

Game-Based Teaching – Dimensions of Analysis

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Abstract: Games are often classified as if they were entities with only objective characteristics. Games thus seem to consist of rules, goals, options etc. However these characteristics do not make sense independently from playing persons. The player's perception of the game is rather added as an external super-characteristic. Particularly concerning educational games this approach is not satisfactory. The focus on learning requires even stronger to take account of the player/learner and the kind of his immersion into the game. There are of course less objectivist approaches to games which differentiate games according the basic playful experiences they provide. Differentiations are also not sufficient to analyze games regarding the implied learning processes. Thus it is necessary to find an integrative way to describe games between the basic affective/motivational experiences they provide, their seemingly objective outlooks, and their educational function. For this purpose we distinguish four dimensions of meaningful interaction with games: fact, time, social and education. The fact dimension of interaction relates to the 'objective' characteristics of the game, i.e. its rules, the roles, goals etc. This dimension includes learning because game experience is dependent on the level of learning/understanding of the rules etc. The time dimension relates to temporal aspects like the representation or story or an action in a game, which gives a certain meaning to roles, goals etc. To understand this meaning cultural/social learning is involved. The dimension of social interaction implies where, when, how ... to cooperate or to compete with potential other players, i.e. processes and decisions which are cognitively demanding. Concerning educational games there is a crucial fourth dimension which has to be taken into account: The educational dimension of the transfer from inside of the game to its outside. What is transferred (skills, knowledge, social competences) is part of the game and then of the outside. However in relation to this fourth dimension there is also an occasional paradox which refers to the possible contradiction of the two goals inherent in educational games: playing and learning. The player/learner knows that he ought to learn while playing or vice versa.

Keywords: Game based learning, game analysis, game design, play anthropology

1. Introduction

In 2008 the authors started to develop an educational game funded by the Lifelong Learning Program of the European Union. This game ought to foster entrepreneurial attitudes (not only restricted to business contexts but also to the general aspect of taking life into one's own hand). The project or working title is 'SEE A Game – Stimulate European Entrepreneurial Attitudes Game' (<http://www.seeagame.eu>). Our basic didactical approach includes on one side the identification of the relevant attitudes (and competences) for successful entrepreneurship and the assessment whether and how these attitudes (and competences) are trainable as well as on the other side the analysis of the educational effectiveness of games (i.e. not only business games). On this ground we construe the general framework for the intended game.

While reflecting on the educational effectiveness of games from a didactic point of view we found, first, that there are many ways to classify games and their educationally relevant elements. A second problem we encountered was that it is still a desideratum of educational game studies "to know what features of games correlate with educational effectiveness." (Randel et al. 1992; cf. also Fletcher 1971, Bredemeir/Greenblat 1981, Garzotto 2007, Wilson et al. 2009) In general "the empirical research on the effectiveness of instructional games is fragmented. ... The research literature is also filled with ill defined terms, and plagued with methodological flaws." (Hays 2005) Accordingly there is scarce empirical evidence regarding significant relations between game attributes and learning outcomes. If there is some evidence it shows mostly a neutral relation. In spite of the scarce research literature and some skepticism regarding the educational effects of games it can however be stated, that games can have at least some attitudinal learning effects. Among affective learning outcomes mainly 'motivation' and 'attitudinal valuing' show some positive effect (Wilson et al. 2009). Also the research review done by Greenblatt (1981) some empirical support could be found for claims that games improve learner motivation and interest. Hence playing games can increase learning motivation. "It has been shown that aspects of games, such as learner control and realism, led to more positive attitudes toward learning versus traditional training methods." (Wilson et al. 2009) Another review came to the same conclusion: "In 12 of 14 studies ... students reported more interest in simulation and game activities than in more conventional classroom activities." (Randel et al. 1992) Particularly the element of 'challenge' inherent in games leads to higher motivation (Wilson et al. 2009). What is however more important than pure learning motivation: further evidence exists that games can

change learners' attitudes about the subject matter – however not always in the intended direction, i.e. it can also harm the attitude in regard of the intended learning target (Greenblatt 1981: 149). Also the relation between attributes and outcomes is highly context (or game) dependent.

Against this backdrop the remainder of this paper presents our first tentative steps in this scientific field.

2. Analysis of educational games

There are many ways to classify games in general and educational games in particular. Many of these classifications try to view games as an objective entity with objective characteristics (e.g. Prensky 2007: 117ff; for an overview Garris/Ahlers 2001 or Salen/Zimmerman 2004). Usual definitions look like that: "A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome." (Salen, Zimmerman 2004: 80) Or: "A game is an artificially constructed, competitive activity with a specific goal, a set of rules and constraints that is located in a specific context." (Hays 2005: 15) The play thus seems to consist of rules, goals, options, conflicts etc. There is even an approach called 'game-ontology', which targets at a hierarchical classification of games. The top-level consists of interface, rules, goals, entities, and entity manipulation (Zagal et al. 2005). Though these characteristics do not make any sense independent from acting/playing persons, the player's perception of the game is – if at all – rather added as a kind of external super-characteristic. Particularly in relation to educational games this approach is not satisfactory, because the focus on learning requires even stronger to take into account the player (or learner) as a subject perceiving and acting in a specific situation with his specific affective (and cognitive) conditions.

This calls for a deeper, more anthropological approach to playing educational games. From early childhood on people usually know exactly whether they are playing or not. There is a conscious change of frame of reference creating specific meanings for respective actions (Bateson 1972). One major (developmental) reason to play is to transfer competences, i.e. dispositions for actions, from one frame of reference to another, from inside of the play or game to the 'real' outside. The experience of playing a game (or something else) is thus fundamental for the determination of a game. A game that is not played is not a game. Whether something is really a game is dependent from one or more persons meaning to play it, i.e. making the specific change of frame of reference. In this respect game-based learning spaces also provide security by their specific not-real frame of reference. "Games can provide a training environment in which users can perform tasks without facing the real-world consequences of failure. Moreover, games that employ progressive difficulty levels allow the user to gain familiarity and build skills in complex or novel task environments in a graduated manner." (Garris et al. 2002: 453)

There are of course less objectivist approaches to games. Also in German we do not differentiate between play and game (both is 'Spiel'), but focus on the common playful or 'ludic' experience. However we do not consider this a cultural prejudice of ours as there are different similar approaches to analyze this experience. E.g., Suits (1978: 34ff) clearly states as four necessary elements of games: ends, means, rules and 'the lusory attitude'. Whereas he sees in games the use of rules which "prohibit more efficient in favour of less efficient means" (i.e. constitution another frame of reference), while this lusory attitude is necessary to accept these specific "constitutive rules" and give meaning to them. Also Caillois (1962) proposed a more phenomenological approach to playing differentiating it in accordance to the specific playful experiences it provides. As often cited, he differentiates 'mimicry' as plays of imitation and taking roles, 'agon' as games of competition, which are constituted and secured by rules, 'alea' as games of chance, and 'ilinx' as plays of vertigo, i.e. the mellow experience of oneself, mainly one's body. In regard of the intrinsically motivating characters of games Malone (1981) considers more personal elements of games: fantasy, curiosity, challenge and control. Obviously most given games relate to more than one of these dimensions.

Accordingly also educational games can include different affective or motivational dimensions – though concerning Caillois' differentiation mostly mimicry and agon – depending on the learning target. Such differentiation does however not sufficiently allow to analyze them regarding their way of structuring learning processes. In regard of the educational function these distinctions are too coarse and unspecific as they miss the specific aspect of transfer into the 'real' world. It is necessary to find an intermediate level between the basic emotional or motivational experiences, the outlook of games and their educational function. The problem is to find the level where the learning processes in games can be described.

3. Four dimensions of meaning in games

As we consider the relation of playing and learning a question of meaning we distinguish general dimensions of meaning for the analysis of game-based learning. In his advanced analysis of the generation of meaning Luhmann (1995: 75) distinguishes three fundamental dimensions: fact, time and social:

- the fact dimension relates to the difference of inside and outside. You can always proceed making meaning by relating something actual to something (more) inside or something (more) outside. Obviously this way of questioning generates things, structures, causal relation etc. Thus this dimension relates to the seemingly characteristics of the game, i.e. its rules, the possible roles, the given challenges, goals etc. Already this dimension includes learning because these characteristics need to be present in order to play the game. And game experience is dependent on the level of learning/understanding of the rules etc.
- the temporal dimension relates to the difference of past and future. You can always proceed by relating something to something before or after or respectively to something variable or constant. This dimension opens the cultural dimension of (inter)action and thus relates to the possible representation or story of the game, which is to be interpreted in relation to the cultural context and might give a certain meaning to roles, goals etc. (Particularly Huizinga 1944 pointed out that games and culture have a developmental interrelation.)
- the social dimension relates to the difference of ego and alter ego. You can always proceed by questioning whether something is the same for ego as for alter: do we mean the same, do we use the same frame of reference. So games form a specific – partly learning related – frame of reference. The frame of a specific game implies questions particularly like where, when, how ... to cooperate or to compete with potential other players.

Concerning educational games however a fourth dimension has to be taken into account, because learning transcends the frame of reference of a game. This makes learning such an essential part of playing:

- the educational dimension of playing relates to the difference of playing and learning. You can always proceed by relating some action/communication to fun or to usefulness. This dimension reflects the provision of skills, knowledge, social competences, attitudes etc. acquired while playing the game for real world usage.

4. The fact dimension

The fact dimension of interaction is closest to the mentioned objectivist definitions of games. Due to its causality structuring function this dimension – if its well structured – provides the possibility to experience autonomy and competence which are two fundamental aspects of intrinsic motivation (Deci/Ryan 1985; the third is connectedness, see below). Interestingly Gee considers learning as a 'lens' for the design of games in general, i.e. also for non-educational games. The built-in ways of how players learn to play a game is an important quality criteria for him (particularly in relation to commercial computer games): "... whether they know it or not, good game designers are practical theoreticians of learning, since – at a beginning or advanced level – what makes games deep is that players are exercising their learning muscles, though often without knowing it and without having to pay overt attention to the matter." (Gee 2004, cf. also Bopp 2006) The process of factual interaction with a game can thus be very complex and will include much learning.

Rules define the specific frame of reference of a game in which immersion (flow) is possible. The rules of a game however can be found on different levels (Salen/Zimmerman 2004). There are the 'operational rules', i.e. the literary rules of the game. These rules define the specific actions one can or has to take and to interact with other players. A main aspect of these rules is the determination of the specific goal or task, which makes the game. There also 'constitutive rules' which refer to the mathematical structure of the game. The sets of actions, options, consequences etc. can be abstracted from the operational rules and analyzed accordingly. This process is a learning process leading to mastery of the game. However there is also the third more general level of implicit rules, like e.g. fairness or possibly the will to learn, which guide the conduct of actions not fully defined by the operational rules. The question what is fair in which game relates directly to the dimension of social interaction and social learning in a game. Many simulation games e.g. in fields of politics, ecology etc. built on this aspect.

It has been pointed out that the goal is a crucial characteristic of a game, and that it has to be well defined in order to allow immersion (e.g. Garzotto 2007; Prensky 2007). It should not be too easy and it should not be too difficult, but “pleasantly frustrating” (Gee 2004) “Ideally, the optimal amount of challenge embedded in a game should create ‘motivational tension’. In other words, motivation is maintained by creating uncertainty about goal attainment.” (Wilson et al. 2009: 16) Accordingly in a learning game the issues of factual interaction should stimulate cognitive curiosity and provide constructive feedback so that the experience of autonomy and competence are possible.

We do not consider it practical to fully operationalize the rather abstract dimensions of meaning in regard of educational game design. However they might serve as an analytically guiding tool in the design process: does the game design provide enough meaning for playing and learning. E.g., in relation to our game we had to question ourselves if we are discussing rules etc. that require and foster specific entrepreneurial attitudes and competences. Without going into details it showed that from a didactic perspective the complex set of attitudes which makes up the entrepreneurial mindset cannot be reasonably integrated into one rule-goal set, i.e. it would have produced more dissonance than meaning. Due to that it was decided to develop two different game modules: one which is highly competitive and one which necessitates negotiation and (strategic) cooperation in the same business context (catering).

4.1 Temporal dimension

The temporal sequence of games, particularly educational ones, can tell a story or make reference to specific real world action with its temporal structure. Thus the rules, goals etc. of a game do not determine (the causal relationships and) the experience of the player completely. The structure of a conflict can be represented as a war or sports (... once upon a time ...) and the game experience of this conflict will change accordingly (cf. Salen/Zimmerman 2004) and in accordance with the background of the player. From this hermeneutic point of view the temporal dimension (of an interpretationally rich game) thus directly relates to cultural representations.

The concepts of narratology and ludology comprise the distinction between the story told and the rules defined in a game (Henriksen 2006). This distinction also relates to the distinction of cooperation and competition which is crucial for the social dimension of game interaction (see below). Competition will be rather found in a context of rules while cooperation often needs a richer context to allow for cooperative activities. The narratological approach can be used to provide facts, sequences, etc., in order to acquire specific information, showing specific skills for a specific context, improve declarative knowledge and reach the next level. With a focus on rules the ludological approach can be rather used to experience and to explore social or technological skills and processes and thus to show effective/efficient acting in the framework of a certain rule set based on strategic/social competences. For us this distinction was relevant in relation to different set of attitudes which can be addressed with such different approaches.

A game represents a cultural issue. Accordingly games are also rather culture and age specific. “Representation means that the game is about something. This can be abstract or concrete, direct or indirect.” (Prensky 2007) It can be fantastic or a simulation of a certain field of action in the real world. (The better the simulation however the more complex the game, the greater the danger that immersion will not be possible anymore.) This dimension thus provides meaning and a frame of reference for possible different learning targets. To know about the target group is thus crucial to successful game design. (Prensky 2007) Gee (2004) makes it a principle that “people learn skills, strategies, and ideas best when they see how they fit into an overall larger system to which they give meaning. In fact, any experience is enhanced when we understand how it fits into a larger meaningful whole.” Hence relevant content, i.e. the cognitive dimension of learning, can particularly be viewed in its relation to the general representation of the game. A good (educational) game design should be focused – particularly in relation to representation/content – in order to give fun and reduce distraction.

Two ways of how the content is related to the game and its representation can be distinguished. The endogenous approach which includes content elements directly into the game and which thus makes the content part of the immersive process. And the exogenous approach which differentiates between the content and engagement in the game, e.g. taking external content as means to proceed a certain step in the game (Henriksen 2006; these two approaches have also been called intrinsic and extrinsic, Prensky 2007).

As already mentioned the relevance of the temporal dimension for learning implies also the dependence on previous knowledge for the educational effectiveness of games. Bredemeier et al. (1982) found that a game designed to change college students' attitudes on dogmatism and ethnocentrism was effective when used in an anthropology class. However when it was used in a philosophy course did not result in the same degree of attitude change. We take this as a hint to consider this dimension seriously in relation to our aim of teaching certain attitudes with a game.

For our game modules the content was not of primary importance. However we use an overarching business context also to integrate some methodological skills (basic accounting, presentation, etc.). Due to our heterogeneous European target groups, which the members of our consortium are confronted with, we choose a context we expected everybody to know something about: catering – everybody has to eat and eating means something to everyone.

5. Social dimension

Learning itself has a social dimension which relates to playing. On the one hand the common change of frame of reference inherent in playing is an important anthropological issue which is present already in mammals as a signal to conspecifics in a context of learning (Bekoff 2002: 124ff); on the other hand playing is interrelated with learning to take roles in a complex way (Mead 1934: 149ff).

This also refers to the third of three reasons of the intrinsic motivation which all can be found in playing games: the feeling of social relatedness (Deci/Ryan 1985). This aspect also gives insight into the nature and development of social games. