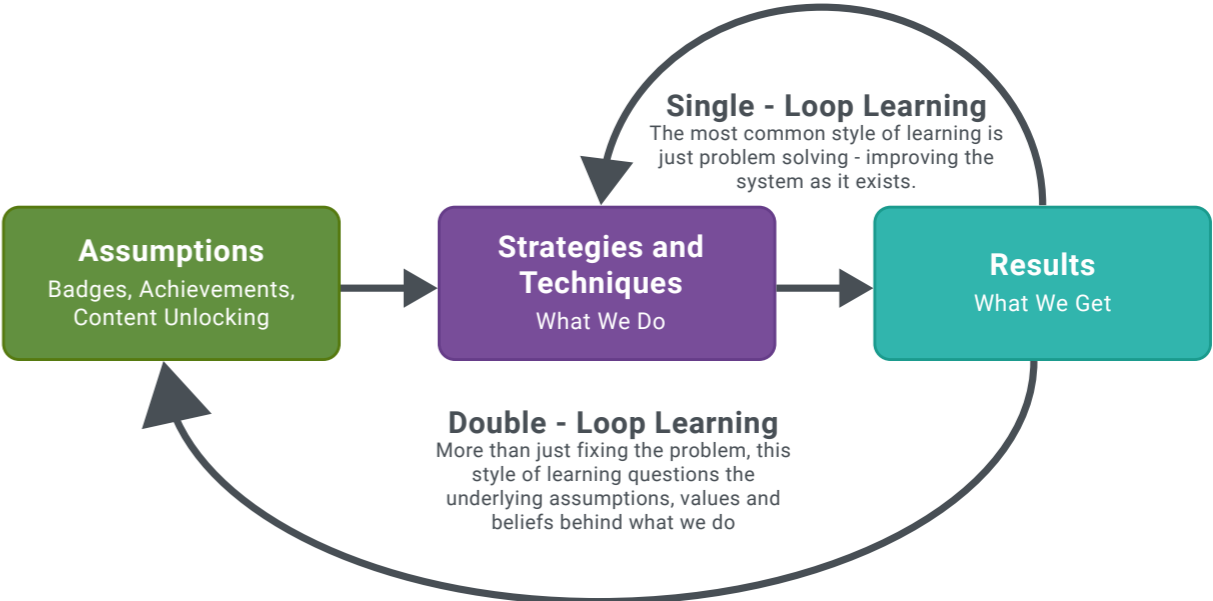


Figure 2 - Double-Loop Learning by Argyris, 2005

The contrast between single- versus double-loop learning is that single-loop learning can be compared with a thermostat that learns to switch-off the heating when a certain temperature is reached, whereas double-loop learning occurs when a device (or a person) learns to monitor a wide set of parameters and becomes keen on which of them are the best first-order predictors for anticipation when heating or cooling is needed. Games as we typically know for increasing speed and precision have already proven its value for learning. Its overall metaphor is “beat your peer student or your own score in the past”. Double-loop learning games place the learner at the core of a realistic situation and ask to discover ‘hidden’ relationships in a certain domain. Where gaming aims at winning, playing aims at conquering new levels of understanding, self-awareness and self-efficacy. In terms of VET, it is the learner who attempts to become his/her own coach.

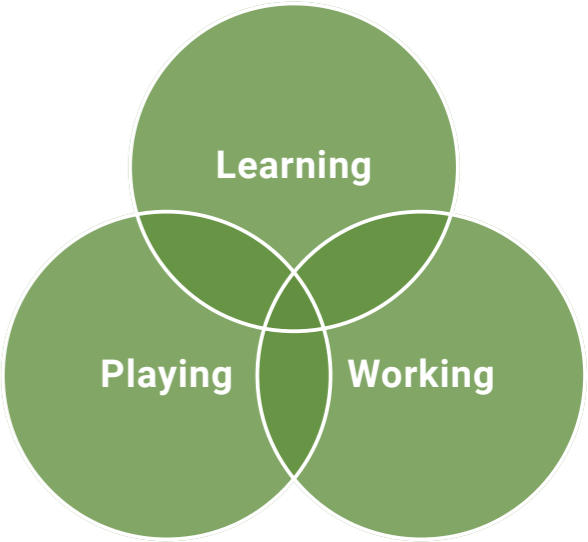


Figure 3: Learning, Playing, Working as Dynamics for Double-Loop Learning (Bonanno & Kommers, 2008)

The relations Learning-Working and Playing-Working have been extensively explored in educational practice before. The intersection Playing-Working seems to be underexploited yet. Its goal is to make apprentices better new colleagues who dare to question and help to trans-form into new business models. As Steve Jobs claimed: "Traditionally we, as Apple, scout and hire the best people around the globe, pay them highest fees, and subsequently tell them what to do..."; It reflects the growing notion that in the post-industrial era, working is the efforts to exceed earlier expectations and survive in an ever more competitive market. The notion of 'double-loop' learning confirms the manifold efforts in the last four decades to equip the learner with ever more autonomy, self-regulation and metacognition, in order to start the process of a life-long learning attitude as early as possible.



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Chapter 2. Why Play-Based Learning? Methodologies and Approach

Play-based learning as **research topic** has been presented as method for pre-school learning mainly. In this IO5 an effort is made to position the playing-working combination as new prospect for VET. In the triangle learning-playing-working the phase of learning is traditionally seen as mitigation between work and play, in which play is unnecessarily seen as 'leisure time', 'divertissement' and 'digression'. The essence of playing is the immediacy between actual interest, affordance and try-out. There is no other agenda than "follow your interest" and "see how far you can go". So, though the improvisation and impulsiveness may look as "unfocussed" and "senseless", the optimal sense-making occurs in the playing attitude as it completely absorbs the person. In terms of the net learning (understanding a complex of variables through experiencing direct- and indirect side effects of an earlier intervention) one can say that playing is one of the very few activities with a minimal of cognitive overload; no prescriptive agenda, no extrinsic motivations and a one-to-one match between cognitive repertoire and intuitive horizon. Just like virtual and vicarious allow the learning to take freedom and fully focus on the proximate zone of achievement, so is a situation of playing the de-facto match between momentary intention, imagination and cognitive operation. It is now a matter of finding complementary arrangements for VET mentors to convey such process and find adequate scenarios for progressively integrating its learning outcomes in meaningful segments of the job performance.

Chapter 3. Gamification of Learning: Principles and Mechanisms for Engagement

Gamification of learning is a much broader process than finding appropriate game templates and integrate them in curricular and instructional contexts. One of the recent efforts has been to classify better what element of gaming would contribute to the learning process. The prefix “serious” has been chosen to narrow the spectrum of diverse gaming genres. Critics came along that gaming for the gamer is always a serious matter. At the other side game ambassadors claim that an explicit serious connotation may squeeze out the attraction of game-experience soon.

1. One of the drivers of game-based learning is **Engagement**; Learners feel immersed and sometimes even obsessed while playing a virtual reality where a certain number of performance parameters are continuously measured and displayed.
2. The second driver is Flow; **its effects** increase the learners’ strength of experience, concentration and endurance.

In particular for VET, gamification in learning has the extra effect of “Breaking the Yoke of Seriousness”; As “Work” is inextricably bound to serious business, the novice might easily get too much infatuated with “avoiding mistakes” so that “risk avoidance” easily emerges and hampers mindset for learning and understanding.

Chapter 4. Digital Storytelling for Learning

Definition: Storytelling describes the social and cultural activity of sharing stories, sometimes with improvisation, theatrics, or embellishment. Every culture has its own stories or narratives, which are shared as a means of entertainment, education, cultural preservation or instilling moral values. Crucial elements of stories and storytelling include plot, characters and narrative point of view. The term “storytelling” can refer in a narrow sense specifically to oral storytelling and also in a looser sense to techniques used in other media to unfold or disclose the narrative of a story. Research into the use of storytelling for learning can be found [here](#). Its main lessons are that both the teacher and the learner have larger repertoires of earlier experiences and imagination than we typically rely on. A story is an existential (how do I experience a certain fact or event?) rather than epistemic (how things are). The term ‘Digital’ storytelling reflects that the face-to-face format is powerful, however not necessarily the only one. For instance, the option of letting people build their stories on top of earlier stories by others, or even simultaneously build parallel stories have been explored in the “Woven Stories” project; Harviainen et al., 1999 and Nuutinen et al., 2010. Connected, interlinked stories are a good candidate to promote collaborative understanding and constructivist in addition to instruction-based learning. The revaluing of storytelling can partly be attributed to the earlier technical virtues of hyperlinking, compartmentalized paragraphs and hypertext as decontextualized information; (Kommers, 1988). Narrative methods for revitalizing teaching and learning can be seen as compensation for the step-by-step “cleaning” of rhetoric; definitional purity and the wish to make texts tractable had the price of losing episodic lines and losing the persona (the imagined concrete person who the listener/reader can identify with). Marketing campaigns have already picked-up this need for ‘[Personal Templates](#)’. In tutorials and manuals, we see the trend to articulate “the user” of “the customer” as vignette character: a fictitious flat character who serves as a simplification of the manifold persons who the apprentice may meet in the near future. In terms of scaffolding, the initial simplification like posing the customer as ‘caricature’ first and allowing an increasing realism of the customer as a more complete person later, might be a good heuristic for the design and pacing of the narrative approach. Once the apprentice becomes involved in virtual presence, the avatar is a comfortable way to represent one-self without disclosing his/her identity. An epitome of narrative format is TED Talks, amongst the ones by [Sir Ted Robinson](#) have a major message on creativity for both regular education and VET. Convincing examples of persuasive communication via narrative formats the conveying a rather formalistic topic as Data Modelling can be seen in “[It’s all design, from IT projects to The Rosie Project: Graeme Simsion at TEDxUniMelb](#)”. Appendix 2 lists seven available free tools for Story-Telling.

Chapter 5. Introducing Characters / Avatars

Characters or its representatives allow the audience / reader to identify with the story. The most compact guidelines for the introduction of characters can be found in film-script guidelines. Crucial in establishing characters are the features of what we call 'a personali-ty'. Let the listener immediately know who (s) he is via expose of (trans)actions and contrast with the other players on stage. Make clear that (s)he is going to play a decisive role in the coming adventure. Typically, the listener should be able to identify with the main charac-ter, but at some essential point there needs to be ambi-guity: 'strange' behavior that cannot be explained or could not be recognized before. Overwhelm the listener very soon with typical bloopers ('big mistakes') by the main character. Keep your story compact so that the main line can easily be remembered. Insert looking back and forth as mental perspective; The listener is supposed to 'create' his/her own interpretation. In case of more abstract concepts in the knowledge domain, elaborations are needed; encourage the listener to interweave prior and final understanding and keep this discrepancy until the very end of the story. The elaboration of Story-Mapping, Hero's Journey and the available multimedia tools for web-authoring can be found in Appendix 1. The next link to David Mamet's message triggers your mind on storytelling:

<https://www.facebook.com/masterclassofficial/videos/10156338507838664/>

Chapter 6. Simulations: definition of the context, team works, skills, pathways, e-tools, management

Both gamification and narrative discourse for learning can be seen in the many simulation programs that have been integrated in various levels from early regular unto the highest levels in corporate and civil training in everyday life already. Since computers became multi-media (Multi Modal), its potential contribution to let people explore almost any context, inclusively 3D spatial environments with stereopsis for surgical training, kin-ematic and proprioceptive sensations for vehicle control and haptic experience for training manipulation feed-back. The instructional context and the apprentice's prior knowledge and skills is decisive for what is actually learnt from a simulation model. The



Figure 4 Dr Bob Geelkerken calibrating the haptic feed-back that corresponds with palpating a virtual patient's stomach

underlying photo of an expert surgeon who calibrates a haptic device before the students start working with it; (Kommers et. al. 2004). A typical phenomenon is that after few hours of practicing, the novice will perform better than the expert. This is the moment that the students need to go to the more realistic context so that many more parameters like the total constitution of the patient, the smell, heart functioning etc. should be taken into account.

As many competences imply social interaction and teamwork, also a large proportion of didactic simulations demand collaborative tasks. In the context of Utrecht University, a number of collaborative group tasks have been developed for the sake of observation and later analysis; (Van Drie et al, 2005). In terms of didactic context, it is important to discern the training of the individual pure job performance and the goals in terms of socio-cognitive development. The Teams-Games-Tournament format (Ke, 2007) originally defined by Bob Slavin (1977), prescribes an overall sequence of cooperative- and competitive group work. Skills progress through simulations have been described by Luursema et al (2008). Its conclusion is that stereopsis only makes a positive difference in case the novice has a limited capacity in spatial imagination.

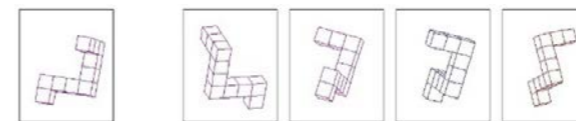


Figure 6 Pretest: (visuo-spatial ability) Vandenberg & Kuse 1979 Mental rotation test

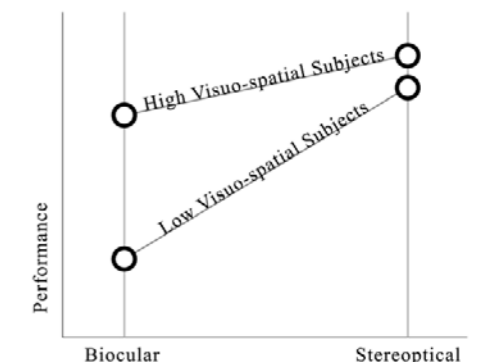


Figure 5 Luursema's finding that the added value of the heavier 3D stereoptic goggles emerges more in case of a weaker visual imagination

Monitoring pathways of skills: One critical factor in the success of learning with simulations is the overview of students' partial successes/failures in the targeted skill domain. The underlying diagrams allow trainers to quickly analyze novices' learning performances. It is an example on how e-tools allow the human factor to survive and even excel, compared to the f2f classroom situation.

The study by Kommers et al (2003) revealed that though virtual reality is one of the prime candidates in vitalizing learning by its realism and direct appeal to the students' natural affordance to act upon urgencies rather than to "know" what experts are saying; VR in itself is not enough to make the learning more effective. Obviously, the realism in VR cannot exceed the real situation itself. As the experiences with Link Trainers for airplane pilots has shown, we know that the simulation can be more effective, once it elicits the novice to go into critically complex situations; exactly those situations that we never hope to meet in reality. The added value is not just that the learner's reflexes are trained to survive in the panic of precious decisive seconds. The value is also that learners can best understand the fundamentals of complex mechanisms when they are forced to work on the edge of what is a success versus a failure. Training through real-patient interventions are not allowed to approach this area. That is why the VR-based medical intervention is an even better preparation to the first clinical steps compared to witnessing dozens of impeccable operations performed by the master. For clarifying the potential value of simulations in VET, few examples maybe be helpful: One of the programs used in secondary education in the Netherlands is a simulation environment called **SIMQUEST** in which teachers can create their own simulations to use in their lessons. The program is free and available in Dutch and English. Although the example is from physics it can be used in any area that employs numeric equations.

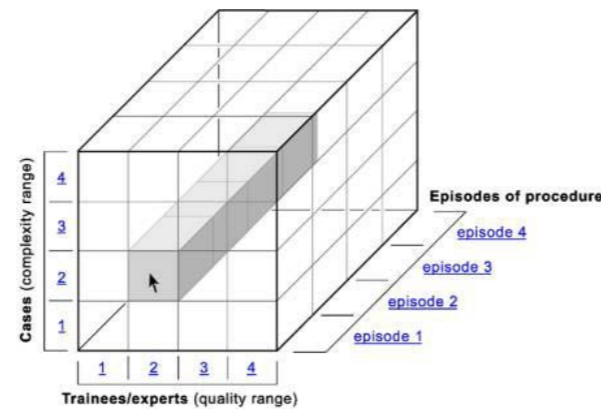


Figure 7 Selecting a Trainee / Patient intervention history

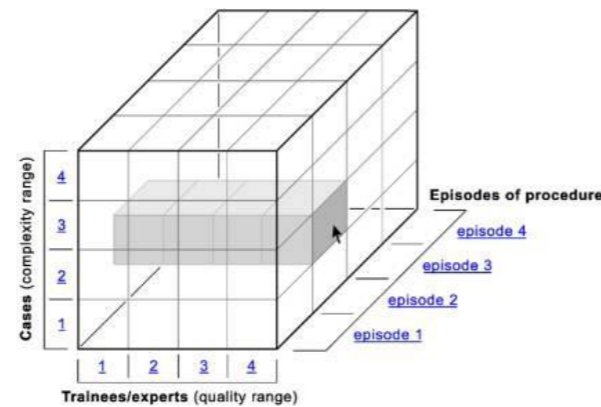


Figure 8 Selecting a particular intervention episode across all trainees for one particular patient

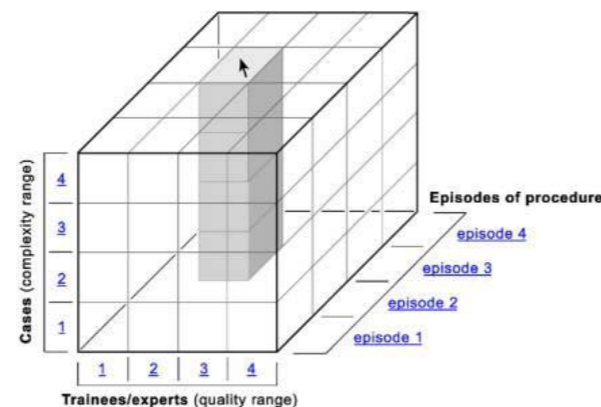


Figure 9 Selecting a particular intervention episode across all patients for one particular trainee

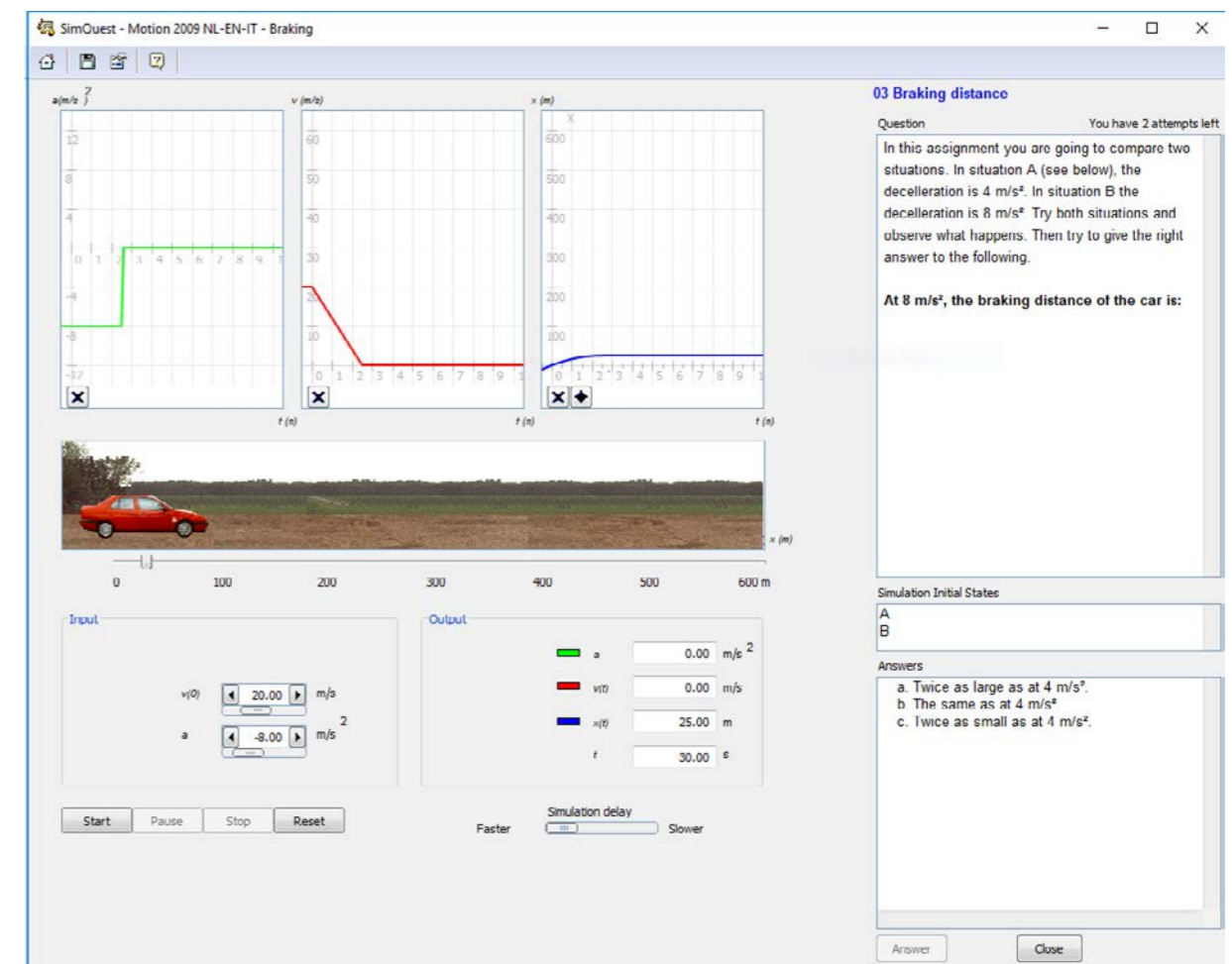


Figure 10 The SIMQUEST environment for the students

Advantages of simulations:

- Safety; E.g. flight simulator, nuclear power plant or operating cranes
- In most cases cheaper than real-life
- More accessible than real-life; You can take it home
- Platform for discovery learning; Students can manipulate and observe (intrinsic feedback)
- Learning as (guided) discovery
- Student controls the learning environment
- Does research to foster knowledge just like a re-searcher
- Constructs knowledge in his/her personal way
- Skills should be more flexible and retained longer
- Fostering of research skills

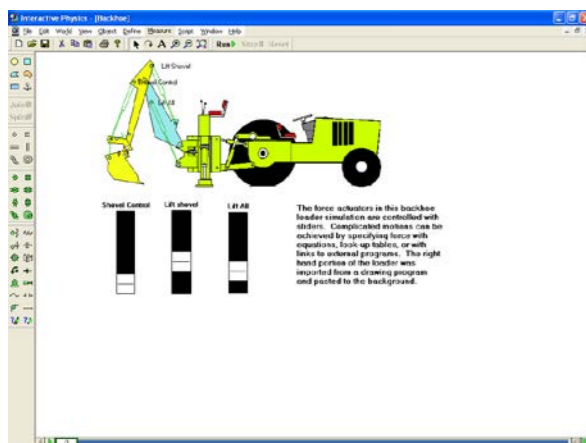


Figure 11 Interactive Physics allows future designers and maintainers to build and experiment with a backhoe, in this case critical for overcoming oscillations



Figure 12 LEGO - LOGO as constructivist learning method

Young delinquents in prison have been exposed to **LEGO-LOGO workshops** in the tradition of Seymour Papert's 'Mind Storms' project at Media Lab MIT. "Climbing steep slopes" was one of the typical exercises. Finally leading to the understandable challenge to "even **climb back hanging walls**" as common dream in prisons.

Lego Serious Play

" ... The **LEGO® SERIOUS PLAY®** Method is a facilitated meeting, communication and problem-solving process in which participants are led through a series of questions, probing deeper and deeper into the subject. Each participant builds his or her own 3D LEGO® model in response to the facilitator's questions using specially selected LEGO® elements. These 3D models serve as a basis for group discussion, knowledge sharing, problem solving and decision making..." Its method is the collaborative process in which each of the participants have a decisive role. The group process needs to be moderated by a trained LEGO® SERIOUS PLAY® facilitator. As conditions for applying Lego Serious Play its web-site mentions:

- The subject is complex and multifaceted and there is a need to grasp the bigger picture, find connections and explore options and potential solutions
- It is important to reach decisions which everyone commits to and honors after the meeting even though he or she does not agree 100%
- Asking each team member or participant the same question results in substantially different answers
- Everyone in the group has an interest or stake in what is on the agenda
- It is important that everyone participates in the discussions and contributes with his or her knowledge and opinions
- You want to increase team understanding and at the same time avoid frustration
- You want to use the time efficiently
- There are no obvious answers
- You would like to gain new learning, insights and new ways of thinking
- You want to deal with tough and complex issues in a constructive atmosphere
- It is vital that participants speak their true feelings without intimidating anyone or being intimidated
- You have a situation in which a few members tend to dominate the discussions and you want to break that routine without offending anyone
- You have a group which feels meetings tend to be a waste of time
- You want to create a level playing field for discussion
- Your meetings or learning events tend to focus more on the messengers than on the messages
- You want to avoid excuses or lack of initiative after the meeting
- There's a risk, participants feel they were not heard or involved in the decision
- You want to ensure that all participants share a common understanding and frame of reference

Its "Creative Commons License Deed" declaration can be found [here](#). The web-site mentions that the LEGO Group after 2010 no longer offers certification programs in the LEGO® SERIOUS PLAY® method, nor does it have a direct association with the end-client. As preliminary conclusion we may say that Lego Serious Play is an elegant demonstrator method to let trainers and students experience the difference between gaming and playing: Gaming is to let its members compete in a limited set of skills and performance qualities, while playing is a broader exploration method for letting its members discover a certain design/creation domain and eliciting one's latent intuition in that field.

Chapter 7. Contexts for Simulations

Simulations have been developed in industrial projects in order to prepare better for the unforeseen complexity during calamities. Its main effect was that engineers and decision makers became better prepared compared to those who just concentrated on formal models with a high degree of precision. As simulations became easier to emulate more complex realities, education has gathered more than only interest and got more and more convinced that a reduced reality had advantages for gaining understanding compared to the situation with full reality and scale. Simulation has even become a metaphor for education at large: If the real setting cannot absorb novices' presence and contributions, it is needed to build a reduced version of a particular enterprise. Not only to increase safety and flexibility for the time of learning, also for breaking-out when no urgent maintenance or trouble shooting was needed. For example, Hewlett-Packard's inkjet cartridge filling factory in Dublin had a mini factory where employees could exercise in fault-finding so that they reached a shorter downtime in case of failure. In other words: Simulations have a wide potential scale of functions. Its use for learning purposes can be focused on tackling renowned problems like flight pilots who need to practice emergency landings that they would never voluntarily undertake in reality. But also, simulations allow novices to explore and experiment configurations in order to develop a better What-If thinking for the cases that fresh reasoning is needed in a future break-down.



Chapter 8. **Minecraft for Schools: MinecraftEdu**

Image Credit - www.pixabay.com
<https://pixabay.com/illustrations/minecraft-river-scene-gaming-1578073/>

A New York City school teacher has crafted a version of Minecraft for schools called **MinecraftEdu**. Given the sandbox game's simple premise — a pixelated world of blocks that users manipulate with tools — plus the ability to add customizable maps, educators can drop students into a world of ancient cultures, Chemistry, English, and more. MinecraftEdu creator Joel Levin, who teaches second-grade computer classes at Columbia Grammar and Preparatory School in New York City and runs a Minecraft club for high schoolers, has been incorporating Minecraft into his classes for the past two years. A great example to see is **Building City of Äänekoski** built in Minecraft. The Äänekoski Minecraft server uses 324 square kilometer map of Äänekoski as the playing area. The base data for the map is from heights maps and road maps that have a 2 meter accuracy and those were combined and then converted into Minecraft with special editors. Compiling this size map takes several hours on high end PC. The server also holds other maps, like city of Saarijärvi, and you can virtually travel between different maps inside the game world.

Chapter 9. **Conclusions**

Entrepreneurship-oriented learning like gamification, storytelling, simulations etc. can only be adopted and effectively integrated if an overall pedagogical frame-work has been articulated. Problem-Based Learning seems the best candidate as it places the learner at the very core of the life-long learning process. Scaffolding (and subsequent fading) is seen as a safe way to make learners less dependent from the teacher and institutional guidance. The same is true for the initial and further (in-service) training of VET teachers. The choice of “narration” is a clever choice to let existing VET trainers build upon their prior traditions and re-flexes; (Kommers & Simmerling, 2015). At the same time, they need an appropriate didactic framework that allows all the new-coming ICT tools to be integrated by the learners themselves. For the moment it is gamification and simulations. In the near future it will be a wealth of MOOCs, Big Data applications, Learning Analytics, Artificial Intelligence, etc. The chosen didactic framework is Problem-Based Learning with an ever-stronger focus on the existential factors of the learner with his/her unique talents.

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Appendix 1. Story Mapping

The mapping prescribes the story to develop along the horizontal dimension, while the vertical dimension expresses the virtues of its detailed behavior; High on the vertical axis means 'expressive', 'virtuous' and 'risky'. The default storyline is an empty character (like a skeleton). The balancing between horizontal develop-ment ("episodic") and the vertical ("epistemic") reveals the composition: the more time you allow an episode; the more expression is allowed.

[Jeff Patton](#) describes user story mapping as a valuable tool for software development once you understand why and how to use it. A favorite format for delineating and molding a story-line is



Figure 13 Silver Stories allows you to create quite huge and complex story maps, like this one.

conceptual mapping; It has been worked out for various stages in instructional and constructivist learning in '[Cognitive Support for Learning: Imagining the Unknown](#)'; Kommers (2004).

Hero Journey

The Hero's Journey is also called the monomyth; A pattern that underlies a large number of stories in which a hero goes through crises and finally wins a battle and returns home safely as reborn. The systematic research of underlying templates of patterns is typically framed in psycho-analytic terms where mythical stories stem from. Freud, Jung and Otto Rank have been cited to build its theory and generalization. Typically, Robert Wagner's operas rest upon the same mechanism of heroic and fabulous human power. Let's not forget that old Greek eposes like Odysseus and Orfeo prelude a long tradition of drama-architecture and rhetoric. The same is the series Bible, Talmud and Koran; they show similar patterns as in Buddhism, Gilgamesh Epos etc.

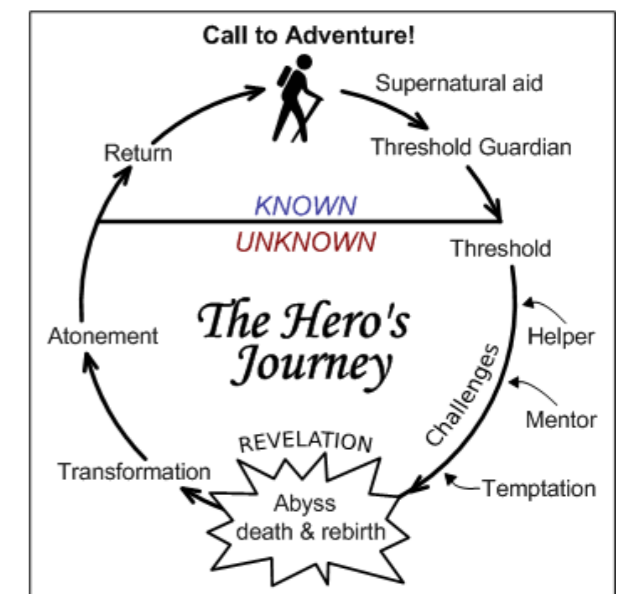


Figure 14 The Hero with a Thousand Faces (1949) is the seminal work of comparative mythologist Joseph Campbell. In this text Campbell discusses his theory of the journey of the archetypal hero found in world mythologies and religions.

Theorists like Otto Rank and Lord Raglan, describe hero narrative patterns in terms of Freudian psychoanalysis and ritualistic senses. Critics argue that the concept is too broad or general to be of much usefulness in com-parative mythology. Others say that the hero's journey is only a part of the monomyth; the other part is a sort of different form, or color, of the hero's journey.

Multimedia

Multimedia stories allow several dimensions (alternative story lines). Not all stories make good multimedia stories. The best multimedia stories are multi-dimensional. They include action for video, a process that can be illustrated with a graphic (e.g., "how tornadoes form" or "how this new surgery works"), someone who can give some pithy quotes for video or audio, and/or strong emotions for still photos and audio. Most multimedia stories require that the reporter go into the field to report the story face-to-face with sources, rather than doing a story entirely by telephone.



Figure 15 MULTIMEDIA STORYTELLING; University of Michigan – Comm439 – Fall 2015

A multimedia story is some combination of text, still photographs, video clips, audio, graphics and interactivity presented on a Web site in a nonlinear format in which the information in each medium is complementary, not redundant. Nonlinear means that rather than reading a rigidly structured single narrative, the user chooses how to navigate through the elements of a story. Not redundant means that rather than having a text version of a story accompanied by a video clip that essentially tells the same story, different parts of a story are told using different media. The key is using the media form – video, audio, photos, text, animation – that will present a segment of a story in the most compelling and informative way.



Appendix 2. Tools for Story-Telling

Story Telling is seen as one of the decisive stages in campaigning and thus a crucial criterion for recruiting new media design talents. A good example is the web community “[Silver Pen Writers](#)”. As online community it encourages and fosters creative writing by arranging review workshops.

E-Tools for Story-Telling

E-Learning Industry: E-Tools for story-telling are in-herently web-based and even cloud-based. Its benefits, compared to the traditional stand-alone applications is that sharing, collaborative design/production and ver-sioning control. Eleven free Digital Storytelling Web-sites are listed

ACMI Generator

ACMI Generator is a creative studio space where you can explore the moving image, be inspired, create your own moving image works, and share your creations with the Generator community. Gain a deeper understand-ing of the context of these inspiring stories through their education themes section. Try the Storyboard Generator and either choose a script or build your own storyboard and share it.

Bubblr

Bubblr is a tool to create comic strips using photos from flickr, just taking a sequence of pictures where you can add bubbles and create a story.

Capzles

All of your media and stories together like never before. Create rich multimedia experiences with videos, photos, music, blogs, and documents.

Comic Master

Comic Master allows you to create your own short graphic novel! With Comic Master you can decide how you want the page or your graphic novel to look, add backgrounds, choose characters and props to appear in your scenes, add dialogue and captions, and much more.

MakeBeliefsComix

At MakeBeliefsComix you can create your own comic strip with an easy and fun way. Choose a character and emotion, add talk or thought balloons, and start your character communicating. You can add other characters, colored backgrounds, objects, and panel prompts to keep your viewers interested. When you are done, you can print or email your comic.

MapSkip

The purpose of MapSkip is to create a weave of stories about the places in our lives. Create a free account and mark up places in Google Maps with your own stories and photos. You can also browse other users' stories, rate them, and discuss them. The best part? MapSkip is free of ads!

PicLits

PicLits is a creative writing site that matches beautiful images with carefully selected keywords in order to inspire you. The object is to put the right words in the right place and the right order to capture the essence, story, and meaning of the picture.

Slidestory

Slidestory allows you to combine picture slideshows with voice narration. Each picture in a slideshow has an accompanying voice narrated mp3 audio file, optional tags, and text caption. Isn't this a very exciting way to make presentations and share them?

Smilebox

Smilebox lets you quickly and easily create slideshows, invitations, greetings, collages, scrapbooks, and photo albums right on your computer. To get started, download and install the Smilebox application. Then simply select the photos you want to use, choose a template, add comments and music, and voila, you've made a Smilebox! With more than 1000 customizable templates to choose from, you'll find inspiration around every corner.

Storybird

Storybird lets anyone make visual stories in seconds. They curate artwork from illustrators and animators around the world and inspire writers of any age to turn those images into fresh stories. Note that while making, sharing, and reading stories on Storybird is free, printing them or downloading them have various fees that are clearly explained with each option.

ZooBurst

ZooBurst is a digital storytelling tool that lets anyone easily create his or her own 3D popup books. ZooBurst books "live" online and can be experienced on your desktop or laptop computer, or on your iPad via the free ZooBurst mobile app. Authors can arrange characters and props within a 3D world that can be customized using uploaded artwork or items found in a built-in database of over 10,000 free images and materials. The basic, free, account allows you to create 10 books of 10 pages

Seven Free Apps for Digital Storytelling

Adobe Slate

Named App Store Editors' Choice, Adobe Slate lets you turn your next newsletter, report, invitation, or travel adventure into a gorgeous visual story that delights readers on any device. Simply tap to select a unique look; beautiful fonts, color, and magazine-style design are automatically incorporated. Fluid movement and elegant motion are applied instantly. Create your Slate story and share the link anywhere.

Puppet Pals

Create your own unique shows with animation and audio in real time! Simply pick out your actors and back-drops, drag them on to the stage, and tap record. Your movements and audio will be recorded in real time for playback later. This app is as fun as your own creativity!

ShowMe Interactive Whiteboard

Turn your iPad into your personal interactive white-board: ShowMe allows you to record voice over white-board tutorials and share them online. It's an amazingly simple app that anyone can use; no matter how young or old.

Sock Puppets

Sock Puppets lets you create your own lip-synched videos and share them on Facebook and YouTube. Add puppets, props, scenery, and backgrounds and start cre-ating. Hit the record button and the puppets automati-cally lip-synch to your voice.

Toontastic

Toontastic is a storytelling and creative learning tool that enables kids to draw, animate, and share their own car-toons with friends and family around the world through simple and fun imaginative play! With over 2 million cartoons created in over 150 countries, parents and teachers rave about the app and kids can't stop creating!

WeVideo

Make and share videos using WeVideo's online video editing software, available on Android, iPhone, iPad, Mac, PC, and Chromebook. In this cloud-based collabo-rative video creation platform, you can save your work to your hard drive, upload to the cloud, and pick up where you left off on another computer. Note that free accounts are limited to 5 minutes of published video time and 2GB of cloud storage.

30hands Starter

A very easy and exciting way to tell a story, explain a concept, or flip a classroom. Create a multimedia presen-tation in minutes and publish it as a video to share. This tool was designed to be simple and fast, so it takes backseat to learning and expression. In a single class period, students can complete a video activity. Mapping these activities to a longer project helps students make PBL projects authentic and fun. Whether you are in Kindergarten or College, 30hands Storyteller helps you learn better by following UDL principles and getting you to think and create iteratively.

Appendix 3. Contributions by the OMNIA Partner

Answers to the questions by Jos and Piet

- From your current good practices, does the choice for PBL (Problem-Based Learning) as framework for gaming, story-telling and simulations look as an appropriate one?

Quite often PBL goes within these examples of gaming and storytelling. But not always; as example about Minecraft Äänekoski I would group it on models like project based learning or cooperative learning. About simulations – it is considered as a framework itself (see picture from Page 7).

- What do you see as the most important steps to be undertaken before PBL can be integrated in courses throughout your organization?

Most important steps are teacher education, good examples about PBL.

- What additional elements would you like to be articulated sharper in the coming version of IO5?

Maybe overlapping of different models could be expressed too?

Finland – Appointment of first Professor of Gamification

Dr. Juho Hamari (DSc, Econ) was appointed as Professor of Gamification at the University Consortium of Pori as of January 2017. This new, joint professorship of the Tampere University of Technology and University of Turku is the first of its kind in Finland. Gamification entails game-like elements in different kinds of systems and game dynamics and mechanics are applied, for example, in online services, education as well as in working life. According to Professor Hamari, studying gamification is very important as games and game-like activities have risen to a central role in different sectors of life and, even more extensively, in the whole society. Gamification is not only the application of game mechanics in online services but also a wider phenomenon that permeates society and culture. Playing games creates new thinking models in other areas of life and gamification aims to influence people's experiences, motivations and behavior in many different areas of application.

1. <https://www.utu.fi/en/news/news/Pages/First-Professorship-for-Gamification-in-Finland-to-University-Consortium-of-Pori.aspx>
2. <http://juhohamari.com/>
3. <https://www.tut.fi/Gamification/>

Research articles:

<https://scholar.google.com/citations?user=tKMLAegAAAAJ>

eOmnia – digital platform –

It offers students the opportunity to undertake part of their studies online. While digital learning tools and skills form an essential part of VET curricula, in Omnia digitalization is seen as a mean to implement the pedagogical strategy, emphasizing the pivotal need to intensify the use of digital tools and methods, reinforcement of interactive and social processes in producing and distributing information, systematic documentation of the products, free access to information and a culture of knowledge and information sharing. This concept is focal also in entrepreneurial learning. The project titled eOmnia aims to offer in 2018 for all Omnia students an opportunity to conduct at least part of the studies online. The current online study options include courses of liberal adult education, general upper secondary education, upper secondary vocational education and training and further training.

1. <https://oppiva.omnia.fi/tag/pelillisyyys/>
2. <https://oppiva.omnia.fi>
3. Minecraft Äänekoski – building the whole town inside Minecraft
Minecraft Äänekoski is a unique project where gamers decided to build whole Äänekoski (municipality) into Minecraft. By doing so, they were strengthening students skills in following:
 - Collaboration and teamwork
 - Quick way to learn the basics of 3D-modelling
 - Understanding maps and different kind of schematics and drawings
 - Measuring distances from maps
 - Ability to understand in 3D dimensions
 - Creativity and new innovations
 - Sustainable development

- Minecraft Äänekoski project has also widened and became larger, now it includes 3D modelling, AR/VR and other possibilities too. <https://www.bit.ly/aanekoski2018>

“Verkkola” - simulated & gamified online business learning.

Verkkola is an online platform for learning online business. Its meaning is to educate vocational upper secondary qualification in Business and Administration students in electronic commerce. Partially it's an online game where one should open his own e-store for clothes. The aim is to get better and learn by playing. Verkkola visualizes learning paths and boost competition. Progression is visualized by open badges and student portfolios. It's possible to follow up learning by analytical tools. Verkkola is CC-licensed (BY-NC) OER made by Finqu, Verifone, Jyväskylän Vocational Adult Education Centre, Omnia (Espoo area VEC), Tredu (Tampere VEC), Salpaus (Lahti VEC) and financed by Opetushallitus (Finnish National Board of Education).

http://www.oph.fi/download/180102_Ryhma_C5_Vesterinen_ja_Rinne_Pelaamalla_verkkokauppiaksi.pdf

<https://verkkola.fi/start>

Omnia Escape Rooms – finding a way to knowledge. Made with Thinglink, these Omnia's Online Escape Rooms are willing to give a hint for students what are VET studies. Students are playing out from the room by answering correct on the questions about theme. Major purpose of Escape Rooms is to help students from K9 to spot the differences between different study possibilities. There are rooms for laboratory technicians, tourism students, pipefitters and ICT-technicians. Later there is a plan to develop escape rooms so they could be used by VR tools.

1. <https://www.thinglink.com>
2. <http://bit.ly/360pakokonsepti4>
3. <http://bit.ly/360pakokonsepti3>
4. http://bit.ly/360pakokonsepti_2
5. <http://bit.ly/360putkisanasto>

ViLLE – making online training easy and fun

The research group in University of Turku has developed an eLearning platform called ViLLE. ViLLE started as a program visualization tool for an introductory programming course, but it has grown to become a general learning platform. It is built on an idea of a community of teachers who share the courses and exercises that they create for the platform. A teacher can build on the work of others and again share the results. The aim is to lessen the individual workload while at the same time support the creation of high quality content. Exercises in ViLLE are template based and there are collections of templates for teaching languages, mathematics and programming. For the student ViLLE gives the benefit of studying at his/her own pace at a convenient time and place. Typically exercises can be tried multiple times to improve the score. In mathematics the values in formulas can be randomized so the exercises are different every time. The exercises are assessed automatically, and feedback is given immediately.

1. <http://www.utu.fi/en/units/sci/units/it/research/cser/Sivut/home.aspx>
2. http://www.utu.fi/en/units/sci/units/it/research/cser/Sivut/using_ville.aspx
3. http://www.utu.fi/en/units/sci/units/it/research/cser/Sivut/ville_learning_platform.aspx
4. <https://oppimisanalytiikka.fi/en>
5. http://www.utu.fi/en/units/sci/units/it/research/cser/Sivut/ville_team.aspx

“Play” project for gamification of VET music studies

Play was a project (2015-2017) for music studies in field of vocational education and training. During the project the aim was to get a view of gamification and new technologies for rather traditional music education. Project outcomes introduces new ways of learning by playing such as Rumpuvelhot (“Drum Wizards”, board game for basics of drumming) and Musikaalituotanto (“Musical Production”, producing a musical as a game). On the project they also tried out about 200 different music apps and produced over 200 pages of learning material with gamification, narrative storytelling and new technologies.

1. https://www.theseus.fi/bitstream/handle/10024/133362/JAMKJULKAISUJA2352017_web.pdf?sequence=1&isAllowed=y (Finnish only)
2. <http://www.hanketuloskortti.fi/hanketuloskortti/play/> (Finnish only)

Seppo

Seppo is an authoring tool for creating educational games. Teacher can adjust the place where the game is played. The game can be played in the school premises, in the city center or in a field trip location. The map of the selected area works as a game board. Teacher can then create the tasks for students to solve in teams. During the game teacher will monitor the game, assess the answers and give feedback. Students work together earning more points. Seppo’s ideology is to strengthen 21st century skills. It combines experimental, project-based learning, technology added to real-life environment, teamwork, creativity and sharing one’s knowledge. Behind the new learning ways Seppo has a background of learning with movement (see Syväoja et al. 2013).

1. <http://seppo.io/en/home/>
2. <http://seppo.io/en/pedagogy/>
3. <http://seppo.io/en/stories/>
4. https://www.oph.fi/download/145366_Physical_activity_and_learning.pdf

Berlin Kompass - Gamification in Language Teaching

There are a lot of different language learning apps and games online. Berlin Kompass is a research-based learning platform for studying German. Main idea of the game app is to get to know Berlin. Platform’s functionality is based on multisensory activities, linguistic problem solving in authentic context and gamification element. Platform itself is equipped with a voice recognition, so platform enables individual learner analysis.

1. <http://journals.sagepub.com/doi/abs/10.1177/0047239515588166>
2. http://www.uta.fi/sis/tauchi/mmig/projects/aktiivitat/kielen_oppimisen_tilat.html (Finnish only)

Kopiraittila

Kopiraittila is a gaming platform online for learning immaterial rights. For VET students there are their own section where they can learn about: 1.) knowledge about immaterial rights, 2.) use of different textual artifacts and 3.) data acquisition and critical reading. Material online is built to resembling driving license: first rehearsal and then take a test. By playing this game VET student achieve necessary knowledge to understand IPR and it's contributions to the studies and work life.

<https://kopiraittila.fi/toinenaste/ammattillinen/?aloita=1> (Finnish only)

Serious Game Business – activities for active students

Moodle has several different plugins to add gamification on to the platform. SeGaBu (Serious Game Business) project (University of Oulu, several Universities of Applied Sciences). SeGaBu concentrated mainly on game making (maker culture, serious games, game business), and during the project many online courses about theme was created. It's possible to join these courses at SeGaBu webpage. Other purpose of the project was to study gamification possibilities in Moodle. Studied activity plugins were Game, Stash and Stash availability, Level Up!, Ranking Block. Basic plugins like tracking progress,

1. www.segabufi
2. <https://youtu.be/bpPLH6ElzGE> (SeGaBu video in English)
3. https://moodle.org/plugins/mod_game
4. https://docs.moodle.org/35/en/Tracking_progress
5. https://moodle.org/plugins/block_xp
6. https://moodle.org/plugins/block_stash
7. https://moodle.org/plugins/availability_stash
8. https://moodle.org/plugins/block_ranking
9. <https://moodle.org/plugins/index.php?q=gamification>
10. <http://www.oamk.fi/epooki/2017/hyotypelit-ja-pelillistaminen>
11. http://ceur-ws.org/Vol-1857/gamifin17_p1.pdf
12. http://www.theseus.fi/bitstream/handle/10024/140972/SeGaBu_julkaisu2018.pdf?sequence=1&isAllowed=y (in Finnish, see list of publications in the end, also English)

Simulations with and without VR/AR/MR

Virtual, augmented and mixed reality is growing area in education. In Omnia, we've been already in several projects concerning different uses of VR/AR/MR. Mr. Esko Lius has done an enormous work introducing new ways of learning. Different tools (from VR glasses to HTC Five different models) are tested in the projects. Crucial thing is to remember to make a script for learning reality which support learning of the theme in question. The project called Oppimisen uudet ympäristöt: VRobotikka 360 ("New environments for Learning: VRobotics 360"). On a vocational upper secondary qualification in the Vehicle Sector Omnia was co-creating VR for changing timing belt for distribution head and on Vocational upper secondary qualification in Social and Health Care VR was created for learning home care visits. Other sub-projects involved AR kitchen and AR Virtual tea. In Finland simulations has been one way to learn Social and Health care both in upper secondary as well as higher education levels. Simulation on studies can be both virtual and real-life. When simulations are taken into real-life, it's close to acting. Simulations like this are done usually in study groups. There are also computer-aided patient simulators. Computer-aided simulations are common also in soldier training, logistics and aviation. As you can see from the picture below, simulations are rare on Finnish teaching models (on digital teaching and guiding as an example).

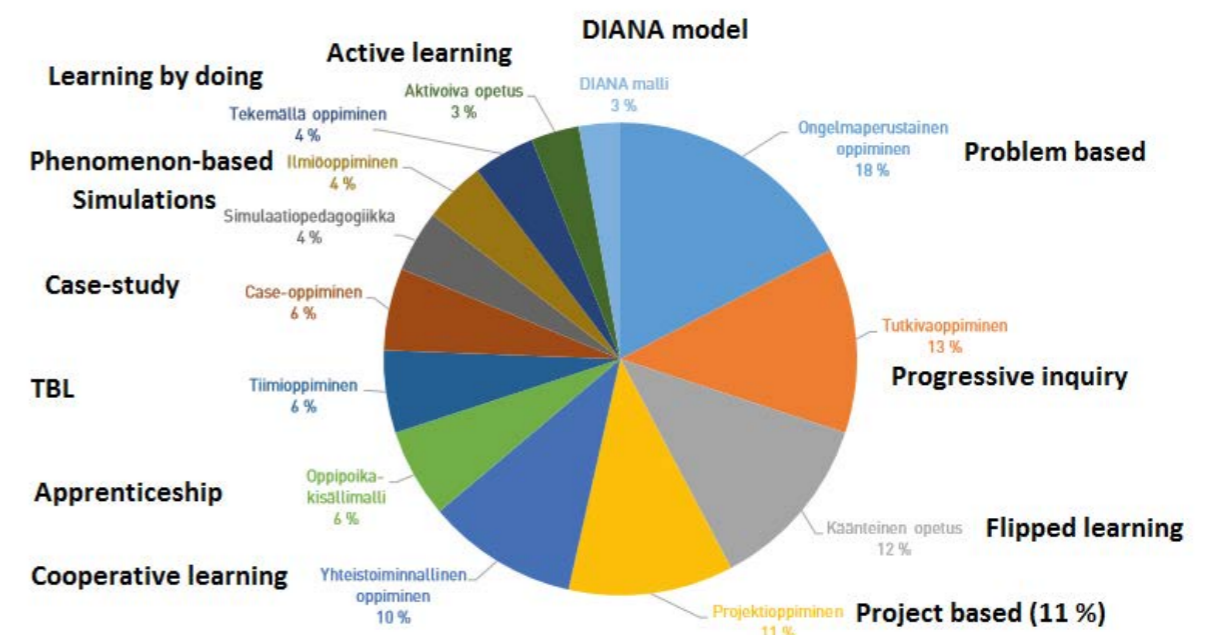


Figure 16 IV4J Finnish contributions draft 6: IO5 Gamification; 1 June 2018 ENY

Figure 16 shows the used models on digital teaching and guiding (from Ammatillisen koulutuksen digitalisaatio ja työelämäyhteistyö – Digitalization of VET and working life co-operation)

<http://bit.ly/230518lius> (in Finnish, but pictures from learning simulations)

<https://www.youtube.com/watch?v=WcYrdZ9clhM&t=2s&list=PLawaxnFUcU3IQTVd980ynxG54Tk4HO-In&index=5> (timing belt)

<https://www.youtube.com/watch?v=y3sXMx7N980&list=PLawaxnFUcU3IQTVd980ynxG54Tk4HO-In&index=5> (elder care)

<https://www.youtube.com/watch?v=y3sXMx7N980&list=PLawaxnFUcU3IQTVd980ynxG54Tk4HO-In&index=5> (kitchen VR)

<https://www.youtube.com/watch?v=QOHfdqgvvFU&feature=youtu.be> (Virtuli tee)

<https://www.theseus.fi/bitstream/handle/10024/83093/simulaatio.pdf?sequence=1> (simulation on social and healthcare studies)

<https://verkkolehdet.jamk.fi/elo/2015/11/24/simulaatio-oppimista-vai-leikkia/>

http://www.oph.fi/download/188475_ammattillisen_koulutuksen_digitalisaatio_ja_tyoelamayhteistyo.pdf

(Digital) Storytelling – making studies flow

Storytelling in the Finnish VET is not so enforced as gamification. All though it's possible to see that digital tools facilitate stories to the learning and storytelling has received more space in education. One way of educating via stories is creating cartoons. It has been popular in Finnish schools to learn difficult facts by drawing cartoons. Now it's even easier with digital tools. Storytelling is possible with variety of tools, most used are cartoon apps, podcasts, videos, but also some other platforms are used (Prezi, Padlet etc.) Narrative learning is one way to deeper learning.

<https://oppiva.omnia.fi/digitaaliset-tarinat-oppimisessa> (in Finnish with pictures)

<https://blog.hamk.fi/hhannula/tarinat-opetuksessa-eritisesi-digitaaliset-tarinat/>

<http://digitproject.weebly.com/> (in English)



Figure 17 Oppiva Omnia -webpage: sample cartoon personal hygiene, washing hands)

Appendix 4. Contributions by the PARTAS Partner

Contributions from John Kearns on behalf of the Irish partner to IO5 concerning Gamification and Narrification, August 25, 2018

Answers to the questions by Jos and Piet

From your current good practices, does the choice for PBL (Problem-Based Learning) as framework for gaming, story-telling and simulations look as an appropriate one? Please elaborate on what PBL may contribute to the future of your institute's future.

Yes – we would see it as a useful tool for good trainers to be able to employ to achieve better impact. It needs to be chosen from among the range of related interactive tools to maximize the effect in the most appropriate circumstances.

What do you see as the most important prerequisites (prior steps to be undertaken) before PBL can be integrated in courses throughout your organization?

We would need to introduce this methodology into a training session for our trainers together with examples of how it can improve the effectiveness of the training program

What additional perspectives would you like to be articulated sharper in the coming version of IO5?

None particularly come to mind – perhaps some insights may come during the staff training event in Utrecht.

Appendix 5. Contributions by the FA-MD Partner

Contributions from the German partner (FA-MD Magdeburg) Ralf Sachsenmaier to IO5 concerning Gamification and Narrification, August 25, 2018

Answers to the questions by Jos and Piet

From your current good practices, does the choice for PBL (Problem-Based Learning) as framework for gaming, storytelling and simulations look as an appropriate one? Please elaborate on what PBL may contribute to the future of your institute's future.

FA Magdeburg is using PBL as practice for the students in the IT field. As we are practice company in dual system, we involve our trainees into the daily tasks what means to solve real problems.

PBL can be a framework for gaming, storytelling and simulations to make the training more attractive and increase the enthusiasm and engagement of our trainees.

Using PBL in our organization it increases the motivation of the students. The student assumes the role of a specialist to solve the problems and will take the responsibility of the solution. The student became a self-learner and more independent working. They will connect their native skills with learning skills and professional practice. Through gaming, storytelling and simulations students can assess by themselves first what they know, what they need to know.

The teacher acting as a coach and tutor will connect direct the student with real problems and help students to organize their approach.

What do you see as the most important prerequisites (prior steps to be undertaken) before PBL can be integrated in courses throughout your organization?

Staff development to introduce innovative programs/strategy for PBL Development of portfolio with "Problems" As we are delivering mostly IT training, we need more structured approach of the method and new media to create problems.

What additional perspectives would you like to be articulated sharper in the coming version of IO5?

Effectiveness of Problem Based Learning

Our concept speaks of Gamification in the Transfer of playful elements and processes to non-game (in-company or school-based) relationships. It considers the results of the behaviour

research and transported in this application in relation to the working and learning processes of companies or educational institutions. While Gamification can be used as a “link between the intrinsic (self-determined) and extrinsic (artificially generated) Motivation is considered to be” <http://web20ph.blogspot.com/2016/03/gamification-und-bildung-wenn-schule.html> in the game developers the basic needs for competence, autonomy and social integration by the system of the game, the structure, and the task wakes (cf. Ibid)

In school-based and education-oriented area of change under the aspect of project-based learning in education classes target the positions of the Gamification through increasing Motivation and behaviour as well as the extension of its competence for the achievement of positive learning outcomes in the training.

See implementing:

<https://de.wikipedia.org/wiki/Gamification>

or

<https://youtu.be/BqyvUvxOx0M>

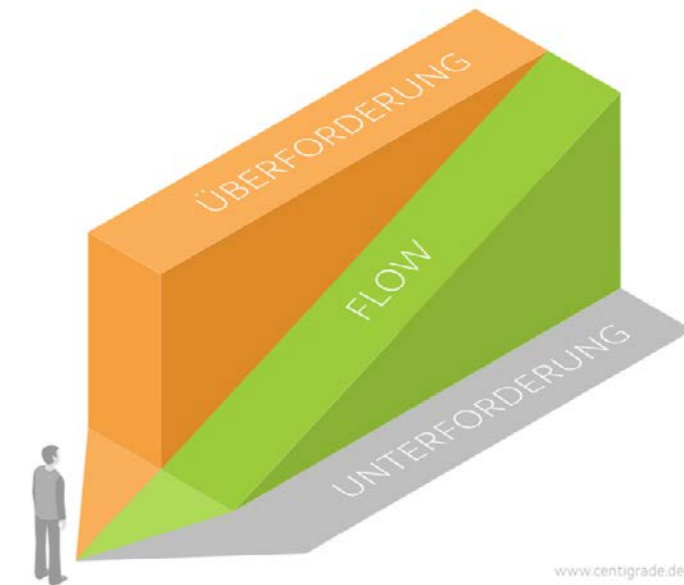
System is critical here to note that in the case of a almost exclusively about the “Gamification” made learning mediation can lead to a possible habituation to this method and, thus, Motivation in the other (traditionally mediated) areas of severe can be reduced. It should also be noted that here, of course, the question of the control of the Motivation may also be “manipulated, could be incorporated at the end of” aspects. Furthermore, it is often criticized, the extent to which the uniform social fabric in the classes and groups through the competition and the “competition” might be disturbed.

In principle, however, students possess different prior knowledge and skills. If here are your learning objectives in the various fields of Learning in specific tasks with increasing difficulty to be decomposed, can solve the learner and these in turn with its own speed and technique. By a timely Feedback to the learners can control the process yourself and can allow, if necessary, in specific areas through global access to a more comprehensive learning system, and process. It is also important to take into account the influence of emotionality in game processes, which can thus be effective.

Nevertheless, lifelong learning is essential in a constantly changing world of work, from training to the job. In doing so, gamification “makes learning self-directed, results-oriented and visualizes learning success. The use of gamification elements in

modern learning management systems involves learners cognitively, socially, and emotionally, providing an individual, motivating learning experience.

Gamification bedient sich bei Konzepten und Methoden aus den Bereichen Verhaltens- und Motivationspsychologie, User Interface Design sowie Game Design. Im Gegensatz zu „Serious Games“, welche Mehrwerte mittels eines vollständigen Spiels vermitteln, konzentriert sich Gamification auf den gezielten Einsatz einzelner, spielerischer Elemente, welche in spielfremdem Kontext Anwendung finden.



Auf dem Weg zur optimalen Erfahrung

Unser Gamification-Designprozess stellt Ihre Nutzer und deren Bedürfnisse in den Mittelpunkt, um eine möglichst optimale Erfahrung zu gestalten. Lassen Sie uns gemeinsam den idealen Bereich zwischen Überforderung und Unterforderung finden, der Ihre Nutzer in die Lage versetzt, den sogenannten „Flow“-Zustand zu erreichen. Diese Art der Prozessoptimierung schlägt sich nicht nur in einer höheren Nutzerzufriedenheit nieder, sondern macht sich auch in einer gesteigerten Prozesseffizienz bemerkbar.

(eg. <https://www.springerprofessional.de/e-learning/aus--und-weiterbildung/mit-gamification-spielend-lernen-/16087836>).

Already in 2016, 50% of gamification projects in education and training were created worldwide. From children’s websites with school content to employee training. The focus is always on the user - actually the gamer - and his needs in the center but in the field of tension to the challenge, for example: acquire competences. Especially with some difficult or even partially understandable topics or to which learners are hard to enthuse, the Gamification offers corresponding possibilities. Storytelling can also contribute to entertainment but also show curiosity and appeal to learners. It thus serves as a teaching framework and then the content, work tasks, materials and competence development are based on the learning objectives.

Likewise, subtasks by “Quest” can collect individual experience points and thus possibly increase in the game level - also as part of the gamification. The points can thus be aligned to difficulty levels, so they can assess their performance, identify optimization needs and contribute to increasing motivation in the levels.

The combination of the areas can thus create a positive teaching structure.

Here are three current examples for pupils and trainees:



<https://www.classcraft.com/de/>

<https://www.classcraft.com/de/#modal-main-video>



<https://education.minecraft.net/class-resources/lessons/>

<https://education.minecraft.net/>

<http://www.ggs-daudenzell.de/index.php/blogs/medienbildung/66-gamification-im-geschichtsunterricht>

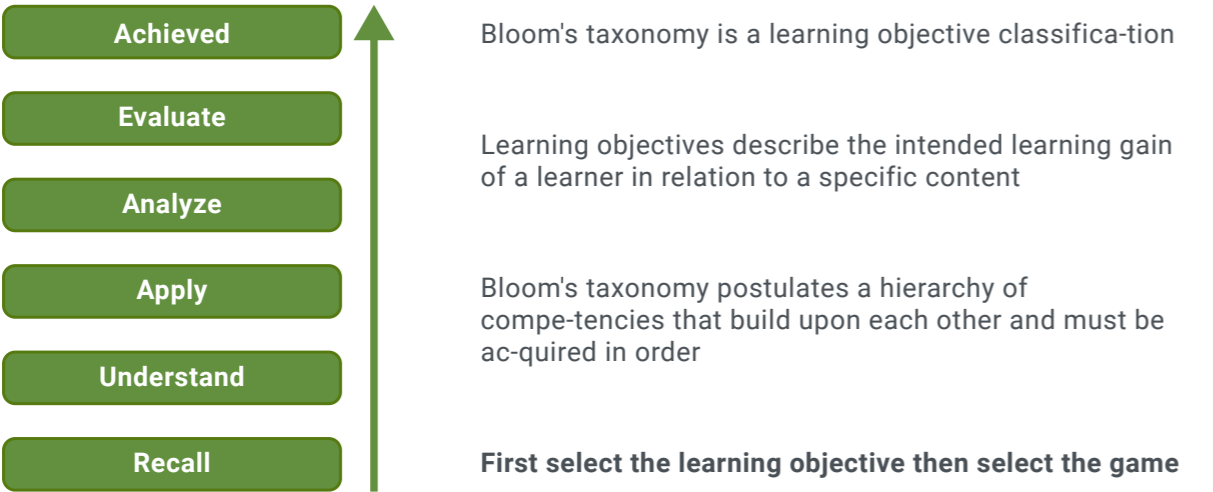
The approach and basic principles are summarized in the various examples and applications of gamification in the teaching and education in the following presentation:

Spieleprinzipien – „Game Mechanics“ (nach Gotscharek & Company)

	<ul style="list-style-type: none"> • Titel, Ranglisten, Leaderboards • Erfahrungspunkte • Achievements • Badges 	<ul style="list-style-type: none"> ▪ Nach außen sichtbare Anerkennung für Erreichtes erhalten ▪ Vergleich mit anderen ermöglichen, dadurch Wettbewerb fördern ▪ Freischalten neuer Level/Content als Belohnung für Erreichtes ▪ Belohnungen für Top-Spieler in der Rangliste
	<ul style="list-style-type: none"> • Punktestand • Fortschrittsanzeige 	<ul style="list-style-type: none"> ▪ Dynamische Anzeige, welche den Erfolg während der Durchführung einer Aufgabe visualisiert ▪ Anzeige des bisherigen Fortschritts und des noch zu erledigenden Teils
	<ul style="list-style-type: none"> • Bewertung von Handlungen • Instant Feedback 	<ul style="list-style-type: none"> ▪ Unmittelbares Feedback und Bewertung für Handlungen bzgl. Aktivitäten ▪ Sammeln von Erfahrungen - Anpassung der Handlungsweisen zur Vermeidung negativen Feedbacks ▪ Ziel: Erreichung positiven Feedbacks von der Umwelt des Spielers ▪ Alleine der Spieler entscheidet, ob das Feedback für ihn hilfreich ist
	<ul style="list-style-type: none"> • Rätsel etc, klar def. Aufgaben • Zeitlimitierte Aufgabenlösung 	<ul style="list-style-type: none"> ▪ Aufgaben/Herausforderungen müssen in bestimmter Zeit gelöst werden ▪ Aufgabenlösung kann alleine oder in der Gruppe erfolgen ▪ Gewinnung an Erfahrungen um komplexere Quests zu lösen ▪ Auswahl der Quests erfolgt nach Wahl des Spielers
	<ul style="list-style-type: none"> • Gemeinsame Problemlösung • Motivation zur Zusammenarbeit (Multiplayer) 	<ul style="list-style-type: none"> ▪ Lösungen von Aufgaben oder eines Problems in der Gruppe/Community das ggf. unterschiedliche Fähigkeiten/Wissen braucht ▪ Motivation der Teilnehmer zur Zusammenarbeit ▪ Förderung der Kommunikation untereinander ▪ Knüpfen von Kontakten / Networking über das Spiel
	<ul style="list-style-type: none"> • Keine Überforderung • Schrittweise Info-Vermittlung • Bindung an das Spiel 	<ul style="list-style-type: none"> ▪ Kaskadierende Info-Mitteilung – Nur für die aktuelle Aufgabe wichtige Informationen werden mitgeteilt ▪ Überforderungen durch gleichzeitig zu viele Informationen vermeiden ▪ Kontinuierliche, aufeinander aufbauende Informationsweitergabe ▪ Bonus – unerwartete Auszeichnungen erhalten ▪ Weiterspielen um den Verlust des Erreichten vermeiden ▪ Weiterspielen und Lernen bis der Expertenstatus erreicht ist
	<ul style="list-style-type: none"> • Emotionale Bindung • Episches Ausmaß 	<ul style="list-style-type: none"> ▪ Spiel-Motivation erreichen durch sinnvolle Ziele ▪ Arbeiten an etwas „Großartigem und Erstrebenswertem“ aus Sicht des Spielers ▪ Teil der Gruppe sein, die das vollbringt was als Einzelner nicht möglich ist
	<ul style="list-style-type: none"> • Kennt Auswirkung eigenen Handelns • (Möglicher) Spielausgang ist vorhersehbar 	<ul style="list-style-type: none"> ▪ Steigerung der Motivation durch Belohnungen/Preise/Auszeichnungen/ Erfahrungspunkte ▪ Spieler wird durch seine Handlungen bestärkt

Quelle: <https://www.gotscharek-company.com/blog/gamification%E2%80%93was-sind-eigentlich-spieltypische-elemente%E2%80%93game-mechanics>

The methodical approach in the implementation and application always goes back to the context of the individual learning objectives:



Quelle: <https://www.gotscharek-company.com/blog/gamification%E2%80%93was-sind-eigentlich-spieltypische-elemente%E2%80%93game-mechanics>

Or as video: <https://de.slideshare.net/gotscharek/gamification-nutzen-erfolgskriterien-einsatzbeispiele>

Applications of Gamification in ABL:

Sometimes we are not aware of which elements or applications of gamification we have already completed in the past or have even got to know or implemented in training. Even grades, awards can be considered as an element of gamification. Prices, bonuses, badges, certificates, etc. are also part of the "Old School Gamification". But new applications are also included in the implementation and communication of training content in work-based learning. Here we have found several examples in practice.

Example of vocational orientation:

Buchstabenfeld

In diesem Buchstabenfeld stecken acht Ausbildungsberufe. Finde sie und kreise sie ein! Umlaute wie ä oder ö werden ae oder oe geschrieben.

Buchstabenfeld – Lösung

Arzthelfer, Bürokaufmann, Elektroniker, Erzieherin, Friseurin, Koch, Maurer, Mechatroniker

Example 2: Fachpraktiker Büromanagement - "Who Wants to Be a Millionaire"

Quelle: http://www.wirtschaft-muenchen.de/publikationen/pdfs/Mein_Weg_in_den_%20Beruf_Spielesammlung.pdf S.8

Here, in a slightly improvised studio environment, questions with possible solutions are given which could allow an additional break time. Here are questions from IHK exams formulated as questions (by trainers). The "candi-date" sits in front, the other trainees are the spectators. Here are consciously "spectator joker" and "telephone joker" used to integrate them more into the action. The right answer can then lead to an additional break time or similar by the correct answer. The combination of playful competition in connection with technical aspects as well as the training of communication and the simulation of examination-like situations can contribute to the competence extension on different levels (on the internet there are different sides, which simulate a corresponding representation and simulation also optically).

Gamification and target groups:

One advantage of the approaches to gamification is that there is basically no direct limitation of the target group. After all, all people like to play or like to solve attractive tasks. The secret lies in designing games in such a way that the "play instinct of the concrete targeted target group is driven"

(cf. <http://crossretail.de/gamification-im-marketing-4-stufen-der-anwendung/>).

In the gamification discussion, it should always be borne in mind that this dependence on the task of “playful processing” as well as supply control also takes account of the consideration of the target groups. Here we have quite general tasks, which may also meet a broad access of target groups (example “stairs” to improve health <https://youtu.be/2lXh2n0aPyw>) or specifically to specific target groups such as students or trainees or Adults with different tasks and goals. On the other hand, it can be seen that the task itself, the structure of the “game” and the content itself can determine the target groups. It should also be noted here that the elements of gamification in the learning process, such as in school or education, in general, the educators can and must be controlled. In addition, of course, gamification can be used independently by all target groups to improve their respective com-petences. Especially through the possibilities in the Internet you only have conditional control options. As a result, we can speak of “internal gamification” (when controlled in companies or schools or educational institutions with objectives) or “external gamification” (if this is not directly related or controlled in the process - whether school / education / enterprise - offered, realized or used).

The application and the interest must be aroused or controlled by the handling, the task and the addressing of the respective target group. On the other hand, it can also be purposefully introduced into specific processes by the relevant actors (teacher, instructor, etc.) within the framework of the structure of the knowledge transfer, e.g. a pedagogical process. This presupposes the conscious use of gamification in the concrete session by the main actor, who makes use of this learning method in order to transport, practice or consolidate his / her content or competence.

A general definition of the target groups is therefore hardly possible. This can only arouse the user’s interest in the specific task, the optics, the medium of the possibility of use, to use this “application / task” to play or to solve. Different topics, questions and contexts can influence the perception of different target groups. On the other hand, there are also simple “competence trainings” like Tetris, for example, which are popular with both children and adults.

Examples of target groups:

Students:

<https://www.planet-schule.de/sf/multimedia-lernspiele.php>
<http://www.spiele-kostenlosonline.de/lernspiele-kostenlos-online-spielen-ohne-anmeldung.html>

Trainees:

<https://azubiweb.com/play>
<http://argraria.wissenschaftliche-weiterbildung.de/course/view.php?id=3>

People with learning disabilities:

For example see (Fachpraktiker Büromanagement)

Adults:

Here you can lead such games with quiz character or bring in accordingly (or for example “Who becomes a Millionaire”). Another example of the concentration and binding nature of the task: A sheet with the following task:

Another example of the concentration and binding nature of the task: A sheet with the following task:

Intelligence Test

Date:

Please read all questions carefully before answering them. You have a total of three minutes time.

1. Who composed the opera Aida? _____

2. Who wrote the book War and Peace? _____

3. Where did the FIFA World Cup take place in 1954? _____

4. Continue the series: 2 - 4 - 6 - _____

5. From whom are the figures Max and Moritz? _____

6. When did Charlemagne live? _____

7. How many continents are there on earth? _____

8. Who invented the light bulb? _____

9. Which country produces the most oil? _____

10. What is the name of the Western Defense Alliance? _____

11. How many zodiac signs are there (Taurus, Aquarius etc.)? Only the number: _____

12. By whom was Napoleon defeated? _____

13. Fill in only today’s date in the upper left corner. Everything else can save you.

Enjoy another two minutes rest.

Gamification in the learning process (context of forms of learning and control)

It seems much more important to look at the concrete application of gamification, in which it may be a way to convey or train certain content. This must then be planned, prepared and accompanied both by appropriate “key figures” such as a teacher or instructor or trainer so that this element can be integrated into the learning process or accompanied or supported accordingly. In this - more controlled function - the gamification seems to be able to achieve a positive learning effect or to reinforce it accordingly. However, this also means an overall concept for the application of elements of gamification in everyday learning or training, the preparation and the filtering or formulating of corresponding learning objectives. Consequently, gamification can and should be considered as a form of learning that can be highly motivating and active - but can also be seen as a form of learning that is accompanied and / or supported by other forms of learning, or as one that provides “basics”. to be used in gamification.

Conclusions and continuations

On the basis of the real implementation of gamification in the education of schools and vocational training as well as in other areas of the “everyday lifelong learning process”, the discussion of “Game Based Learning” (GBL) is now being discussed. The close and direct relation to problem-based learning lies in the close connection of concepts. The basis for this is definitely a problem to be solved or a corresponding task that is playfully resolved through various procedures - the problem is dealt with in context. Therefore, the GBL can be seen as an element of problem-based learning - the core is the problem and the GBL is the solution method.

At the same time, work-based learning can draw on this model. Here comes the “problem” from the direct world of work. The method for solving or realizing the task in the context of the world of work is done by playful elements and contributes to the problem-solving competence. The transfer of the game principles to the world of work facilitates our learning processes here. In doing so, work-based learning does not only focus on the aspect of imparting learning and training content, but also on “lifelong learning” in the future world of work. Gamification in this process is a successful action-oriented method - most conveniently embedded in the work-based learning of the individual.

Further, also the elements of the Open Educational Resources back to the GBL and use here usually just such content for knowledge transfer.

Additional information:

<https://www.soziotech.org/gamification-steigerung-der-nutzungsmotivation-durch-spielkonzepte/>

https://www.e-teaching.org/didaktik/konzeption/methoden/lernspiele/game_based_learning/

Appendix 6. Contributions by the SBH Südost Partner

Contributions from Ines on behalf of the German partner SBH Südost (Halle) to IO5 concerning Gamification and Narrification, August 25, 2018

Answers to the questions by Jos and Piet

From your current good practices, does the choice for PBL ([Problem-Based Learning](#)) as framework for gaming, story-telling and simulations look as an appropriate one? Please elaborate on what PBL may contribute to the future of your institute's future.

Problem-based learning is mainly implemented in real-life applications as a simulation project in order to implement practical problem-solving processes under predominantly school conditions. However, the selectivity between simulation and game is quite thin here. If playful elements of PBL have predominantly motivational aspects, simulations serve to transform essential learning content about PBL into action and application-oriented knowledge for the students (through this attractive form of PBL). However, this presupposes the necessity of integrating content and tasks (also in "gamification") into the PBL that are appropriate to the level of achievement, which enables the students to acquire competences in the learning process only through "learning guidance".

What do you see as the most important prerequisites (prior steps to be undertaken) before PBL can be integrated in courses throughout your organization?

Even if this learning method is already integrated in the everyday teaching concept and is already in use, it is always necessary to check the implementation - from the "problem" to a "PBL structure" in order to achieve the learning result - with regard to applicability and suitability with regard to the students and the contents. This also requires method training for the teachers ("problem-oriented learning environment" and "PBL according to McMaster").

„Teamwork“ on topics, content and media from and for PBL in the organizations is helpful for this.

What additional perspectives would you like to be articulated sharper in the coming version of IO5?

Problematic "time" for the PBL in the field of tension between knowledge and action in training for the transfer of material! Problematic "gamification, storytelling and simulation" between problem-based and problem-oriented learning!

Appendix 7. Contributions by the Euro-Net Partner

Contributions from Peppino Franco on behalf of the Italian partner (Euro-Net, Potenza) to IO5 concerning Gamification and Narrification, August 25, 2018

Answers to the questions by Jos and Piet

From your current good practices, does the choice for PBL ([Problem-Based Learning](#)) as framework for gaming, story-telling and simulations look as an appropriate one? Please elaborate on what PBL may contribute to the future of your institute's future.

I think that it is essential to teach to learners informal and not-formal context an approach to real-life problems.

Because of the difficulties in teaching this topic it could be useful to use a gamified approach in order to break down the barriers and unleash creativity.

In my organisation we are used to apply a Creative Problem Solving Methodology approach and we've already introduced it in Vocational courses we are teaching at.

What do you see as the most important prerequisites (prior steps to be undertaken) before PBL can be integrated in courses throughout your organization?

An interesting element in a Problem-Based learning is connected with the collaborative approach in a classroom where it is important to be concentrated and detect the synergic power coming from the single participants.

As prerequisite, I think the main problem is to break down the barriers from each student in terms of creativity (psychological and sociological) - it is possible to try to test the creativity in a gamified context or support the students to elaborate own vision of a career or of own abilities (elements that I've discovered by teaching in master classes, where the students have very limited ability to detect own career and possibilities available on the job market - the teacher are also very distant from the job market).

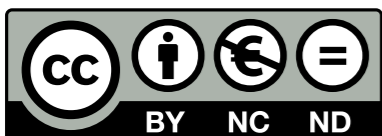
What additional perspectives would you like to be articulated sharper in the coming version of IO5?

It is good to introduce the vision coming from some documents attached to this email:

- a 2010 IBM poll of 1,500 CEOs from 60 countries and 33 industries have identified creativity as the most crucial skill for future success and leadership competency. Creativity is a critical skill that can be taught through a specific methodology and practical exercises to test and learn to think outside the usual mental schemes.

- PISA 2012 results

- collaborative problem solving.



Erasmus+ IV4J „Innovation in VET for Jobs and Employment“

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