

# Literature Review



## **PLAY4GUIDANCE**

**A European Business Game to train and guide students and young unemployed on entrepreneurial, transversal and mathematical skills**

**Authors: Yvonne Crotty , Margaret Farren, Martin Owen,  
Dublin City University (DCU)**

## Table of contents

<b>1. Introduction.....</b>	<b>3</b>
1.1 The organization of this document .....	3
<b>2. Review .....</b>	<b>5</b>
2.1 Competences.....	5
2.2 Entrepreneurship Competences.....	7
2.3 Relating competences to gaming .....	12
<b>3. Summary.....</b>	<b>19</b>
<b>4. References .....</b>	<b>20</b>
<b>5. Appendix.....</b>	<b>23</b>
5.1 Learning employment and business competences through playing games .....	23
5.2 Learning about business and competences .....	24
5.3 Learning Competences through playing computer games.....	33
5.4 Learning Competences.....	36
5.5 Learning about Business.....	36
5.6 Learning through using computers, games and simulation.....	38
5.7 Comparing the approaches to competence .....	47

## 1. Introduction

This review provides pointers to some key resources recommended by partners in the Play for Guidance consortium that inform us about using games for learning and developing entrepreneurial competences. It is a selection that we hope will inform ourselves and our stakeholders about the researched background of the project. It is not meant to be an exhaustive view of the literature in which we juxtapose and come to some judgment about the relative worth of different reports on research. We highlight those publications that are in themselves summative and comparative or are particularly seminal in their field. We also include pointers to papers from participant states and maybe not written in English, so that we can share the specific cultural and national concerns that may be different from state to state and are not necessarily visible in international academic or business publications.

Abstracts of the articles used to synthesize the information in this document are included in the Appendix.

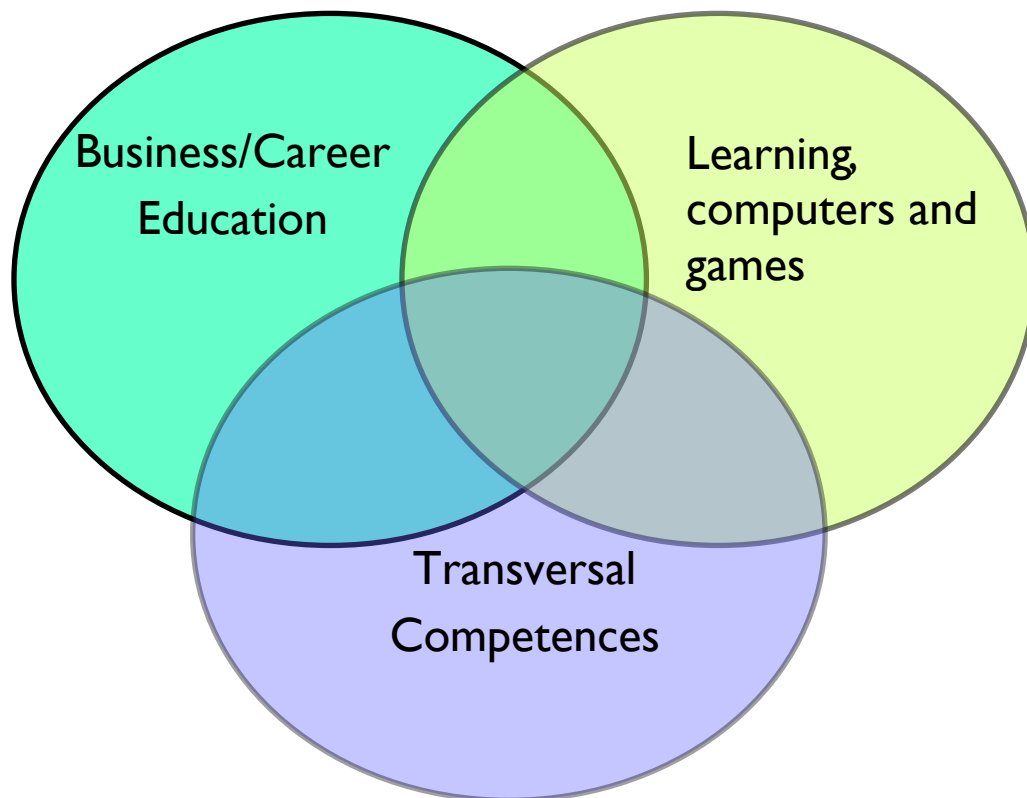
### 1.1 The organization of this document

There are three contributing component domains to our work:

- Education about business
- Competences and Dispositions
- Learning through (computer) games and simulations

Each of these areas has a rich collection of research literature. We have chosen to point the reader to those sources that give a firm overview of each of the fields rather than provide depth. We end with an experimental matrix that juxtaposes ideas about games and competences from key documents.

The literature review begins with our working definition of competences. It examines studies related to entrepreneurship competences before outlining and examining how competences relate to gaming.



However, we have tried to give some prominence to areas where these sets intersect and thus get closer to the area in which we are working.

We conclude with a table that compares the list of characteristics of entrepreneurs that were developed by our key source in developing the Play4Guidance Survey (Wu, 2009) and two authors who represent other elements of the Venn diagram above. Gee (2007) has been influential in the development of serious games and Claxton (2005) has been influential in applying cognitive science to practical educational activities – exemplified by his work on Building Learning Power.

We also conclude with a note on a differing body of work, which takes a different approach to an analysis of transferable competences. Epistemic games start from describing actions within epistemic communities of professionals and designs opportunities for learners to engage in those actions.

## 2. Review

### 2.1 Competences

Competences are discussed in different domains from different perspectives. Correspondingly, there are different definitions in use so that there is no common understanding of the concept “competences”. To clarify our view, we define the key characteristics of competences and the consequences for the project design.

As a basic definition, we define **competences as a “collection of skills, abilities, and attitudes to solve a problem in a given context”** (cf. Pawlowski & Holtkamp, 2012). This definition indicates that competences are dependent on the context which can consist of different aspects such as

- Cultural context contains aspects such as country- or regional characteristics
- Organizational context contains aspects such as different branches, sectors or organizational characteristics
- Professional context contains aspects such as different qualification / competence levels (e.g. Higher Education, Professional Education).

This context dependence means that for each competence, three aspects need to be specified:

1. Which **skills, abilities, and attitudes** constitute the competence?
2. Which **problems** should be solved?
3. For which **context** (cultural, organizational, professional) a competence is valid?

Additionally, it is necessary to:

1. Develop a common **vocabulary** to describe competences, problems and contexts
2. To define **proficiency levels** for each competence.

As a starting point for a common vocabulary, we recommend the use of the following description scheme (Paquette, 2007).

Generic Skills Classes			Active meta-knowledge (Pitrat)	Generic problems (KADS)	Cognitive objectives (Bloom)	Skills cycle (Romiszowski)
1	2	3				
Receive	1. Acknowledge					Attention
	2. Integrate	2.1 Identify 2.2 Memorize			Memorize	Perceptual acuteness and discrimination
Reproduce	3. Instantiate / Specify		Knowledge Search and Storage		Understand	Interpretation
	4. Transpose / Translate					Procedure Recall
	5. Apply	5.1 Use 5.2 Simulate	Knowledge Use and Expression		Apply	Schema Recall
Produce / Create	6. Analyze		Knowledge Discovery	Prediction, Supervision, Classification, Diagnosis	Analyze	Analysis
	7. Repair			Repair		
	8. Synthesize	8.1 Induce 8.2 Plan 8.3 Model / Construct		Planning, Design, Modeling	Synthesize	Synthesis
Self-manage	9. Evaluate		Knowledge Acquisition			Evaluation
	10. Self-control	10.1 Initiate / Influence 10.2 Adapt / control				Initiation, Continuation, Control

*Figure 1: Competence Descriptions (Paquette, 2007)*

Based on these initial considerations, it becomes essential for the project P4G and the empirical exploration of the “Greatest Common Denominator Skills Matrix” to:

- Develop a set of **Generic Competences for Entrepreneurship** for all countries and contexts
- Explore specific competence needs for each country and target group (**Competence Profiles**).

These considerations are the central assumptions for the design of the assessment study in the project. We will explore generic competences and analyse how competences differ for various contexts.

## 2.2 Entrepreneurship Competences

A variety of studies have explored the field and also proposed competence descriptions for the fields of entrepreneurship. A variety of different concepts relate to the tasks to be a successful entrepreneur. One issue, which is closely related, is the field of innovation, i.e. an entrepreneur needs to be able to create innovations including accessing markets (Morris et al. 2013). Thus, our literature review contains both, entrepreneurship and innovation competences.

In the following, we present exemplary approaches, which were chosen based on clear selection criteria for inclusion in the deliverable:

- Clarity: The paper is clearly described and provides a clear definition of each competence.
- Understandability: Competences are described in an understandable and assessable way
- Empirical basis: The competences are derived in empirical studies and / or validated
- Comprehensiveness: The specification covers the full range of competences, not just one specific detailed competences area (e.g. communication)
- Context similarity: The context of the competence specification is close to the context of P4G, i.e. for start-ups, students and / or unemployed.

As a first result, we can state that no commonly accepted standard has been developed. Therefore, we present selected approaches which have been analysed in the literature review. We present exemplary approaches to show the variety of competence descriptions regarding their scope, methodology and level of detail / abstraction.

A starting point is the **literature review** on the following page by Mitchelmore & Rowley (2010). It provides a comprehensive study on possible competences synthesized from previous research and publications.

<b>Entrepreneurial competencies</b>	<ul style="list-style-type: none"> <li>Identification and definition of a viable market niche</li> <li>Development of products of services appropriate to the firms chosen market niche/product innovation</li> <li>Idea generation</li> <li>Environmental scanning</li> <li>Recognising and envisioning taking advantage of opportunities</li> <li>Formulating strategies for taking advantage of opportunities</li> </ul>
<b>Business and management competencies</b>	<ul style="list-style-type: none"> <li>Development of the management system necessary for the long term functioning of the organisation</li> <li>Acquisition and development of resources required to operate the firm</li> <li>Business operational skills</li> <li>Previous involvement with start-ups</li> <li>Managerial experience</li> <li>Familiarity with industry</li> <li>Financial and budgeting skills</li> <li>Previous experience</li> <li>Management style</li> <li>Marketing skills</li> <li>Technical skills</li> <li>Industry skills</li> <li>The ability to implement strategy (development programmes, budgets, procedures, evaluate performance)</li> <li>Familiarity with the market</li> <li>Business plan preparation</li> <li>Goal setting skills</li> <li>Management skills</li> </ul>
<b>Human relations competencies</b>	<ul style="list-style-type: none"> <li>Development of the organisational culture management feel is necessary to guide the firm</li> <li>Delegation skills</li> <li>The ability to motivate others individual and in groups</li> <li>Hiring skills</li> <li>Human relations skills</li> <li>Leadership skills</li> </ul>
<b>Conceptual and relationship competencies</b>	<ul style="list-style-type: none"> <li>Conceptual competencies</li> <li>Organisational skills</li> <li>Interpersonal skills</li> <li>The ability to manage customers</li> <li>Mental ability to coordinate activities</li> <li>Written communication skills</li> <li>Oral communication skills</li> <li>Analytical skills</li> <li>Logical thinking skills</li> <li>Deal making skills</li> <li>Commitment competencies</li> </ul>

**Figure 2: Entrepreneurial Competences (Mitchelmore & Rowley, 2010)**

This competence description covers core entrepreneurial competences as well as related competences. However, it is based on a synthesis of previous papers and does not provide



prioritizations. Additionally, no competence levels are provided. As the authors mention themselves, it is necessary to understand which competences are useful in which context.

As a second **comprehensive approach**, Morris et al (2013) specify detailed competence descriptions for business as well as personal / social competences:

1. Opportunity Recognition: the capacity to perceive changed conditions or overlooked possibilities in the environment that represent potential sources of profit or return to a venture
2. Opportunity Assessment: ability to evaluate the content structure of opportunities to accurately determine their relative attractiveness
3. Risk Management/Mitigation: the taking of actions that reduce the probability of a risk occurring or reduce the potential impact if the risk were to occur
4. Conveying a Compelling Vision: the ability to conceive an image of a future organizational state and to articulate that image in a manner that empowers followers to enact it
5. Tenacity/Perseverance: ability to sustain goal-directed action and energy when confronting difficulties and obstacles that impede goal achievement
6. Creative Problem Solving/Imaginativeness: the ability to relate previously unrelated objects or variables to produce novel and appropriate or useful outcomes
7. Resource Leveraging: skills at accessing resources one does not necessarily own or control to accomplish personal ends
8. Guerrilla Skills: the capacity to take advantage of one's surroundings, employ unconventional, low-cost tactics not recognized by others, and do more with less
9. Value Creation: capabilities of developing new products, services, and/or business models that generate revenues exceeding their costs and produce sufficient user benefits to bring about a fair return
10. Maintain Focus yet Adapt: ability to balance an emphasis on goal achievement and the strategic direction of the organization while addressing the need to identify and pursue actions to improve the fit between an organization and developments in the external environment
11. Resilience: ability to cope with stresses and disturbances such that one remains well, recovers, or even thrives in the face of adversity
12. Self-Efficacy: ability to maintain a sense of self-confidence regarding one's ability to accomplish a particular task or attain a level of performance
13. Building and Using Networks: social interaction skills that enable an individual to establish, develop and maintain sets of relationships with others who assist them in advancing their work or career."

This framework is rather comprehensive but merges different competences so that these are complex to assess. Also, domain specific competences such as communication are not included which are frequently discussed in other sources.

A further **meta-analysis** has been done by Jain (2011) focusing on entrepreneurship motives and characteristics, which can be seen as competences:

- Achievement Motivation (Need for Achievement)
- Need for Independence/Autonomy/Personal Control
- Need for Personal Growth and Development
- Need for Social Recognition and Respect
- Need for Social Security and Greater Comfort for the Self and Family
- Need for Money/Wealth
- Need for Enjoying Creative, Innovative and Path-breaking Work, etc.
- Innovativeness
- Creativity
- Proactivity
- Risk-taking Propensity
- Internal Locus of Control
- Self-efficacy
- Tolerance for Ambiguity
- Social Intelligence
- Extraversion
- Miscellaneous Competencies
- Personal and Family Background (Jain, 2011)

While this analysis is comprehensive, it does not describe the specific competences in detail and is thus not usable without interpretation bias.

Also, very **practical advice** exists. As an example, Cooney (2012) connects competence descriptions with guidance for application when starting a business, including the following categories:

- Technical Skills - which are those skills necessary to produce the business's product or service;
- Managerial Skills, which are essential to the day-to-day management and administration of the company;
- Entrepreneurial Skills - which involve recognizing economic opportunities and acting effectively on them;
- Personal Maturity Skills - which include self-awareness, accountability, and emotional skills.

This kind of research is not methodologically sound, however, the practice orientation can help to design scenarios for our business game.

Further models are considered by **industry consortia** such as the Consortium for Entrepreneurship Education (2014). These models aim at providing guidance for education and are usually based on experts and – methodologically – good practices.

Also, different **empirical approaches** have been conducted. As an example, Izquierdo & Deschoolmeester (2010) have derived the following competences:

- Decision making
- Innovative thinking
- Identifying and solving problems
- Having a different view of the market
- Communication
- Deal making and negotiation
- Identifying business opportunities
- Evaluating business opportunities
- Networking
- Team work
- Team building
- Intuitive thinking
- Coping with uncertainties
- Coping with stress
- Taking calculated risk

While the analysis is also rather comprehensive, this study is related to undergraduate students and might not be transferable to other contexts and target groups.

As a final study, Wu (2009) has conducted **expert interviews** to determine important entrepreneurial competences:

1. Analytical Thinking: the ability to analyse problems systematically.
2. Business Acumen: the ability to discover opportunities and transform resources into performance.
3. Client Service Orientation: the ability to meet the needs of both internal and external customers.
4. Commitment to Learning: the ability to actively pursue learning and develop competitiveness.
5. Communication: the ability to effectively receive and express information or feelings.
6. Conceptual Thinking: the ability to recognize patterns or trends in a problem.

7. Order and Quality: the ability to reduce uncertainty and to control quality.
8. Developing Others: the ability to help others make progress.
9. Empathy: the ability to understand and respond to the concerns of others.
10. Expertise: the ability to perform professional jobs.
11. Flexibility: the ability to effectively adapt to a variety of situations.
12. Influence: the ability to influence thoughts and actions of others.
13. Information Seeking: the ability to capture enough information to increase knowledge or find solutions.
14. Initiative: the ability to be a self-starter and to meet the challenge of higher level objectives.
15. Innovation: the ability to make something new and to improve performance.
16. Organizational Awareness: the ability to recognize the power relationships in organizations.
17. Personal Motivation: the will to succeed and offer service.
18. Relationship Building: the ability to build and maintain personal networks.
19. Results Orientation: the ability to set performance objectives and measures.
20. Self-Confidence: the ability to express oneself in a hostile situation.
21. Self-Control: the ability to manage one's emotions under pressure or temptation.
22. Team Leadership: the ability to create a favourable environment and mobilize people to succeed.
23. Verbal and Written Communication: the ability to speak and write satisfactorily.

This study has an appropriate level of detail and abstraction and is very comprehensive and well described. As only few studies are based on empirical work, are not suitable for our context, or are poorly understandable, we have chosen this approach as the basis for our further work. This choice does not limit us to the competences proposed by Wu (2009) – the categories are mainly a starting point for further exploration, prioritization and validation.

### 2.3 Relating competences to gaming

One main aspect of the project is to transform / map competences needed to the business game. For this purpose, we show how competences relate to issues and achievements in serious games. The competences of P4G are derived by Michelmore & Rowley (2010) and Wu (2009). The second list is based on Mark Prensky's (2003) interpretation of James Paul Gee's (2003) "What we learn from Computer Games". The third list is representative of those who are promoting a competence based approach to learning, which is exemplified by Guy Claxton's (2002) work in "Building Learning Power". There are other approaches, including the work of the Epistemic Games Group working at University of Wisconsin with David W Shaffer. There is a short discussion of this work below the table.

Play 4 Guidance Survey Competences	“What we learn from Computer Games”, JP Gee	“Building Learning Power”, Guy Claxton
<p>Analytical Thinking: The ability to analyse problems systematically.</p>	<p>Watching their own behaviour Mastering game language Doing, thinking and strategizing</p>	<p>Reflectiveness, Questioning, Imagining, Planning, Revising, Making links, Reasoning, Distilling</p>
<p>Business Acumen: The ability to discover opportunities and transform resources into performance.</p>	<p>Doing and reflecting Doing, thinking and strategizing Mastering upfront things needed later</p>	<p>Resourcefulness, Absorption, Noticing, questioning, making links, imagining,</p>
<p>Client Service Orientation: The ability to meet the needs of both internal and external customers.</p>		<p>Reciprocity, interdependence, collaboration, empathy and listening, capitalising, imitation</p>
<p>Commitment to Learning: The ability to actively pursue learning and develop competitiveness.</p>	<p>Getting more out than what they put in Having to master new skills at each level Thinking about the game and how they learn</p>	<p>Reflectiveness, absorption, managing distractions, questioning, reasoning, revising</p>
<p>Communication: The ability to effectively receive and express information or feelings.</p>		<p>Empathy and Listening</p>

Play 4 Guidance Survey Competences	“What we learn from Computer Games”, JP Gee	“Building Learning Power”, Guy Claxton
<p>Conceptual Thinking: The ability to recognize patterns or trends in a problem.</p>	<p>Appreciating good design Seeing interrelationships Relating the game world to other worlds Discovering meaning Understanding how knowledge is stored Applying learning from problems to later ones</p>	<p>Resourcefulness, questioning, making links, imagining, reasoning, capitalising, distilling</p>
<p>Order and Quality: The ability to reduce uncertainty and to control quality.</p>	<p>Taking risks with reduced consequences Experiencing tasks being neither too easy nor too hard.</p>	<p>Imagining, reasoning, planning, revising</p>
<p>Developing Others: The ability to help others make progress.</p>	<p>Sharing with other players Helping others and modifying games, in addition to just playin</p>	<p>Reciprocity, interdependence, collaboration, empathy and listening, capitalising, imitation</p>
<p>Empathy: The ability to understand and respond to the concerns of others.</p>	<p>Relating the game world to other worlds</p>	<p>Reciprocity, interdependence, collaboration, empathy and listening, imitation, noticing</p>
<p>Expertise: The ability to perform professional jobs.</p>	<p>Mastering game language</p>	<p>Reflectiveness, Questioning, Imagining, Revising, Making links, Reasoning, Distilling</p>
<p>Flexibility: The ability to effectively adapt to a variety of situations.</p>	<p>Thinking Intuitively Being encouraged to practice Repeating until you get better</p>	<p>Planning, revising, reflectiveness, perseverance,</p>

<b>Play 4 Guidance Survey Competences</b>	<b>“What we learn from Computer Games”, JP Gee</b>	<b>“Building Learning Power”, Guy Claxton</b>
<b>Influence:</b> The ability to influence thoughts and actions of others.	Being Part of the gaming world	Reciprocity, interdependence, collaboration, empathy and listening, capitalising, imitation, making links
<b>Information Seeking:</b> The ability to capture enough information to increase knowledge or find solutions.	Mastering game language Reading in context Relating Information Meshing information from multiple media Receiving information when needed	Resourcefulness, Absorption, Noticing, questioning, making links, imagining,
<b>Initiative:</b> The ability to be a self-starter and to meet the challenge of higher level objectives.	Taking risks with reduced consequences Having to master new skills at each level	Resilience, absorption, managing distractions, imitation, perseverance
<b>Innovation:</b> The ability to make something new and to improve performance.	Trying rather than following instructions	Questioning, making links, imagining, capitalising
<b>Organizational Awareness:</b> The ability to recognize the power relationships in organizations.	Seeing interrelationships Reading in context Doing, thinking, strategizing	Noticing, distilling, making links
<b>Personal Motivation:</b> The will to succeed and offer service.	mastering game language Putting in effort because they care Watching their own behaviour Being reward for achievement	Absorption, resilience, perseverance

Play 4 Guidance Survey Competences	“What we learn from Computer Games”, JP Gee	“Building Learning Power”, Guy Claxton
<b>Relationship Building:</b> The ability to build and maintain personal networks.	Sharing with other players Helping others and modifying games, in addition to just playing Being part of the game world	Reciprocity, interdependence, collaboration, empathy and listening, imitation
<b>Results Orientation:</b> The ability to set performance objectives and measures.	Being encouraged to practice	Planning, collaborating, capitalizing
<b>Self-Confidence:</b> The ability to express oneself in a hostile situation.		Resilience, resourcefulness, reflectiveness
<b>Self-Control:</b> The ability to manage one’s emotions under pressure or temptation.		Absorption, managing distractions, perseverance, meta learning
<b>Team Leadership:</b> The ability to create a favourable environment and mobilize people to succeed.	Combining multiple identities Helping others and modifying games, in addition to just playing	Reciprocity, interdependence, collaboration, empathy and listening, capitalising, imitation
<b>Verbal and Written Communication:</b> The ability to speak and write satisfactorily.		



Play 4 Guidance Survey Competences	“What we learn from Computer Games”, JP Gee	“Building Learning Power”, Guy Claxton
	Practice in a simplified setting	
	Repeating until you get better	
	Being lead from easy problems to harder ones	
	Thinking about Games and their culture	

The table shows some general relations between competences and gaming characteristics. In the game-related outputs, the competences found in this study should thus be mapped to gaming characteristics and situations to derive requirements and gaming situations.

The main findings from the literature suggest that there are many competences, which can be developed through gaming, such as motivation, confidence, perseverance, risk-taking and problem-solving (Gee, 2007a; Prensky, 2003; Eseryal et al. 2014). Relationship building is also an important feature in game-based learning, as players relate to one another and as members of an online community (Gee, 2007a). In order for competences to be realized however it is important that players are challenged at the right level to scaffold motivation and engagement (Prensky, 2003; Eseryal et al. 2014). Player motivation and engagement are essential for developing complex problem solving competences (Eseryal et al. 2014).

The P4G project itself is a computer-based simulation in which ‘A computer model attempts to reflect the basic dimensions of a business environment, and the students vie either against each other or against a set of computer competitors to achieve success in the simulated marketplace’ (Anderson and Lawton, 2009, p.194). A situated problem-solving environment is particularly effective in game-based learning (Gee, 2007b) and various competences can be developed through cognitive processing and complex problem solving. Problem solving however is also dependent on the problem solver’s motivation (Eseryal et al. 2014). The study by Eseryal et al. (2014) further suggests that an environment should be provided whereby learners have various opportunities to make autonomous choices, as well as providing various feedback mechanisms within the game for developing the player’s sense of competence (Eseryel et al. 2014). Therefore three specific interactions are recommended for supporting competences during the design of educational games:

- 1) Interface interactivity, which refers to the direct interaction between players and game systems;
- 2) Narrative interactivity, which refers to the interaction between the players and the storyline;
- 3) Social interactivity, which refers to the communication and collaboration between human players (Eseryel et al. 2014, p. 50)

Research carried out by Professor David W. Schaffer and the Epistemic Games group in the University of Wisconsin shows how an evidence-centered design can address the challenge of assessment in digital learning environments (Shaffer et al. 2009). Such an approach involves players acting out roles in professions with a visible epistemic structure e.g. businessman, town planner etc. through computer mediated scenarios. Thus, these games encourage the player to 'behave' in role within the epistemic frames of those roles. At the highest level of abstraction these assessments focus on making the right decisions based on the evidence gathered. Thus gathering and judging evidence and then solving a problem based on the evidence is their way forward. An approach, which tries to detail behaviour of 'professionals', as in P4G, can benefit from addressing some of the ideas followed by the Epistemic Games group. It is however difficult to combine this approach with a list of competences.

### 3. Summary

This literature review has provided a theoretical framework for the Play4Guidance project. It has focused on three main themes related to the project: (1) Competences, (2) Entrepreneurial competences, and (3) Relating competences to gaming. The correlation between the Play4Guidance competences and those developed through gaming, as outlined by Claxton (2002) and Gee (2003), are evident from the table presented on page 14.

## 4. References

Anderson, P. and Lawton, L. (2009) Business Simulations and Cognitive Learning: Developments, Desires and Future Directions, *Simulation and Gaming* 40 (2): 193-216

Claxton, G. (2002). Building learning power. TLO Limited Bristol.

Consortium for Entrepreneurship Education (2014): Entrepreneurship Competency Model, <http://www.careeronestop.org/competencymodel/competency-models/entrepreneurship.aspx>

Cooney, T. M. (2012). Entrepreneurship Skills for Growth-Orientated Businesses. Workshop on Skills Development for SMEs and Entrepreneurship, OECD, Copenhagen.

Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An Investigation of the Interrelationships between Motivation, Engagement, and Complex Problem Solving in Game-based Learning. *Educational Technology & Society*, 17 (1), 42–53.

Izquierdo, E., & Deschoolmeester, D. (2010). What entrepreneurial competencies should be emphasized in entrepreneurship and innovation education at the undergraduate level? *Handbook of Research in Entrepreneurship Education*, 3, 194-207.

Jain, R.K. (2011). Entrepreneurial competencies a meta-analysis and comprehensive conceptualization for future research. *Vision: The Journal of Business Perspective*, 15(2): 127-152.

Fink, A (2005). *Conducting Research Literature Reviews: From the Internet to Paper* (2nd ed.). Thousand Oaks, California: Sage Publications.

Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in*

Entertainment (CIE), 1(1), 20-20.

Gee, J.P. (2007a). What video games have to teach us about learning and literacy? New York: Palgrave Macmillan

Gee, J. P. (2007b). Learning and games. In K. Salen (Ed.), *The ecology of games: Connecting youth, games, and learning* (pp. 21- 40). Cambridge, MA: MIT Press

Mitchelmore, S., & Rowley, J. (2010). Entrepreneurial competencies: a literature review and development agenda. *International Journal of Entrepreneurial Behaviour & Research*, 16(2), 92-111.

Morris, M. H., Webb, J. W., Fu, J., & Singhal, S. (2013). A Competency-Based Perspective on Entrepreneurship Education: Conceptual and Empirical Insights. *Journal of Small Business Management*, 51(3), 352-369.

Paquette, G. (2007). An ontology and a software framework for competency modeling and management. *Educational Technology & Society*, 10(3), 1-21.

Pawlowski, J. M., & Holtkamp, P. (2012). Towards an internationalization of the information systems curriculum. *Multikonferenz Wirtschaftsinformatik 2012*, 2, 437.

Prensky, M. (2003). Escape from planet Jar-Gon: Or, what video games have to teach academics about teaching and writing. *On the horizon*, 11(3).

Shaffer, D.W., Hatfield, D., Svarovsky, G.N., Nash, P., Nulty, A., Bagley, E., Frank, K., Rupp, A.A., Mislevy, R. (2009) Epistemic Network Analysis: A Prototype for 21st-Century Assessment of Learning. *International Journal of Learning and Media* 1 (2): 33-53



Wu, W. W. (2009). A competency-based model for the success of an entrepreneurial start-up. WSEAS Transactions on Business and Economics,6(6), 279-291.

## 5. Appendix

### 5.1 Learning employment and business competences through playing games

#### Strategy Learning in a Total Enterprise Simulation

Patz, A. L. (2002). Strategy Learning in a Total Enterprise Simulation. *Developments in Business Simulation and Experiential Learning*, 143-148.

<https://journals.tdl.org/absel/index.php/absel/article/view/766>

Biased total enterprise (TE) simulations are helpful in determining what is learned and not learned and who does and does not learn it. This is shown using one TE simulation over a large number of industries and participants. In general, the learning of and attention to strategy ratings led to superior and large performance differences between winning, first place teams, and losing, last place ones. Other variables, such as prices, do not matter. The ones that do are broad or focused product line, quality, service, brand image, low cost, market share leadership, superior value, and global or focused coverage.

In the development of business enterprise simulations, designers use as their knowledge base theories and business fundamentals drawn from accounting, finance, marketing, economic, production, and management courses. A problem exists, however, as each discipline has alternative procedures, theories, and unresolved issues. Because the simulation designer must choose specific procedures and theories, the personal bias of the designer enters the picture and cannot be avoided even if the designer attempts to avoid bias. The learning benefits of a specific simulation are thereby by what is and is not chosen as the knowledge base. The TE simulation employed was THE BUSINESS STRATEGY GAME (Tompson & Stappenbeck, 1999, 2001), this game provides the researcher with the necessary tools to determine what kind of individuals and teams prove to be the winner and losers types.

Nevertheless, if it can be shown that a particular TE design emphasizes strategy over the usual price and cost factors, a major step has been taken in the discovery of how learning does and does not take place. An earlier attempt to demonstrate this (Patz, 2001) was preliminary, but it did point in the desired direction. Therefore, the purpose of this paper is to demonstrate the feasibility of discovering TE learning effects.

#### How computer games help children learn

Shaffer, D W How computer games help children learn, 1st ed. New York: Palgrave Macmillan, 2006.

<http://www.palgrave.com/page/detail/how-computer-games-help-children-learn-david-williamson-shaffer/?K=9781403975058>

This book reports on a series of activities which are not "computer games" - but games mediated by computers. In Epistemic Games students take on a professional role with responsibility to conduct some task (eg town planner, scientific investigative journalist) and the discusses the ways forward to recognise the competences of those playing the game.

### The Effectiveness of Business Games in Strategic Management Course Work

Wolfe, J “The Effectiveness of Business Games in Strategic Management Course Work,” Simulation Gaming, vol. 28, no. 4, pp. 360–376, Dec. 1997.

<http://dl.acm.org/citation.cfm?id=288891>

The variety and user-friendliness of computer-based games available to the strategic management instructor has increased, although the number of commercially available games has fallen due to a number of factors. Based on the criterion of objectively measured learning outcomes, the various games studied over the years produce genuine results and results that are superior to those obtained via the case approach, which is the major alternative teaching strategy. Far less research has been conducted on game-facilitating factors that lead to effective learning outcomes in a business game environment.

## 5.2 Learning about business and competences

### A competency based model for the success of an entrepreneurial start-up

Wu, W. W. (2009). A competency-based model for the success of an entrepreneurial start-up. WSEAS Transactions on Business and Economics,6(6), 279-291.

1. Analytical Thinking: the ability to analyze problems systematically.
2. Business Acumen: the ability to discover opportunities and transform resources into performance.
3. Client Service Orientation: the ability to meet the needs of both internal and external customers.
4. Commitment to Learning: the ability to actively pursue learning and develop competitiveness.
5. Communication: the ability to effectively receive and express information or feelings.
6. Conceptual Thinking: the ability to recognize patterns or trends in a problem.
7. Order and Quality: the ability to reduce uncertainty and to control quality.
8. Developing Others: the ability to help others make progress.
9. Empathy: the ability to understand and respond to the concerns of others.
10. Expertise: the ability to perform professional jobs.
11. Flexibility: the ability to effectively adapt to a variety of situations.
12. Influence: the ability to influence thoughts and actions of others.
13. Information Seeking: the ability to capture enough information to increase knowledge or find solutions.



14. Initiative: the ability to be a self-starter and to meet the challenge of higher level objectives.
15. Innovation: the ability to make something new and to improve performance.
16. Organizational Awareness: the ability to recognize the power relationships in organizations.
17. Personal Motivation: the will to succeed and offer service.
18. Relationship Building: the ability to build and maintain personal networks.
19. Results Orientation: the ability to set performance objectives and measures.
20. Self-Confidence: the ability to express oneself in a hostile situation.
21. Self-Control: the ability to manage one's emotions under pressure or temptation.
22. Team Leadership: the ability to create a favorable environment and mobilize people to succeed.
23. Verbal and Written Communication: the ability to speak and write satisfactorily.

### **A competency based perspective on Entrepreneurial Education: Conceptual and Empirical Insights**

Morris, M. H., Webb, J. W., Fu, J., & Singhal, S. (2013). (2013). A Competency-Based Perspective on Entrepreneurship Education: Conceptual and Empirical Insights. *Journal of Small Business Management*, 51(3), 352-369.

1. Opportunity Recognition: the capacity to perceive changed conditions or overlooked possibilities in the environment that represent potential sources of profit or return to a venture
2. Opportunity Assessment: ability to evaluate the content structure of opportunities to accurately determine their relative attractiveness
3. Risk Management/Mitigation: the taking of actions that reduce the probability of a risk occurring or reduce the potential impact if the risk were to occur
4. Conveying a Compelling Vision: the ability to conceive an image of a future organizational state and to articulate that image in a manner that empowers followers to enact it
5. Tenacity/Perseverance: ability to sustain goal-directed action and energy when confronting difficulties and obstacles that impede goal achievement
6. Creative Problem Solving/Imaginativeness: the ability to relate previously unrelated objects or variables to produce novel and appropriate or useful outcomes
7. Resource Leveraging: skills at accessing resources one does not necessarily own or control to accomplish personal ends
8. Guerrilla Skills: the capacity to take advantage of one's surroundings, employ unconventional, low-cost tactics not recognized by others, and do more with less
9. Value Creation: capabilities of developing new products, services, and/or business models that

generate revenues exceeding their costs and produce sufficient user benefits to bring about a fair return

10. Maintain Focus yet Adapt: ability to balance an emphasis on goal achievement and the strategic direction of the organization while addressing the need to identify and pursue actions to improve the fit between an organization and developments in the external environment

11. Resilience: ability to cope with stresses and disturbances such that one remains well, recovers, or even thrives in the face of adversity

12. Self-Efficacy: ability to maintain a sense of self-confidence regarding one's ability to accomplish a particular task or attain a level of performance

13. Building and Using Networks: social interaction skills that enable an individual to establish, develop and maintain sets of relationships with others who assist them in advancing their work or career

### Assessing and Developing Program Outcomes through Workplace Competencies

Thomas J. Brumm, Iowa State UniversityFollow, Larry F. Hanneman, Iowa State University, and Steven K. Mickelson, Iowa State UniversityFollow, "Assessing and Developing Program Outcomes through Workplace Competencies," International Journal of Engineering Education, vol. 22, no. 1, pp. 123–129., 2006.

<http://www.ijee.ie/articles/Vol22-1/IJEE1691.pdf>

The College of Engineering at Iowa State University (ISU) partnered with constituents and assessment professionals to identify and validate 14 observable and measurable competencies necessary and sufficient to measure program outcomes. Constituents identified the engineering and experiential workplaces as settings most likely to develop and demonstrate the competencies, and the traditional classroom as least likely. Engineering students in the experiential workplace are assessed on the competencies by their supervisors, providing feedback for curricular change. These results confirm that we must re-examine how we use the classroom to educate engineers and our belief that experiential education is critical to students' success.

### Assess Your Entrepreneurial Skills

Canadian Foundation for Economic Education , "Assess Your Entrepreneurial Skills." .

<http://www.mvp.cfee.org/en/selfassessskills.html>

Entrepreneurs tend to start ventures that build on specific skills they've already developed and knowledge they've already acquired in a certain occupation or industry, for example, auto repair. But all entrepreneurs tend to share other, more general, skills such as communication, team-building, and creative-thinking skills. The assessment exercise is to find out how well you've developed the skills that successful entrepreneurs tend to use to start and grow their ventures.

### Critical Entrepreneurial Competencies

R. Dixon, R. L. Meier, D. C. Brown, and R. L. Custer, "The Critical Entrepreneurial Competencies Required by Instructors from Institution-Based Enterprises: A Jamaican Study," JITE, vol. 42, no. 4, 2005.

<http://hdl.voced.edu.au/10707/93850>.

The changing economies in many developing countries have forced governments and educators to place a high priority on entrepreneurial training and development. The Jamaican economy, for example, depends greatly on what are known as "own account workers;" that is, workers who start and run their own small businesses. Forty percent of jobs generated in the Jamaican economy are dependent on "own account business" (Thwaites, 1999). Echoing the need for such workers with entrepreneurial competencies for the building of the Jamaican economy, then Senator N'dombet-Assamba urged some 500 graduates from the training academies of the National Training Agency of Jamaica (Human Employment and Resource Training (HEART) Trust /NTA) to transform the Jamaican economy into a more indigenous one by forming their own businesses ("The Jamaica Gleaner," 2001).

Entrepreneurial competency refers to the sum of the entrepreneur's requisite attributes for successful and sustainable entrepreneurship (Kiggundy, 2002). According to Kiggundy, these attributes include attitudes, values, beliefs, knowledge, skills, abilities, personality, wisdom, expertise (social, technical, and managerial), mindset, and behavioral tendencies. Cunningham and Lischeron (1991) identified six schools of thought on entrepreneurship that explain what constitutes an entrepreneur. Of the six schools, three assert that entrepreneurial traits are innate and cannot be developed or trained in the classroom. The other three schools of thought hold that entrepreneurial skills and competencies can be acquired through formal training.

### **Guidelines for planning and implementation of initiatives for entrepreneurship education**

ISFOL, "Indicazioni per la programmazione e la realizzazione di iniziative per l'educazione all'imprenditorialità." ISFOL. April 2013

[http://isfoloa.isfol.it/bitstream/123456789/565/1/Consolini Di%20Saverio Loasses Richini Indicazioni%20imprenditorialita.pdf](http://isfoloa.isfol.it/bitstream/123456789/565/1/Consolini%20Saverio%20Loasses%20Richini%20Indicazioni%20imprenditorialita.pdf)

An Italian document which presents guidelines for planning and implementation of initiatives for entrepreneurship education

### **Towards greater coherence and cooperation in Entrepreneurship Education**

Koenen, S "Entrepreneurship Education: 'Towards greater coherence and cooperation in Entrepreneurship Education,'" Final Report, Aug. 2011.

[http://ec.europa.eu/enterprise/policies/sme/promoting-entrepreneurship/education-training-entrepreneurship/reflection-panels/files/entr\\_education\\_panel\\_en.pdf](http://ec.europa.eu/enterprise/policies/sme/promoting-entrepreneurship/education-training-entrepreneurship/reflection-panels/files/entr_education_panel_en.pdf)

The document includes the current state of play in entrepreneurship education, especially in relation to the development of entrepreneurship education strategies and their implementation as well as a useful framework and progression model for mapping the area of entrepreneurship

education. The European Social Fund is highlighted by the Commission as a potential means of funding assistance which could be further explored by Member States.

### **Entrepreneurial competencies: a literature review and development agenda**

Mitchelmore, Siwan and Rowley, Jennifer; "Entrepreneurial competencies: a literature review and development agenda," *Int Jnl of Ent Behav & Res*, vol. 16, no. 2, pp. 92–111, Mar. 2010.

<http://www.emeraldinsight.com/doi/abs/10.110>

**Purpose:** Entrepreneurial competencies are seen as important to business growth and success. The purpose of this paper is therefore to undertake a literature review of research on entrepreneurial competence in order to: provide an integrated account of contributions relating to entrepreneurial competencies by different authors working in different countries and different industry sectors and at different points in time; and, develop an agenda for future research, and practice in relation to entrepreneurial competencies.

**Design/methodology/approach:** The article starts with a review of the development of the concept of competence, with particular reference to its use in the context of management competencies. It then draws together views on the notion of entrepreneurial competence before exploring and summarising research on the link between entrepreneurial competencies and business performance and growth. A core section then compares the models of entrepreneurial competencies cited in the literature, and on this basis proposes a set of entrepreneurial competencies which can be used as the basis for further research and practice. Finally, the different perspectives adopted by researchers to the measurement of entrepreneurial competencies are reviewed.

**Findings:** Conclusions suggest that although the concept of entrepreneurial competencies is used widely by government agencies and others in their drive for economic development and business success, the core concept of entrepreneurial competencies, its measurement and its relationship to entrepreneurial performance and business success is in need of further rigorous research and development in practice.

**Originality/value:** This article integrates previous models of entrepreneurial competencies towards the development of an entrepreneurial competency framework.

### **The impact of entrepreneurship education on entrepreneurship skills and motivation**

Oosterbeek, H . van Praag, and A. Ijsselstein, "The impact of entrepreneurship education on entrepreneurship skills and motivation," *European Economic Review*, vol. 54, no. 3, pp. 442–454, Apr. 2010.

<http://linkinghub.elsevier.com/retrieve/pii/S0014292109000932>

This paper analyzes the impact of a leading entrepreneurship education program on college students' entrepreneurship skills and motivation using an instrumental variables approach in a difference-in-differences framework. We exploit that the program was offered to students at one location of a school but not at another location of the same school. Location choice (and thereby treatment) is instrumented by the relative distance of locations to parents' place of residence. The results show that the program does not have the intended effects: the effect on students' self-

assessed entrepreneurial skills is insignificant and the effect on the intention to become an entrepreneur is even negative.

### Entrepreneurship

Mitchelmore S and Rowley J (2010), '**Entrepreneurship**' in Rowley J., *Being an information innovator*, London: Facet Publishing, 2010. ISBN 978-1-85604-671-8

A variety of studies have explored the field and also proposed Competence Descriptions for the field of entrepreneurship. However, no commonly accepted standard has been developed. One proposal by Mitchelmore & Rowley (2010) shows a comprehensive, exemplary concept:

- *The scheme is available at page 8 of this document*

### Entrepreneurial competency Model

Career Onestop: <http://www.careeronestop.org/competencymodel/competency-models/entrepreneurship.aspx>

From a meta-analysis

Entrepreneur's Motives

- Achievement Motivation (Need for Achievement)
- Need for Independence/Autonomy/Personal Control
- Need for Personal Growth and Development
- Need for Social Recognition and Respect
- Need for Social Security and Greater Comfort for the Self and Family
- Need for Money/Wealth
- Need for Enjoying Creative, Innovative and Path-breaking Work, etc.

Entrepreneur's Attitudes & Personal Characteristics

- Innovativeness
- Creativity
- Proactivity
- Risk-taking Propensity
- Internal Locus of Control
- Self-efficacy
- Tolerance for Ambiguity
- Social Intelligence
- Extraversion

- Miscellaneous Competencies
- Personal and Family Background

### Entrepreneurial skills assessment

Smith, W.L. Schallenkamp, K. and Eichholz, D. E. "Entrepreneurial skills assessment: an exploratory study," International Journal of Management and Enterprise Development, vol. 4, no. 2, pp. 179–201, 2007.

<http://inderscience.metapress.com/index/a809krvapfvxrw0n.pdf>

This paper examines literature related to seventeen skills suggested as being critical to individuals seeking to embark on entrepreneurial activities. It also reports the results of an exploratory study regarding the importance and usefulness of these skills to individuals pursuing entrepreneurial activities. The exploratory study disclosed that nine of the skills ranked highest in both importance and usefulness. All seventeen skills are discussed in the context of the literature review and the exploratory study. Implications for future research and for practice are also presented.

### Entrepreneurship Skills for Growth Orientated Businesses

Prof. Thomas M. Cooney, Dublin Institute of Technology

Report for the Workshop on 'Skills Development for SMEs and Entrepreneurship', Copenhagen, 28 November 2012 OECD. [http://www.oecd.org/cfe/leed/Cooney\\_entrepreneurship\\_skills\\_HGF.pdf](http://www.oecd.org/cfe/leed/Cooney_entrepreneurship_skills_HGF.pdf)

Technical Skills - which are those skills necessary to produce the business's product or service;

Managerial Skills, which are essential to the day-to-day management and administration of the company;

Entrepreneurial Skills - which involve recognizing economic opportunities and acting effectively on them;

Personal Maturity Skills - which include self-awareness, accountability, emotional skills, and creative skills.

### Entrepreneur Test | Psychometric Tests

Unkown, "Entrepreneur Test | Psychometric Tests." [Online].

<http://www.psychometrictest.org.uk/entrepreneur-test/>. [Accessed: 11-Nov-2014].

The entrepreneurial questionnaire is designed to assess the personality traits associated with entrepreneurial ability, in order to provide insight into the current qualities possessed by the candidate. It has been suggested that some people are naturally predisposed to success in this kind of career, due to characteristics of their personality which could affect decision making processes, attitude towards achieving goals and whether they are able to remain optimistic during difficulties. However, once aware of the key elements that accompany a successful entrepreneurial outlook, it is possible to improve upon those qualities, whether they come naturally to the individual or not.

## Learning Needs Assessment in Entrepreneurship Training: a Practical Approach of Competency Based Assessment

Timo Nokolous (2011)

<http://essay.utwente.nl/61634/1/Nicklaus, T. - s0111112 %28verslag%29.pdf>

Development of entrepreneurial competencies is fundamental to startup founders. Special training programs intend to facilitate the acquisition of specific competencies aimed to enable founders to successfully run their business. Frequently, part of these programs is an initial assessment to identify earlier acquired competencies to facilitate the learning process. This work develops such a competency-based learning needs assessment to evaluate initial communication competency of participants at the VentureLab Twente Training Program. Therefore, the theoretical background of competency-based training and education, competency profiles and entrepreneurship competencies is analyzed and evaluated. Based on these insights different assessment methods are identified and compared to each other with regard to their suitability. Subsequently, a learning needs assessment with use of a discrepancy model is developed. The designed assessment measures communication competency of start-up entrepreneurs by means of a role-play video analysis and represents the results on a spider-chart. An inter-rater reliability analysis among the judgments of six trainers of communication competency is done to evaluate the consistency of the rating scale among different assessors. A qualitative evaluation and a statistical analysis confirm the assessment as a valid instrument to measure communication competency for training purposes of startup entrepreneurs.

## What Entrepreneurial Competencies should be emphasized in Entrepreneurial Education and Innovation Education at the Undergraduate Level?

Edgar Izquierdo, Dirk Deschoolmeester (2008)

[http://www1.kmu.unisg.ch/rencontres/Renc2008/Topics\\_2008/C/Rencontres\\_2008\\_Deschoolmeester\\_Izquierdo\\_f.pdf](http://www1.kmu.unisg.ch/rencontres/Renc2008/Topics_2008/C/Rencontres_2008_Deschoolmeester_Izquierdo_f.pdf)

An empirical study:

- Decision making
- Innovative thinking
- Identifying and solving problems
- Having a different view of the market
- Communication
- Deal making and negotiation
- Identifying business opportunities
- Evaluating business opportunities
- Networking

- Team work
- Team building
- Intuitive thinking
- Coping with uncertainties
- Coping with stress
- Taking calculated risk



### 5.3 Learning Competences through playing computer games

#### Modeling Diagnostic Assessments with Bayesian Networks

Almond R.G. , DiBello L. V., Moulder B., and Zapata-Rivera J.-D., “Modeling Diagnostic Assessments with Bayesian Networks,” *Journal of Educational Measurement*, vol. 44, no. 4, pp. 341–359, Dicembre 2007.

<http://onlinelibrary.wiley.com/doi/10.1111/j.1745-3984.2007.00043.x/abstract>

This paper defines Bayesian network models and examines their applications to IRT-based cognitive diagnostic modeling. These models are especially suited to building inference engines designed to be synchronous with the finer grained student models that arise in skills diagnostic assessment. Aspects of the theory and use of Bayesian network models are reviewed, as they affect applications to diagnostic assessment. The paper discusses how Bayesian network models are set up with expert information, improved and calibrated from data, and deployed as evidence-based inference engines. Aimed at a general educational measurement audience, the paper illustrates the flexibility and capabilities of Bayesian networks through a series of concrete examples, and without extensive technical detail. Examples are provided of proficiency spaces with direct dependencies among proficiency nodes, and of customized evidence models for complex tasks. This paper is intended to motivate educational measurement practitioners to learn more about Bayesian networks from the research literature, to acquire readily available Bayesian network software, to perform studies with real and simulated data sets, and to look for opportunities in educational settings that may benefit from diagnostic assessment fueled by Bayesian network modeling.

#### Modeling Diagnostic Assessments with Bayesian Networks

Anderson P. and Lawton L., “Business Simulations and Cognitive Learning: Developments, Desires, and Future Directions,” *Simulation & Gaming*, vol. 40, no. 2, pp. 193–216, May 2008.

<http://sag.sagepub.com/content/40/2/193.full.pdf+html>

This article focuses on the research associated with the assessment of the cognitive learning that occurs through participation in a simulation exercise. It summarizes the objective evidence regarding cognitive learning versus the perceptions of cognitive learning achieved as reported by participants and instructors. The authors also explain why little progress has occurred in objectively assessing cognitive learning in the past 25 years and provide potential options for filling this deficiency.

#### Interrelationships between Motivation, Engagement, and Complex Problem Solving in Game-based Learning

Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An Investigation of the Interrelationships between Motivation, Engagement, and Complex Problem Solving in Game-based Learning. *Educational Technology & Society*, 17 (1), 42–53.

[http://www.ifets.info/journals/17\\_1/5.pdf](http://www.ifets.info/journals/17_1/5.pdf) This investigation was designed to examine the complex interplay between learners’ motivation, engagement, and complex problem-solving outcomes

during game-based learning. This article challenges the assumption that all games are engaging. It seeks to separate the concepts of motivation and engagement and examine how they can be achieved as a learning outcome in games development. The study also seeks to examine if motivation and engagement have an impact on complex problem solving competencies.

Eighty-eight participants were asked to play a massive multi player online game called McLarins Adventures twice a week over the period of a year. A pre test complex problem scenario and motivation inventory was distributed to participants before the experiment. A post test complex problem scenario was also distributed after the experiment in order to assess changes in problem solving representations and levels of motivation. Results were analyzed using a hierarchical regression.

The authors suggest three modes of interaction that should be carefully designed in educational games to sustain motivation and engagement. (1) Interface interactivity, which refers to the direct interaction between players and game systems; (2) narrative interactivity, which refers to the interaction between the players and the storyline; and (3) social interactivity, which refers to the communication and collaboration between human players. Student motivation and engagement have crucial impact on students' development of complex problem-solving competencies in game-based learning. Further to this, other findings were:

- The level of autonomy and choice within a game can influence engagement.
- The design features of the game can affect learners' self-efficacy and perceived competence.
- It is crucial to design game-based learning environment to scaffold students' motivation and engagement.

### What video games have to teach us about learning and literacy

Gee, J.P. What video games have to teach us about learning and literacy, Rev. and updated ed. New York: Palgrave Macmillan, 2007.

[http://en.wikipedia.org/wiki/What\\_Video\\_Games\\_Have\\_to\\_Teach\\_Us\\_About\\_Learning\\_and\\_Literacy](http://en.wikipedia.org/wiki/What_Video_Games_Have_to_Teach_Us_About_Learning_and_Literacy)

A controversial look at the positive things that can be learned from video games by a well known professor of education. James Paul Gee begins his new book with 'I want to talk about vide games- yes, even violent video games - and say some positive things about them'. With this simple but explosive beginning, one of America's most well-respected professors of education looks seriously at the good that can come from playing video games. Gee is interested in the cognitive development that can occur when someone is trying to escape a maze, find a hidden treasure and, even, blasting away an enemy with a high-powered rifle. Talking about his own video-gaming experience learning and using games as diverse as Lara Croft and Arcanum, Gee looks at major specific cognitive activities:

- \* How individuals develop a sense of identity
- \* How one grasps meaning
- \* How one evaluates and follows a command
- \* How one picks a role model

\* How one perceives the world

This is a ground-breaking book that takes up a new electronic method of education and shows the positive upside it has for learning.

Usefully, this might be read with Prensky's review of the book (2003) below.

### **A Review of Gee's "What video games have to teach us about learning and literacy"**

[Marc Prensky](#), (2003) "Escape from Planet Jar-Gon: or, what video games have to teach academics about teaching and writing", *On the Horizon*, Vol. 11 Iss: 3

<http://www.marcprensky.com/writing/Prensky%20-%20Review%20of%20James%20Paul%20Gee%20Book.pdf>

This is a very useful review of JP Gee's book - with a very useful de-jargonisation of Gee's main thesis.

### **A Prototype for 21st-Century Assessment of Learning**

Shaffer, D W. Hatfield, G. N. Svarovsky, P. Nash, A. Nulty, E. Bagley, K. Frank, A. A. Rupp, and R. Mislevy, "Epistemic Network Analysis: A Prototype for 21st-Century Assessment of Learning," *International Journal of Learning and Media*, vol. 1, no. 2, pp. 33–53, May 2009.

<http://www.mitpressjournals.org/doi/abs/10.1162/ijlm.2009.0013>

In this article we examine educational assessment in the 21st century. Digital learning environments emphasize learning in action. In such environments, assessments need to focus on performance in context rather than on tests of abstracted and isolated skills and knowledge. Digital learning environments also provide the potential to assess performance in context, because digital tools make it possible to record rich streams of data about learning in progress. But what assessment methods will use this data to measure mastery of complex problem solving—the kind of thinking in action that takes place in digital learning environments?

Here we argue that one way to address this challenge is through evidence-centered design<sup>1</sup>—a framework for developing assessments by systematically linking models of understanding, observable actions, and evaluation rubrics to provide evidence of learning. We examine how evidence-centered design can address the challenge of assessment in new media learning environments by presenting one specific theory-based approach to digital learning, known as epistemic games (<http://epistemicgames.org/eg/>), and describing a method, epistemic network analysis (ENA), to assess learner performance based on this theory. We use the theory and its related assessment method to illustrate the concept of a digital learning system—a system composed of a theory of learning and its accompanying method of assessment, linked into an evidence-based, digital intervention. We argue that whatever tools of learning and assessment digital environments use, they need to be integrated into a coherent digital learning system linking learning and assessment through evidence-centered design.

## 5.4 Learning Competences

### Building Learning Power

Gornall, S, Claxton, G. :Building Learning Power: a poster” Extract from “Building Learning Power in Action” TLO, Bristol, 2005

[http://www.buildinglearningpower.co.uk/images/blpia\\_extract.pdf](http://www.buildinglearningpower.co.uk/images/blpia_extract.pdf)

A poster that describes the key concepts, competences and attributes of learning power.

### Assessment of Key Competences’, Literature Review, Glossary and examples.

Pepper, D. “‘Assessment of Key Competences’, Literature Review, Glossary and examples.” Commission EUROPEAN COMMISSION Directorate-General for Education and Culture, Nov-2012.

[http://ec.europa.eu/education/policy/school/doc/keyreview\\_en.pdf](http://ec.europa.eu/education/policy/school/doc/keyreview_en.pdf)

This document supports the Commission Staff Working Document 'Assessment of Key Competences in initial education and training: Policy Guidance, which is one of the documents accompanying the Communication from the Commission "Rethinking Education: Investing in skills for better socio-economic outcomes". This document has three sections. The first section presents the research and literature related to the assessment of key competences. The second section presents a glossary of the key terms used in this context. The third section supports the aforementioned Staff Working Document by providing three examples of the assessment of key competences from Austria, Lithuania and Ireland. These extended examples present the work on the development of the assessment of key competences in a wider policy context.

## 5.5 Learning about Business

### Vocational trends and entrepreneurship preferences in university students

Arslan, K. Vocational trends and entrepreneurship preferences in university students

Doğuş University Journal, 2002/6, 1-11

<http://journal.dogus.edu.tr/ojs/index.php/duj/article/view/189/205>

Entrepreneurship has always had a significant role in the development of the modern civilization. Its significance is expected to grow more in this age which is called as the age of information or communication. Developed societies consider university graduates as the individuals who became ready for education. In Turkey, where the people are said to have more entrepreneurship characteristics, each individual who starts university education should be considered as a candidate entrepreneur. Entrepreneurship spirit may be present genetically or may be developed by time due to the factors such as family, environment, education and income. In this article, the roles of physical, social and economic environment on the formation of entrepreneurship tendencies and professional preferences have been analysed based on a detailed survey.

### The development of entrepreneurship in Turkey: a qualitative research on entrepreneurs

Bozkurt O.C., Kalkan A. , Koyuncu O., Alparslan A.M, The development of entrepreneurship in turkey: a qualitative research on entrepreneurs Journal of Süleyman Demirel University Institute of Social Sciences Year: 2012/1, Number:15

[http://abs.mehmetakif.edu.tr/upload/0421\\_132\\_dosya.pdf](http://abs.mehmetakif.edu.tr/upload/0421_132_dosya.pdf)

Promoting entrepreneurship and developing entrepreneurial characteristics and quality is very important to attribute for a country's development. Successful entrepreneurial activities are quite functional in creating employment in country, accelerating economic growth, the emergence of new industries and the process of change and development in the society. The purpose of this study is to determine the views and suggestions of successful entrepreneurs operating in Turkey about the development of the property of entrepreneurship. Besides time this study aim to determine, what is effective in intergenerational transfer of entrepreneurial culture and what needed to be done to increase the number of entrepreneurs in Turkey. In accordance with this purpose, in order to obtain the required data, in depth interviews were conducted with entrepreneurs in the province of Antalya. Detailed data are obtained from interviews by examining and assessing by the analysis of the content.

### Professional ideals and entrepreneurial intentions

Çiçek R. , Durna U., Professional ideals and entrepreneurial intentions, Mustafa Kemal University Journal of Social Sciences Institute Year: 2012 Volume: 9 Issue: 17, p. 17-31

<https://www.pegem.net/dosyalar/dokuman/139160-2014020593715-2.pdf>

Today, countries of the increasing level of welfare, elimination of employment issues, income distribution are attached great importance to entrepreneurship to be balanced. Entrepreneurship is one of the most important characteristic of knowledge economy with globalization process. For the globalization economic factors and enlarging marketing dimensions it has become a reality that the importance of entrepreneurship has been increased. In today's increased economic competitions, it is an important factor to develop entrepreneurs' capabilities of our own countries people. For these purpose in this study, university students and their individual characteristics, entrepreneurship trends and relationships between professional ideals are investigated. Gender and scholars of the ideal of their own work setting up ideal salary guarantee and teamwork between the relationships have been determined. Academics and school performance of an ideal, an ideal service-intensive work pace, was found between. With the ideal of becoming a civil servant salary guarantee and an ideal relationship between the services has been identified. In addition, a relationship between school performance and salary are guaranteed.

### Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers

Osterwalder A, Pigneur Y., Bernarda G. et al "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" Wiley, Chicester October 2010 <https://strategyzer.com/books? ga=1.50497965.520915624.1418061087>

<https://strategyzer.com/books? ga=1.50497965.520915624.1418061087>

This book suggests exercises for entrepreneurs in developing businesses. Understanding the relationships between the nine key principles - customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships and cost structure - enables one to figure out fairly fast how and why businesses function the way they do. Also, at a very early stage, it becomes clear what is not working in ones own business as well as others. The nine principles or, key elements, can all be explained on one piece of paper, and that is where design thinking comes in. Instead of writing long, arcane and stuffy business plans, this is what one ought to do - figure it all out on one piece of paper first. That said, there are as many permutations and combinations of the nine elements. The authors give examples of how the business models for Google, Apple iPod, etc. work

### How to Create Products and Services Customers Want

Osterwalder A, Pigneur Y, Bernarda G. et al "Value Proposition Design: How to Create Products and Services Customers Want" Wiley, Chicester October 2014

[https://strategyzer.com/books?\\_ga=1.50497965.520915624.1418061087](https://strategyzer.com/books?_ga=1.50497965.520915624.1418061087)

This book is a resource for building teams to build an enterprise. It is about clarity in entrepreneurial thinking and ensures a focus on the needs of the customer. links to Business Model Generation above.

## 5.6 Learning through using computers, games and simulation

### More Than Just Fun and Games: Self-Reported Problem Solving Skills, and Academic Grades

Adachi, P.J.C., Willoughby, T. More Than Just Fun and Games: The Longitudinal Relationships Between Strategic Video Games, Self-Reported Problem Solving Skills, and Academic Grades J Youth Adolescence (2013) 42:1041–1052

This paper presents a cogent argument to justify strategic video game play as contributing to positive correlation between academic results, problem solving and game play. The ubiquitous playing of computer games among 97% of adolescence referenced and the growth of the industry illuminate the pivotal role played by the industry to the teenage audience. The research is borne out of a dearth of empirical evidence to validate problem solving skills. Previous research has focused on negative correlations between time spent playing video games and academic performance. The paper addresses gaming and cognitive development, problem solving and academic performance studies to date and identify a need to complete a longitudinal analysis set within specific boundaries.

The study examined if genre of game predicted an increase in self reported problem solving. Three co-variables were factored in, gender, parental education, and number of computers in the home. Results support the initial hypothesis but with limitations. The reliance on 'self reporting' measures to gauge change. Can an adolescent give an objective measure of problem solving skills? In the future a need to focus on a long term study, to include a wider demography. A need to

decouple strategy games into type. This study is the first study to focus on strategic game play and problem solving skills and should set a precedent for follow on research.

### Integration of Educational Computer Games into Educational Environments

Akinici, A. Sirakaya M., Yildirim D., Tûzûn H . Integration of Educational Computer Games into Educational Environments

<http://yunus.hacettepe.edu.tr/~htuzun/html/academic/2010-ICITS-Akinci.pdf>

Computer and internet technologies, which are quickly changing and improving, are affecting education like any other domains of everyday life. One of the application areas of the computer and internet technologies is computer games. Use of computer games for entertainment has recently increased. While computer games offer enjoyable time for people, they may also provide an environment where people could learn. The use of computer games in education is an important issue that must be emphasized, especially for school-age children who like them so much. In studies related to the use of computer games in educational environments, it is usually conceptually focused on how computer games would be integrated into educational environments effectively and correctly. In this work, the practical research about the integration of educational computer games in educational environments are analyzed and found that the current practice is grouped under four dimensions. These four-dimensions consist of pedagogical dimension, technical infrastructure dimension, teacher-student dimension and partner dimension.

### Serious Educational Game Assessment

Annetta, L. A., & Bronack, S. (2011). Serious Educational Game Assessment: Practical Methods and Models for Educational Games, Simulations and Virtual Worlds: Practical Methods and Models for Educational Games, Simulations and Virtual Worlds. Springer.

<http://public.ebib.com/choice/publicfullrecord.aspx?p=974162>

In a reality of accountability and subsequent assessments along with the prolific use of the term 21<sup>st</sup> century skill, there seems to be a decoupling of sorts. Serious Educational Games, Simulations, and Virtual Worlds are common platforms by which today's students collaborate, communicate, become entertained and in many cases learn albeit most times not in a traditional school setting. School connectivity is increasing and cloud computing is becoming a reality in K-20 education. This volume is a starting point for exploring another dimension of effective use of the innovations such as 3-dimensional virtual learning environments, Serious Educational Games, simulations and virtual worlds. This collection is a suggestion of some of the most creative, relevant, and useful accounts of how pioneers in Serious Educational Games, Simulations, and Virtual Worlds are bridging the gap between providing innovative spaces for learning and assessing their effectiveness. Each of the chapters in this book details a process, or a product, or a theoretical

construct that can serve as a model, a tool, or a foundation upon which to base your own effort and exploration into 21<sup>st</sup> century assessment.

### Digital game-based learning once removed: Teaching teachers

Becker K., "Digital game-based learning once removed: Teaching teachers," British Journal of Educational Technology, vol. 38, no. 3, pp. 478–488, Maggio 2007.

<http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8535.2007.00711.x/abstract>

In the spring of 2005, the author designed and taught a graduate-level course on digital game-based learning primarily for teachers. Teachers cannot be expected to embrace digital games as a tool for learning unless they have a sound understanding of the potential as well as the limitations, and are confident in their ability to use games effectively to enhance learning. The course was designed as an introduction to digital games and gaming for instruction and learning. In it, students explored the theories, the possibilities, considerations and constraints related to the design of instructional games, and the use of learning and commercial entertainment games in classroom and out-of-class settings. The design of the course, along with the rationales, will be outlined and participant reaction will be profiled. Suggestions for future course designs are described, as well as key elements crucial for teacher preparation. Ultimately, the success of digital games as a medium for learning depends to a large extent on the abilities of new and practicing teachers to take full advantage of this medium.

### Game-Based Assessment of Persistence

DiCerbo, K. E. (2014). Game-Based Assessment of Persistence. Educational Technology & Society, 17 (1), 17–28.

[http://www.ifets.info/journals/17\\_1/3.pdf](http://www.ifets.info/journals/17_1/3.pdf)

Today employers are seeking multi dexterous workers that can creatively communicate and collaborate, maintaining a high level of persistence and resilience in their application to multi-modal problems. This has prompted research into the area of games as a to way to evaluate key knowledge bases and skill set. Persistence is a highly valued cognitive attribute required as a dominant skill within the complex task base of the 21st. Century. This paper addresses "persistence " as a common factor evident under "games actions " when recording logged data in the commercial childrens game Poptropica.

### The 23 Best Game-Based Education Resources for 2014

Edudemic Staff, "The 23 Best Game-Based Education Resources for 2014 | Edudemic." [Online].

<http://www.edudemic.com/23-best-game-based-resources-2014/>. [Accessed: 14-Dec-2014].

Edudemic has covered [game-based learning](#) and [gamification in the classroom](#) on numerous occasions in the past. When learning becomes a game, it's an enjoyable, effective experience for



students and teachers alike. We've curated 23 of the best game-based education resources for 2014

### Role Game Playing as a Platform for Creative and Collaborative Learning

[Gjedde, L](#) 2013, '[Role Game Playing as a Platform for Creative and Collaborative Learning](#)'. in P Escudeiro & C Vaz de Car Valho (eds), Proceedings of the 7th European Conference on Game Based Learning. vol. 1, Academic Conferences and Publishing International Limited, Reading, UK, pp. 190-198.

[http://issuu.com/acpil/docs/ecgbl2013-issuu\\_vol\\_1](http://issuu.com/acpil/docs/ecgbl2013-issuu_vol_1)

The focus of this paper is on Game Based Learning within a narrative environment to develop key skills of communication, collaboration, creativity and critical thinking. This research is centered on how to inform educational design and practice. The critical methodology employed Live Action Role Play (L.A.R.P.) was directed to a residential school in Denmark embracing all subjects, within grades 9 and 10.

An important background note is the use of L.A.R.P. in developing an inclusive model that serves the special needs cohort but is also challenging within the mainstream class. At the core is developing a design that empowers the learner through participation and socialisation with the medium, a creative collaborative framework that builds motivation. Creative interaction are identified at 4 levels- Immersion, Epic, Ludic and Mindful. This opens up a number of perspectives and meanings through engagement in the role. Addressing the issue of curricular targets and evaluation revealed this group utilising the L.A.R.P. methodology scored on par as the average.

### A new approach of adult education: dramatization

Gökkaya, Z " A new approach of adult education: dramatization" Hasan Ali Yücel Faculty of Education Journal Vol: 11-1, Issue: 21, 2014-1, p.71-84

Gamification applications appear as the new face of education in the information age. In recent years, the business sector is giving more emphasis on continuous learning and in-company training, but also faces the problem of scarce resources and time. Gamification which supports learning at work, is a practical solution to the emerging needs of qualified personnel and an ideal method to achieve positive outcomes for education of adults. Internalization and practice opportunities are major conditions of adult education, can be provided with gamification. It is known that, extrinsic motivators such as scoring, leveling, and award system help individuals to adopt and get addicted to the games. Gamification is an alternative model of distance education applications so as to convert extrinsic motivators to intrinsic motivation. Gamification supported by mobile technologies also has the potential to reach a mass users group.

### Statistical Methods for Assessments in Simulations and Serious Games

Jianbin Fu, Diego Zapata, and Elia Mavronikolas, “Statistical Methods for Assessments in Simulations and Serious Games.”

<http://onlinelibrary.wiley.com/doi/10.1111/j.1745-3984.2007.00043.x/abstract>

This paper defines Bayesian network models and examines their applications to IRT-based cognitive diagnostic modeling. These models are especially suited to building inference engines designed to be synchronous with the finer grained student models that arise in skills diagnostic assessment. Aspects of the theory and use of Bayesian network models are reviewed, as they affect applications to diagnostic assessment. The paper discusses how Bayesian network models are set up with expert information, improved and calibrated from data, and deployed as evidence-based inference engines. Aimed at a general educational measurement audience, the paper illustrates the flexibility and capabilities of Bayesian networks through a series of concrete examples, and without extensive technical detail. Examples are provided of proficiency spaces with direct dependencies among proficiency nodes, and of customized evidence models for complex tasks. This paper is intended to motivate educational measurement practitioners to learn more about Bayesian networks from the research literature, to acquire readily available Bayesian network software, to perform studies with real and simulated data sets, and to look for opportunities in educational settings that may benefit from diagnostic assessment fueled by Bayesian network modeling.

#### Literature review in games and learning

Kirriemuir J., McFarlane A., and NESTA Futurelab, Literature review in games and learning: a report for NESTA Futurelab. Bristol: NESTA Futurelab, 2004.

[http://archive.futurelab.org.uk/resources/documents/lit\\_reviews/Games\\_Review.pdf](http://archive.futurelab.org.uk/resources/documents/lit_reviews/Games_Review.pdf)

Although it is an early publication in games and learning, this survey provides a good definition and scope of the issues and themes of the domain. The review provides:

- a summary of the contemporary state of the computer and video gaming industry, market and culture
- an overview of the main developments in research into gaming and the educational relevance of video games, and a summary of the literature resulting from this research
- a basis for communication between the educational research community and the commercial sector on the subject of the use of games technologies in the design of learning resources
- a basis for discussion within educational communities on the use of digital games within educational settings.

#### Digital games: motivation, engagement and informal learning

Iacovides, I “Digital games: motivation, engagement and informal learning,” The Open University, 2012.

<http://oro.open.ac.uk/35603/>

This thesis investigates the relationships between motivation, engagement and informal learning, with respect to digital games and adult players. Following the reconceptualisation of motivation and engagement (as forms of micro and macro level involvement respectively) three linked studies

were conducted.

In the first study, 30 players were interviewed via email about their gaming experiences. The resulting set of learning categories and themes drew attention to learning on a game, skill and personal level, which arose from micro-level gameplay and macro-level interaction with wider communities and resources. The second investigation consisted of eight case studies that examined how involvement and learning come together in practice. Participants were observed in the lab during two gameplay sessions and kept gaming diaries over a three week period. A method for categorising game-play breakdowns and breakthroughs (relating to action, understanding and involvement) was developed in order to analyse several hours of gameplay footage. The previous categories and themes were also applied to the data. The findings suggested a relationship between macro-involvement and player identity, which was further investigated by a third survey study (with 232 respondents). The survey helped to establish a link between identity, involvement, and learning; the more strongly someone identifies as a gamer, the more likely they are to learn from their involvement in gaming practice.

### **The effect of simulation games on the learning of computational problem solving**

Liu, C. C., Cheng, Y. B., & Huang, C. W. (2011). The effect of simulation games on the learning of computational problem solving. *Computers & Education*, 57(3), 1907-1918.

<http://dl.acm.org/citation.cfm?id=2010737>

Simulation games are now increasingly applied to many subject domains as they allow students to engage in discovery processes, and may facilitate a flow learning experience. However, the relationship between learning experiences and problem solving strategies in simulation games still remains unclear in the literature. This study, thus, analyzed the feedback and problem solving behaviors of 117 students in a simulation game, designed to assist them to learn computational problem solving. It was found that students when learning computational problem solving with the game were more likely to perceive a flow learning experience than in traditional lectures. The students' intrinsic motivation was also enhanced when they learned with the simulation game. In particular, the results of the study found a close association between the students' learning experience states and their problem solving strategies. The students who perceived a flow experience state frequently applied trial-and-error, learning-by-example, and analytical reasoning strategies to learn the computational problem solving skills. However, a certain portion of students who experienced states of boredom and anxiety did not demonstrate in-depth problem solving strategies. For instance, the students who felt anxious in the simulation game did not apply the learning-by-example strategy as frequently as those in the flow state. In addition, the students who felt bored in the simulation game only learned to solve the problem at a superficial level.

### **MindShift-Guide to Digital Games and Learning**

Shapiro, J "MindShift-GuidetoDigitalGamesandLearning.pdf." . MindShift 2014

<http://www.kqed.org/assets/pdf/news/MindShift-GuidetoDigitalGamesandLearning.pdf>

What makes this guide unique?

- We take you several steps beyond looking up educational games in the app store and checking the number of stars they've been rated to gauge the benefits of a particular game.
- We provide a thoughtful, comprehensive look at games and learning, as well as specific examples.
- While we had teachers in mind when developing this guide, any lifelong learner can use it to develop a sense of how to navigate the games space in an informed and meaningful way.
- Our annotated Table of Contents gives you a window into the scope and content of each section

### An innovative way for using computers in science teaching

Smyrnaioiu. Z (2007). « An innovative way for using computers in science teaching -Una Manera Innovadora Para Usar Las Computadoras En La Enseñanza De La Ciencia », Journal of Science Education, n 2, vol. 8, p. 99-102. ISSN 0124-5481

The quality of science teaching is a very important aspect of education in the secondary. The design of tools for teaching using new communication and information technologies (ICTs) is another important alternative to traditional methods to improve science education and to give students the opportunities of deep understanding. But each active method should be applied by teacher with systemic links with other methods and with main objectives of the course. The designers of educational software try to produce tools which imply other forms of work and other modes of regulation of the learning activities. The variety of tasks with which the pupils are confronted leads to a diversification of the mental activities that are required of them. The designers generally have the concern of allowing learners to work in an autonomous way. To learn how to learn, to develop higher cognitive capabilities, to facilitate and optimise learning, to encourage the creation of knowledge. But what has happened in reality? In fact, technology based learning environment exploits only part of the functionalities that the ICTs allow, for obvious reasons of the limits the cognitive capabilities of the pupil have, especially when they are young pupils. So, the learner is not very capable to manage several tasks if the environment is too complex. It thus proves necessary to conduct studies making possible to evaluate what technology based learning environment really offers in the cognitive plan. Other essential problem is the appropriate representation of the central concepts and topics of the course, what can be done using modern systemic approaches for that. We present a study concerning the learning of physics (mechanics) while using the 'MODELSCREATOR' technology based learning environment. This learning environment makes possible the creation of models by pupils. From the analysis of answers collected from college pupils, in France, we show that the use of the software can facilitate the comparisons between aspects of reality, their conceptualisation and their symbolic notations, provided that it intervenes jointly with the concrete realization of experiments.

