The Motivational Competence Developing Game Framework

Linda Dowidat, Johannes A. König, Martin R. Wolf

Lab. for IT Organization & Management, FH Aachen - University of Applied Sciences.

Abstract

Competence Developing Games (CDGs) are a new concept of how to think about games with serious intentions. In order to emphasize on this topic, a new framework has been developed. It basically relies on learning and motivation theories. This 'motivational Competence Developing Game Framework' demonstrates how it is possible to use these theories in a CDG development process. The theoretical derivation and use of the framework is explained in this paper.

1 Introduction

The importance of games with a serious purpose increased during the last years. There are many different kinds of games (serious games, business simulations, gamification, etc.) with a serious intention. However, from a scientific point of view, it seems advantageous to evaluate the different kinds of games with a unified point of view. Accordingly, the umbrella term Competence Developing Game was introduced last year. "A Competence Developing Game (CDG), is a game that has the primary purpose to teach knowledge, skills, and personal, social and/or methodological abilities, in work or study situations and in professional and personal development of the game player, by retaining the motivation of a gaming situation" (König & Wolf, 2016a). Games following this definition have in common the usage of the motivation of a play situation, to encourage people to achieve a serious learning goal. The CDG definition does not restrict to a specific game kind. On the one hand a CDG can be implemented as serious game using a computer, a game console, a smartphone or similar. One the other hand it can be realized as a board game with pawns, boards or a deck. Further a CDG can be a business simulation that uses board game or video game elements in a professional development context or it can be any different conceivable kind of game (no matter whether digital, analog or mixed) that matches the CDG definition: Be any kind of game and use the game motivation for a serious topic. For all games matching these requirements, the Pyramid Assessment Framework for 'Competence Developing Games' provides a standardized and comparable way to evaluate all different kinds of games under the CDG umbrella (König & Wolf, 2016b) in only seven assessment steps ('Problem' → 'Learning Goal' → 'Story & Pedagogy' → 'Game Design & Aesthetics' → 'Experience' → 'Aftereffect' → 'Impact') (König & Wolf, 2016c). The next logical task is to explore a practical and quality assured way to develop CDGs because current developing strategies are designed for one special game kind. There is e.g. no developing strategy that is suitable for both: digital and analog games.

Veröffentlicht durch die Gesellschaft für Informatik e. V. 2017 in
M. Burghardt, R. Wimmer, C. Wolff, C. Womser-Hacker (Hrsg.):
Mensch und Computer 2017 – Tagungsband, 10.–13. September 2017, Regensburg.
 https://doi.org/10.18420/muc2017-mci-0130

But such a developing strategy is needed to find the most promising game kind for a particular serious topic. The first step of finding such a generic framework is introduced in this paper.

CDGs can be used for different purposes like adult education in companies or in private situations, for child education, education for handicapped people, etc. A common reason for companies not to use these educational possibilities are lacking time capacities due to the prior tasks. Of course, with educational efforts for children diverging challenges arise. Instead, a lot of other challenges arise. CDGs for handicapped people, on the other hand, show complete different reasons concerning the question whether they are accepted or not. These considerations show that the quality of a CDG depends among other on its environment (place & people) in which the game takes place.

So far, there is no structured method or framework that supports the CDG developer to include the game environment into the developing process. But there is a large amount of learning and motivation theories that have the potential to support the CDG development. Grund collects this kind of theories in his literature review from 2015. He identified six different learning and motivation theories that are mentioned more than once (Grund, 2015). The main idea behind this paper is to pick up these theories and make them applicable during the CDG developing process under consideration of the future CDG environment. The resulting framework is called 'The motivational Competence Developing Game Framework' (mCDG-Framework).

2 Integration of Motivation and Learning Theories in a CDG Context

During his research, Grund used the search terms "serious gaming", "gamification" and "games with a purpose". All in all, he found 28 relevant theories. The focus lay on the six theories mentioned more than once, which were also the most recognized theories: "Flowtheory of Motivation", "Self-determination Theory", "Experienced-based learning Theory", "Goal-Setting Theory", "Bloom's Taxonomy" and the "Constructivist Learning Theory" (Grund, 2015). The term 'Competence Developing Game' already recognizes that the main purpose of such games has to lay in teaching competences. The CDG definition uses the competence definition from the European University Continuing Education Network (EUCEN): "'competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development" (EUCEN, 2009). Another explanation of the term competence is provided by Weibler. He describes that competence means attaching knowledge and action to become capable of acting. Weibler believes that competences are acquired in special situations with specific tasks, activities, and requirements (Weibler, 2012). These two definitions feel quite different to the reader but a detailed view shows that they are not inconsistent with each other. The EUCEN definition focuses on the term's meaning, while Weiblers definition focuses on how to get a new competence. Upon close observation, both definitions are widely overlapping with regard to their content: The EUCEN definition uses the wording 'proven ability' while Weibler speaks of 'becoming capable'. Overall both definitions describe the

same: skills and the power to use them. Interesting marginalia is that the EUCEN definition calls for a "proven ability".

Summarizing, the statements show that the idea of teaching competences by use of a game is not trivial because a pure knowledge transfer is not sufficient. It is necessary to teach the usage too. In order to achieve this by using the six theories, each of these theories needs different fulfillment requirements. If a game should use a theory it has to meet the specific theory requirements. Because of the highly complex nature of these requirements every requirement has a set of conditions. A CDG must fulfill these conditions in order to meet the theory requirements. However, even if a game designer knows which theory he wants to apply and even if she or he is aware of the fulfillment conditions, this does not mean that there will be a successful application in a game. There is still a gap between the conditions a game relies on and the CDG developing process. A tool is needed to close this gap. It should support a game designer to fulfill the conditions and further to consider whether the results of the tool application are as desired. For that kind of exercise, taking a (serious) game framework into account seems to be apparent. So far, the game research sector delivers a big variety of frameworks with different characteristics and applications. A closer look was taken into the following frameworks: (Mitgutsch & Alvaro, 2012), (Winn, 2009), (Kessels et al., 1996), (Annetta, 2010) and (Hunicke et al., 2004). Despite their differences, these frameworks still have in common that they include every aspect of a game during the framework usage. Thereby, most of these frameworks focus on only one special kind of game. The only exception is Hunicke's MDA-Framework. It is constructed for every kind of game and "attempts to bridge the gap between game design and development, game criticism, and technical game research" (Hunicke et al., 2004). By this, the MDA-Framework is ideally suited to support the developer in fulfilling a theory condition-set because the mCDG-Framework should support different game kinds too. Generally, the MDA-Framework is a formal approach to understand games. It is constructed as a tool to help scholars, researchers and (game) designers. The shortcut MDA stands for the main framework elements: Mechanics, Dynamics and Aesthetics. At the level of data representation and algorithms, Mechanics describe game components. Examples are actions, behaviors and control mechanisms facilitated to the player within a game context (Hunicke et al., 2004). Overall, mechanics support gameplay dynamics. Dynamic encompasses the outcomes of the Mechanics depending on players' inputs and outputs. In other words, Dynamic describes a game runtime behavior. Finally, Aesthetics determine emotions evoked in the player while interacting with the game (Hunicke et al., 2004).

The mCDG-Framework should help to fulfill the theory conditions in a first step and support the game developer to consider quickly whether the results are as desired. These two aspects are covered by the three MDA-Framework elements. The integration of the MDA-Framework in our mCDG-Framework requires the development of supportive procedures out of a Mechanics, Dynamics, and Aesthetics perspective. These procedures support a game designer to integrate relevant aspects of an education or motivation theory into a CDG. Back to the mCDG-Framework, this integration of relevant aspects can be achieved by fulfilling the condition-set of a theory. Further, a fulfilled condition-set implies an applied education or motivation theory. By that, theory requirements are met. Concluding the mCDG-Framework

is a chain consisting of four links: Procedure (M, D, A) -> Conditions -> Requirements -> Theory. Table 1 shows the structure of the mCDG-Framework.

Theory	Requirements	Conditions	Procedure
Theory Name	Theory Requirements	Conditions-Set	Procedure (M)(D)(A)

Table 1: Framework Structure

The fulfillment of this sequence allows a game designer to integrate a motivation and/or learning theory into a CDG, independently of the game kind. By that, the framework provides the possibility to transfer the supported learning or motivation theories into game mechanics. Yet, the framework does not offer the possibility to choose which theories are the best for a special purpose and how to combine different theories to one resulting mechanics concept. By that, the mCDG-Framework is a reference work providing food for thought and exemplary describing implementation strategies. However, competence acquisition through a game only happens if an appropriate combination of learning and motivation theories to one closed game takes place offering different possibilities to try various behaviors. So the mCDG-Framework supports only the first necessary step, it explains how to use a motivation or learning theory in a CDG context. The second equally important step, choosing suitable theories and combining these into one game mechanics, is not supported through the framework yet.

3 Derivation of the mCDG-Framework

3.1 mCDG-Framework Notation

The mCDG-Framework has different requirements and conditions. Conditions have different relations. Sometimes, conditions are assembled in a hierarchical structure and build on top of each other, sometimes conditions can be fulfilled up to a selected point, etc. These relations are visualized by using the logical (&&) AND and the logical (||) OR operator. The mCDG-Framework uses these logical operators combined with an arrow to visualize conditions in a hierarchical relationship. In this context, an &&-arrow indicates that all conditions have to be fulfilled in the presented sequence. On the other hand, an ||-arrow indicates conditions that build upon each other but allows a game designer to fulfill them up to a self-selected point. For a better notation understanding, table 2 shows an everyday example of the mCDG-Framework notation. To have a nice holiday, (1) you need to book the plane tickets first (1.1). This requires an identity card (1.1.1) and the provision of payment for the tickets (1.1.2). After arriving in your destination, you should entertain your kids (1.2). This requires entertaining activities like go swimming (1.2.1) or (not an exclusive or!) present a book (1.2.2). Afterwards, you can choose if you want to get a tan. If so, you can choose between just getting a tan (1.3) or getting a tan healthfully (1.4), or mix both possibilities. Choosing to get a tan healthfully for example requires to wear swimwear in a first step and to use sun blocker.

Theory	Requirements	Conditions
Theory: 1 nice Holiday	1.1: book a flight**(&&)**➔	1.1.1 show identity card **(&&)**
		1.1.2 pay the ticket
	1.2: entertain children**(||)**➔	1.2.1 go swimming **(||)**
		1.2.2 present a book
	1.3: get a tan somehow **(||)**	1.3.1: wear swimwear **(||)**➔
		1.3.2: use sunblocker
	1.4: get a tan healthfully	1.4.1: wear swimwear **(&&)**➔
		1.4.2: use sunblocker

Table 2: Relations Examples

3.2 mCDG Framework Components

The mCDG Framework includes seven different theories (six theories researched by Grund plus the "Three-store model" as cognitivism representative). The main purpose of the framework is to make these theories applicable during the CDG development process. Accordingly, it presents requirements, a corresponding condition-set and application supporting procedures. The whole mCDG-Framework takes 13 landscape pages plus an appendix. For this reason, it can neither be printed here completely nor explain the derivation of all 13 pages. What is offered is the whole framework free to download by launching the following link: http://www.itom.fh-aachen.de/mCDG/mCDG-Framework.pdf. However, the mCDG Framework components will be introduced (the motivation & learning theories). In the next section, the inclusion of theory 7 into the framework will be explained with an example.

Theory (1) 'Three-store model': The Three-store model is a cognitivism-based learning theory. Cognitivism arises from cognitive-psychology which implies that the human brain collects information, encodes information and finally further processes them (Jadin, 2013). Zimbardo and Gerrig explain this process by dividing human's memory in a sensory memory, a working memory, and a long-term memory (Zimbardo & Gerrig, 2004).

Theory (2) 'Bloom's Taxonomy of Educational Objectives': Bloom's Taxonomy is a framework for classifying learning result expectations placed on students depending on instruction. Bloom describes his taxonomy as a kind of measurement tool. He differentiates between six major categories in the cognitive domain: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation (Krathwohl, 2002).

Theory (3) 'Constructivist Learning theory: Constructivist learning assumes that learning happens through experience where experience includes perception and knowledge (Freyermuth et al., 2013). Siebert describes consequences that result from this assumption as a list of five learning types: learning through perturbation, learning as an experience of differences, learning as re-entry, learning as cognitive structurisation and learning as second order observation (Siebert, 1998).

Theory (4): 'Experienced-based learning theory': Experienced-based learning has similarities with constructivist theories but is more understood as a holistic approach. It describes the process of acquiring new knowledge as a combination of realization and transformation. Kolb's famous Experiential Learning Cycle describes four appropriate steps: Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation.

Two types of learners (doers and observers) have to be taken into account when paying attention to these four steps. For this reason, Kolb describes four learning styles derived by combining both learner types with his learning cycle: Accommodator, Diverger, Assimilator and Converger (Kolb, 1984).

Theory (5): 'Flow theory': The mental state of flow was discovered by Mihaly Csikszentmihalyi. He observed artists during their work and discovered a highly intensive and concentrated working behavior even if they were not rewarded for their activities. He concluded that the activity by itself creates an autonomous reward feeling to the artist. He defined the artist behavior as flow. Further he points out six factors that describe the experience of flow (Nakamura & Csikszentmihalyi, 2002): "Intense and focused concentration on the present moment", "Merging of action and awareness", "Loss of reflective self-consciousness", "A sense that one can control one's actions", "Distortion of temporal experience (… time has passed faster than normal)" and "Experience of the activity as intrinsically rewarding, such that often the end goal is just an excuse for the process" (Nakamura & Csikszentmihalyi, 2002). The flow theory is the first motivation theory used in the mCDG-Framework.

Theory (6) 'Self-Determination Theory': The main self-determination theory (short: SDT) aspects are based on motivation and personality. This basically makes this theory a motivation theory. Following the SDT theory concept, a control of human behavior occurs through the concept of intentionality. This means that human beings are always motivated when they want to achieve something - so to chase an explicit purpose with an appropriate behavior. In opposition to cognitive motivation theories (e.g. the Goal-Setting Theory), SDT considers motivation as a qualitative factor and does not differentiate between being motivated and being unmotivated. This kind of differentiation occurs through the level of humans' self-determination. If the freedom of action increases (mentally and psychologically), self-determined acting will increase too (Deci & Ryan, 1993).

Theory (7): 'The Goal-Setting Theory': The main Goal Setting Theory assumption is that conscious goals force activities. Locke and Latham have proven that persons forced to achieve challenging goals deal with a more extensive amount of work than persons with unspecific and non-challenging goals. They summarized this discovery in six essential elements structured in a High-Performance Cycle (Locke & Latham, 2002).

3.3 mCDG Framework Derivation Examples

In the following, theory seven 'Goal Setting' will exemplary introduce how the mCDG-Framework was derived. For a better understanding of the derivation process the THEORY'S NAME will be printed in capital letters, *Requirements* in italic letters and **Conditions** in bold letters. However, to comprehend the following explanations, it is necessary to open the framework by launching the following link: http://www.itom.fh-aachen.de/mCDG/mCDG-Framework.pdf.

The GOAL SETTING THORY was introduced by Locke and Latham. They developed the so called High Performance Cycle. The cycle shows that (human) performance is a result of demands (due to challenging goals), moderators and mediators. These three elements are

summarized by the mCDG-Framework requirement to set specific and challenging goals (7.1). Further Locke and Latham assume (in their circle) a high level of satisfaction coming from the shown performance. Finally, this feeling of satisfaction results in an increased will to accept future challenges (Locke & Latham, 2002). However, they identify four basic mediators: Choice/Direction, Effort, Persistence, and Strategies. Referencing to the high-performance cycle, these mediators have a direct input to the shown performance and by that the power to improve it (Locke & Latham, 2002). To achieve this, it is necessary to canalize attention and effort in one direction and fade out irrelevant information to achieve sophisticated and specific goals (7.1.1). Furthermore, goals serve as a driving force. Higher goals result in a higher effort (Locke & Latham, 2002). It is therefore recommended to cause exceptional effort to achieve sophisticated and specific goals (7.1.2). Also, persistence benefits from challenging goals (Locke & Latham, 2002) so that there is a need to generate endurance to achieve sophisticated and specific goals (7.1.3). Achieving challenging goals requires a lot of personal time and effort. A person will only show the willingness to invest the needed activities if she or he believes that the goal is achievable. After all, goals are also able to (indirectly) influence activities if they cause excitement, discoveries, and knowledge. This behavior often results in a task-specific strategy development (Locke & Latham, 2002). Thus, facilitating task-specific strategies to achieve sophisticated and specific goals (7.1.4) is a requested condition. Referring again to the high-performance cycle, also moderators influence human performance in a direct way. Locke and Latham identify the five moderators: Goal Commitment, Goal Importance, Self-Efficacy, Feedback, and Task Complexity. The first moderator is the goal commitment because the goal performance relationship has its maximum always when persons accept their individual goals and feel a commitment for them (Locke & Latham, 2002). Therefore, it is recommended to promote goal commitment to achieve sophisticated and specific goals (7.1.5). Furthermore, goal commitment is positively influenced by goal importance and self-efficacy. Importance can be strengthened, e. g. due to public announcements, superior's support, monetary stimulations or through self-chosen goals (Locke & Latham, 2002). Whichever method is chosen, promoting goal relevance to achieve sophisticated and specific goals (7.1.6) is appropriate. Leaders can increase it by ensuring adequate training, providing success experience, finding personality matching role models and communicate in a persuasive way to express a person's confidence in his or her skills needed to achieve the goal (Locke & Latham, 2002). Promoting self-efficacy to achieve sophisticated and specific goals (7.1.7) is the desired approach. To facilitate an effective way of goal reaching, one needs summarized feedback that allows him or her to evaluate the progress and the progress speed. If it turns out that their effectivity or efficiency is too low they will begin to increase their activities or to figure out a new strategy (Locke & Latham, 2002). Thus, implementing feedback to achieve sophisticated and specific goals (7.1.8) is the next condition. Every person has different individual skills restricting task processing for a specific goal. For that reason, it is essential to customize task complexity in order to achieve sophisticated and specific goals (Locke & Latham, 2002) (7.1.9).

At this point, only one procedure will be looked at: the procedure for the condition 7.1.1. To provide a balanced goal setting (not too challenging and not too easy), it is necessary to implement all conditions. This is due to the fact that the conditions are derived from Locke and Latham's Mediators and Moderators and both aspects have, as shown in the High-

Performance Cycle, a direct input to the human performance. Therefore, it is not recommended to implement only a condition subset. This relationship is marked in the mCDG-Framework with the (&&) notation. The main idea behind point 7.1.1 is to get the player focused on the (serious) game goals. To achieve that, the (m)echanic should create appropriate tasks that drive attention in one direction and establish an interaction space where focus is clearly outlined. During such tasks, a (d)ynamic should appear in which the players are focused. The game designer should check whether it is so. Finally, the game (a)esthetic should check whether the player is so strongly focused that a strong sensation of playing occurs.

4 mCDG-Framework Application

This chapter will show how to work with the mCDG-Framework during the game developing process. Herrmanny and Schmidt introduced a user-centered game design procedure model for developing playful software applications for businesses in 2014 (Hermanny & Schmidt, 2014). There, the procedure model is a great way to develop such applications. Figure 1 shows the whole procedure model and marks the steps in the game development process where the mCDG-Framework should be considered.

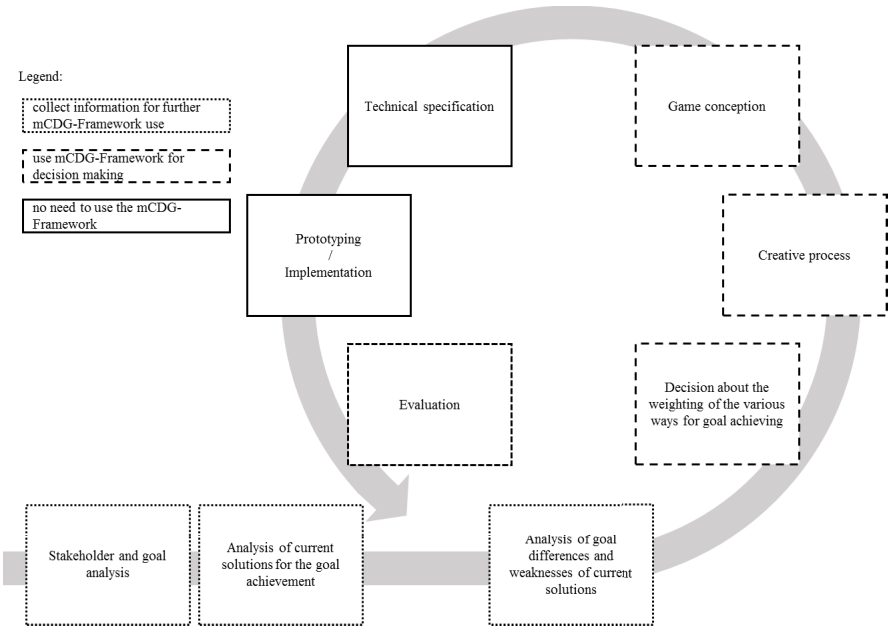

Figure 1: How to use the mCDG-Framework (according to Herrmanny & Schmidt, 2014)

To give an impression of how to apply the framework, condition 2.1.1 and 7.1.1. will be used. Further, a short case study for a continuous example of the framework use is needed: The

whole framework was developed within the research project GHOST. This research project is funded by the German Federal Ministry of Education and Research (BMBF). GHOST is a synonym for "Gamified Hacking Offence Simulation-based Training". The project scope is the development of a CDG that sensitizes non-IT employees in IT-Security topics. In detail, employees should build awareness of typical IT-Security traps and how to avoid them. Examples for such traps are: Use of flash drives of unknown origin, open phishing mails (e. g. ransomware), forget to lock the computer screen, use of unsafe passwords, forget to install updates, etc.). For the following example, it is necessary to make unproven assumptions for simplification. In a real mCDG-Framework application, it would be necessary to prove assumptions for sophisticated result. The first step is to perform (through the game developer) a "Stakeholder and Goal Analysis". Of course, there is a big diversity of people who are interested or involved in such a project. But for simplification, it is assumed that there are three important groups.

The first important stakeholder is the public institution that supports the project. The concrete goal of this cooperation is a CDG for IT Security Sensitization. Therefore, a game with single and multiplayer aspects is needed to satisfy the nature of the serious topic. The second important stakeholders are the managers who have the freedom of choice whether they use our training concept or a competitor's one. One of the main reasons against an employee training is the consumed time. Thus, a concept where employees can play self-timed as far as possible was needed. The third important stakeholder group are the game players. GHOST is aimed for every non-IT office employee. It was assumed that their basic computer knowledge fits the requirements of an office career. But it cannot be assumed that all employees have computer game experience. A more realistic assumption is that most of them have board game experience. Consequently, two things can be concluded: first, there was need for a game with an easy usage and intuitive handling. Second, a game mechanic that is more orientated on board games than on classic video games was required. To assure these stakeholder requirements, it was decided to develop the CDG as a video game because a video game provides the opportunity for single and multiplayer gaming (serious topic nature). Further, a round-based game design (like in board games) will be used. It will offer single and multiplayer rounds. By that, only the multiplayer rounds require a global time schedule. Employees can time their single player rounds by themselves. To keep the game control as simple as possible, the CDG will be developed as a tablet game with a one-figure touch-control supported by context sensitive menus. The game players do not have to control a camera, they do not have to learn menu structures, and they do not have to learn how to move their avatar with various buttons or a mouse. The second aspect of step one is to perform a goal analysis. Normally, an elaboration of all serious CDG goals is needed. In this paper, one of them will be picked up: To teach people the competence to identify phishing emails. Step two and three are to analyze current solutions. The main idea behind these tasks is to avoid the mistakes of other solutions and to make sure that there is a need for the own one. There are CDGs with an IT-Security scope but this kind of applications addresses mostly administrators. Furthermore, a lot of these applications lack motivating game design. The next three steps include different game design decisions which are highly influenced by the mCDG-Framework (in form of the mechanic procedures). This example has only one goal so – in this case – there is no need for a goal priority decision. But it is recommended to use theory 2: Bloom's Taxonomy to find a

sophisticated players' competence goal. The level 'apply' seems appropriate because a pure 'remember' or a pure 'understanding' is insufficient to identify phishing emails. The employee not only has to remember the rules but he needs to understand them. Based thereon, he can learn to apply his knowledge to identify phishing emails. However, as shown in the mCDG-Framework, it is necessary to fulfill 2.2.3 for the level 'apply'. Because of the (||)➔ connection the steps 2.2.2 and 2.2.1 have to be taken into account too. The mechanic of 2.2.1 recommends to 'create objects / tasks of same content or rather incentives invoking newly introduced contents'. This can be achieved by presenting identical phishing signal-words and normal words repeatedly to the player with the task to identify the 'bad' keywords. A possible incentive for this activity could be the collection of points related with a point collection competition. After some time, the player will remember the 'bad' words. In 2.2.2 it is described to 'create tasks and context where new content can be interpreted, exemplified, classified, summarized, inferred, compared and explained autonomously'. Creating a task with these characteristics can be accomplished by mixing the well-known keywords with new but similar keywords. This is acceptable as long as the player identifies new keywords at the first try. The 2.2.3 request is to 'create tasks, where new content has to be executed and implemented'. Fulfilling this can be done following well known keywords and new keywords to formulate complete email subject lines. The task of the player is to distinguish a phishing subject line from a harmless one. The last theory example will be theory 7 respectively 7.1.1. Due to the mechanics, the designer should 'create tasks which drive attention in one direction and an interaction space where focus is clearly outlined'. Driving the attention to the game can be achieved by implying a suitable amount of pressure to the game player. This can be done by setting a countdown clock for every 'good email' or 'bad email' decision. With the player's skills increasing, the countdown can be reduced. The step 'Evaluation' is the last step influenced by the mCDG-Framework. Every procedure delivers a dynamic and aesthetic component. These components are designed to prove whether the mechanics work as planned. Therefore, it is obvious to perform these during the evaluation process. As seen in figure 1, the 'Evaluation' is a part of the game development iterations. Thus, the proof whether the designed mechanics operate as required is integrated in the development process. The necessary test steps are delivered by the mCDG-Framework (dynamic & aesthetic) as well. However, after the development process, the evaluation of the game in its entirety should be performed with the pyramid framework for competence developing games (cf. König & Wolf, 2016b). This provides the possibility to assure that the complete game works as required in every aspect.

5 Conclusion and Future Work

There is a big variety of motivation and learning frameworks. As shown in this paper, it is possible and useful to take these theories into account. Using these theories enhances the CDG quality in both aspects of learning and motivation. The mCDG-Framework demonstrates a first step on how to use it in practice by including the framework in a procedure model for the development of playful software. Nevertheless, it is still difficult to use the framework due to its large range. Not every theory is useful for every kind of CDG and sometimes it is necessary to use a collection of theories in a specific order. Further work should explore ways to support

a game designer to use the mCDG-Framework. From today's view, it seems desirable to deliver an entirely new CDG-Development process which includes the mCDG-Framework in a suitable manner. These could be the next step for a higher CDG quality level.

References

Annetta, L. A. (2010). The "I's" have it: A framework for serious educational game design. In Gerianne, A.: *Review of General Psychology, Special Issue: Video Games: Old Fears and New Directions, 14*(2), 105-112.

Deci, E. L. & Ryan, R. M. (1993). Die Selbstbestimmungstheorie der Motivation und ihre Bedeutung für die Pädagogik. *Zeitschrift für Pädagogik*, *39*(2), 223-238.

EUCEN (2009). *European Universities Continuing Education Network*. Retrieved from: http://www.eucen.eu/EQFpro/GeneralDocs/FilesFeb09/GLOSARY.pdf.

Freyermuth, G. S., Gotto, L. & Wallenfels, F. (2013). *Serious Games, Exergames, Exerlearning. Zur Transmedialisierung und Gamification des Wissenstransfers*. Bielefeld: Transcript.

Grund. C. K. (2015). How games and game elements facilitate learning and motivation: A literature review. In Cunningham, D., Hofstedt, P., Meer, K., Schmitt, I. (eds.): *Proceedings Informatik 2015*. Bonn: Gesellschaft für Informatik, pp. 1279-1293.

Jadin, T. (2013). Multimedia und Gedächtnis. Lehrbuch für Lernen und Lehren mit Technologien. In Ebner, M. & Schön, S. (eds.): *Lehrbuch für Leben und Lernen mit Technologien*. *2nd Edition*. L3T.

Herrmanny, K. & Schmidt, R. (2014). Ein Vorgehensmodell zur Entwicklung von Gameful Design für Unternehmen. In Butz, A., Koch, M. & Schlichter, J. (eds.): *Mensch & Computer 2014 – Workshopband*. Berlin: De Gruyter, pp. 369–377.

Hunicke, R., Leblanc, M. & Zubek, R. (2004). MDA: a formal approach to game design and game research. *Proceedings of the Challenges in Games AI Workshop*, *Nineteenth National Conference of Artificial Intelligence* 2004.

Kessels, J. W. M., Keursten, P. & Smit, C. A. (1996). The eight field instrument: analysis framework for training effects. In Kessels, J. W. M. & Smit, C. A.: *The Learning Company*.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, N.J: Prentice-Hall.

König, J. A. & Wolf, M. R., (2016a). A New Definition of Competence Developing Games. In *Proceedings of the Ninth International Conference on Advances in Computer-Human Interactions* (ACHI 2016). Venice (Italy): ThinkMind Digital Library, pp. 95-97.

König, J. A. & Wolf, M. R. (2016b). The Pyramid Assessment Framework for 'Competence Developing Games'. In *HCI International 2016 – Posters' Extended Abstracts, 18th International Conference on Human-Computer Interaction* (HCI International 2016). Toronto (Canada): Springer, pp. 232-237.

König, J. A. & Wolf, M. R. (2016c). The Pyramid Assessment Framework for 'Competence Developing Games'. Retrieved from: http://www.itom.fh-aachen.de/images/pdf/Plakat_Toronto_web.pdf.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into practice, 41*(4), 212-218.

Locke, E. A. & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 57*(9), 705–717.

Mitgutsch, K. & Alvarado, N. (2012). Purposeful by design? A serious game design assessment framework. In *Proceedings of the International Conference on the Foundations of Digital Games*. Raleigh, North Carolina (USA), pp. 121-128.

Nakamura, J. & Csikszentmihalyi, M. (2002). The Concept of Flow. In Snyder, C. R. & Lopez, S. J. (eds.): *Handbook of positive psychology*. Oxford (UK): Oxford University Press, pp. 89–105.

Siebert, H. (1998). *Konstruktivismus: Konsequenzen für Bildungsmanagement und Seminargestaltung*. *DIE-Materialien für Erwachsenenbildung*. Frankfurt am Main: DIE.

Weibler, J. (2012). *Personalführung*. München: Verlag Franz Vahlen.

Winn, B. M. (2009). The Design, Play, and Experience Framework. In Ferdig, R. E. (ed.): *Handbook of Research on Effective Electronic Gaming in Education*. *3rd Edition.* Hershey, PA: IGI Global, pp. 1010-1024.

Zimbardo, P. G. & Gerrig, R. J. (2004). *Psychologie*. *16th updated Edition*. München: Pearson Studium.