### Students' Constructionist Game Modelling Activities as Part of Inquiry Learning Processes

Smyrniou, Z., Foteini, M., & Kynigos, C. (2012). Students' Constructionist Game Modelling Activities as Part of Inquiry Learning Processes. *Electronic Journal of e-Learning*, 10(2), 235-248. ISSN 1479-4403

Learning science requires the understanding of concepts and formal relationships, processes that - in themselves- have been proved to be difficult for students as they seem to encounter substantial problems with most of the inquiry-learning processes in which they engage. Models in inquiry-based learning have been considered as powerful 'tools' that may help students in enhancing their reasoning activity and improving their understanding of scientific concepts. Modelling, however, in the form of exploring, designing and building computer models of complex scientific phenomena has also been embedded in the constructionist learning approach. Working collaboratively with constructionist game microworlds that by design invite students to explore the fallible model underpinning the game and change it so as to create a new game, may provide students opportunities to bring into the foreground their conceptual understandings related to motion in a Newtonian space and put them into test making them at the same time objects of discussion and reflection among the members of the group. Apart from the meaning generation, we also study in this paper, the students' group learning processes i.e. the construction of emergent activity maps to either plan their actions as they engage in game modelling activities or to report on the outcomes generated when these actions are implemented. The connections between the students' activities as they work with a constructionist medium and the inquiry-based learning activities from which the students are considered to pass when engaging in scientific inquiry also constitute one of the main issues this paper attempts to study.

### Computer games and learning

Ulicsak, M. and Williamson, B "Computer games and learning" Futurelab, Bristol, 2010

[http://www.futurelab.org.uk/sites/default/files/Computer\\_games\\_and\\_learning.pdf](http://www.futurelab.org.uk/sites/default/files/Computer_games_and_learning.pdf)

It is assumed by some that the models games employ lead to learning, as young people effectively learn how to play without necessarily being explicitly taught, doing vast amounts of reading or interacting with others; while others see games as boring, tedious, time-consuming, and repetitive. Both of these viewpoints can be true: as stated the impact of a game is dependent on the game itself, but also the player, circumstance of use, mediation of the teacher and other players. In fact, many academic researchers of young people's uses of digital media argue, counter to the hype, that computer games have been insufficiently well researched as a medium for learning. This handbook summarises not only the key theories around why they are considered to have potential, but how they have been used in the past, how they are used for learning in a family context, what attributes lead to learning, and considerations for using them with young people.

### Assessment for Complex Learning Resources

Wesiak, M. AL-Smadi, M. Höfler, and C. Gütl, "Assessment for Complex Learning Resources: Development and Validation of an Integrated Model," *International Journal of Emerging Technologies in Learning (IJET)*, vol. 8, no. S1, pp. pp. 52–61, Jan. 2013.

<http://online-journals.org/index.php/i-jet/article/view/2354>

e-learning systems meet the challenge to provide interactive, personalized environments that support self-regulated learning as well as social collaboration and simulation. At the same time assessment procedures have to be adapted to the new learning environments by moving from isolated summative assessments to integrated assessment forms. Therefore, learning experiences enriched with complex didactic resources - such as virtualized collaborations and serious games - have emerged. In this extension of an integrated model for e-assessment (IMA) is outlined, which incorporates complex learning resources and assessment forms as main components for the development of an enriched learning experience. For a validation the IMA was presented to a group of experts from the fields of cognitive science, pedagogy, and e-learning. The findings from the validation lead to several refinements of the model, which mainly concern the component forms of assessment and the integration of social aspects. Both aspects are accounted for in the revised model, the former by providing a detailed sub-model for assessment forms.

## 5.7 Comparing the approaches to competence

This table compares three aspects covered in the literature survey above as exemplified by three key lists. The first list is a list of attributes we have covered in the survey and has resonance with the work of Michelmore & Rowley (2010) and Wu (2009). The second list is based on Mark Prensky's interpretation of James Paul Gee's "What we learn from Computer Games". The third list is representative of those who are promoting a competence based approach to learning, which is exemplified by Guy Claxton's work in "Building Learning Power". There are other approaches, including the work of the Epistemic Games Group working at University of Wisconsin with David W Shaffer. There is a short discussion of this work below the table.

<b>Play 4 Guidance Survey Competences</b>	<b>"What we learn from Computer Games", JP Gee</b>	<b>"Building Learning Power", Guy Claxton</b>
Analytical Thinking: The ability to analyze problems systematically.	Watching their own behaviour Mastering game language Doing, thinking and strategizing	Reflectiveness, Questioning, Imagining, Planning, Revising, Making links, Reasoning, Distilling
Business Acumen: The ability to discover opportunities and transform resources into performance.	Doing and reflecting Doing, thinking and strategizing Mastering upfront things needed later	Resourcefulness, Absorption, Noticing, questioning, making links, imagining,

<b>Play 4 Guidance Survey Competences</b>	<b>“What we learn from Computer Games”, JP Gee</b>	<b>“Building Learning Power”, Guy Claxton</b>
Client Service Orientation: The ability to meet the needs of both internal and external customers.		Reciprocity, interdependence, collaboration, empathy and listening, capitalising, imitation
Commitment to Learning: The ability to actively pursue learning and develop competitiveness.	Getting more out than what they put in Having to master new skills at each level Thinking about the game and how they learn	reflectiveness, absorption, managing distractions, questioning, reasoning, revising
Communication: The ability to effectively receive and express information or feelings.		Empathy and Listening
Conceptual Thinking: The ability to recognize patterns or trends in a problem.	Appreciating good design Seeing interrelationships Relating the game world to other worlds Discovering meaning Understanding how knowledge is stored Applying learning from problems to later ones	Resourcefulness, questioning, making links, imagining, reasoning, capitalising, distilling



<b>Play 4 Guidance Survey Competences</b>	<b>“What we learn from Computer Games”, JP Gee</b>	<b>“Building Learning Power”, Guy Claxton</b>
Order and Quality: The ability to reduce uncertainty and to control quality.	Taking risks with reduced consequences Experiencing tasks being neither too easy nor too hard.	Imagining, reasoning, planning, revising
Developing Others: The ability to help others make progress.	Sharing with other players Helping others and modifying games, in addition to just playin	Reciprocity, interdependence, collaboration, empathy and listening, capitalising, imitation
Empathy: The ability to understand and respond to the concerns of others.	Relating the game world to other worlds	Reciprocity, interdependence, collaboration, empathy and listening, imitation, noticing
Expertise: The ability to perform professional jobs.	Mastering game language	Reflectiveness, Questioning, Imagining, Revising, Making links, Reasoning, Distilling
Flexibility: The ability to effectively adapt to a variety of situations.	Thinking Intuitively Being encouraged to practice Repeating until you get better	planning, revising, reflectiveness, perseverance,

<b>Play 4 Guidance Survey Competences</b>	<b>“What we learn from Computer Games”, JP Gee</b>	<b>“Building Learning Power”, Guy Claxton</b>
Influence:  The ability to influence thoughts and actions of others.	Being Part of the gaming world	Reciprocity, interdependence, collaboration, empathy and listening, capitalising, imitation, making links
Information Seeking:  The ability to capture enough information to increase knowledge or find solutions.	Mastering game language Reading in context Relating Information Meshing information from multiple media Receiving information when needed	Resourcefulness, Absorption, Noticing, questioning, making links, imagining,
Initiative:  The ability to be a self-starter and to meet the challenge of higher level objectives.	Taking risks with reduced consequences Having to master new skills at each level	Resilience, absorption, managing distractions, imitation, perseverance
Innovation:  The ability to make something new and to improve performance.	Trying rather than following instructions	questioning, making links, imagining, capitalising

<b>Play 4 Guidance Survey Competences</b>	<b>“What we learn from Computer Games”, JP Gee</b>	<b>“Building Learning Power”, Guy Claxton</b>
Organizational Awareness: The ability to recognize the power relationships in organizations.	Seeing interrelationships Reading in context Doing, thinking, strategising	Noticing, distilling, making links
Personal Motivation: The will to succeed and offer service.	mastering game language Putting in effort because they care Watching their own behaviour Being reward for achievement	Absorption, resilience, perseverance
Relationship Building: The ability to build and maintain personal networks.	Sharing with other players Helping others and modifying games, in addition to just playing Being part of the game world	Reciprocity, interdependence, collaboration, empathy and listening, imitation
Results Orientation: The ability to set performance objectives and measures.	Being encouraged to practice	Planning, collaborating, capitalising

<b>Play 4 Guidance Survey Competences</b>	<b>“What we learn from Computer Games”, JP Gee</b>	<b>“Building Learning Power”, Guy Claxton</b>
Self-Confidence: The ability to express oneself in a hostile situation.		Resilience, resourcefulness, reflectiveness
Self-Control: The ability to manage one’s emotions under pressure or temptation.		Absorption, managing distractions, perseverance, meta learning
Team Leadership: The ability to create a favorable environment and mobilize people to succeed.	Combining multiple identities Helping others and modifying games, in addition to just playing	reciprocity, interdependence, collaboration, empathy and listening, capitalising, imitation
Verbal and Written Communication: The ability to speak and write satisfactorily.		
	Practice in a simplified setting	

<b>Play 4 Guidance Survey</b>	<b>“What we learn from Computer Games”, JP Gee</b>	<b>“Building Learning Power”, Guy Claxton</b>
	Repeating until you get better	
	Being lead from easy problems to harder ones	
	Thinking about Games and their culture	

There is one major exception in the key literature which is not easily represented by the table as presented. This is the work of the Epistemic Games group working in U Wisconsin with Prof David W Shaffer. Shaffer and his co-workers have developed a series of computer-mediated scenarios where students act out roles in professions with a visible epistemic structure - journalism, scientist, town planner, business man etc. The games encourage the learner to “behave” in role within the epistemic frames of those roles. Rich assessments of performance are being developed. At the highest level of abstraction these assessments focus on making the right decisions based on the evidence gathered. Thus gathering and judging evidence and then solving a problem based on the evidence is their way forward.

The position is best described in these quotations taken from a paper: Epistemic Networks for Epistemic Commitments (Knight et al, 2014):

“We thus recast these two positions such that our focus is on:

1. *Which sources of information are selected* – comprised of credibility decisions (from corroboration of information across sources, to trust in the authoritativeness of sources)
2. *How information is used* (in action – to justify claims, to make decisions) – comprised of justifications and source use (from dialogic approaches using talk of an exploratory nature, to attempts to directly approach questions by matching information to answers)
3. *How links between information are created (or not)* – comprised of claims, (explicitly in language and through structured environments, as well as implicitly through search patterns) made around connectedness of concepts (from a holistic to a piecemeal perspective of knowledge) “

and, later in the same subsection headed “**A Proposal for Epistemic Commitments** “ they provide some illustration of the acts that exemplify the epistemic behaviour:

1. *Source selection*, the corroboration of information across opened links, and the types of links repeatedly visited (e.g. use of authoritative sites such as ‘BBC’, repeated use of top links in search engine results pages, use of source metadata in the justificatory framework below).
2. *The type of justificatory framework used*, the assertion of information (perhaps closely related to a style of search which emphasizes precision of information with little consideration to its wider impact) versus reasoning and understanding activities (closely related to exploratory dialogue)
3. *The sorts of connections made* by students between concepts in their dialogue and document creation, and in the ways that users build links between information in their search patterns (building on search terms by rephrasing and appending new query terms, following internal links, and using terms from opened sources to find new ones all imply some commitment to holistic perspectives on knowledge).



## 02: Literature Review

This model thus describes both a conceptual and practical means to explore epistemic commitments in information seeking environments, and will be the model adopted in this work.

Clearly an approach which tries to detail behaviour of “professionals” - such as we are attempting to do benefits from addressing some of the ideas followed by the Epistemic Games group. However it is difficult to combine this approach with a list of competences.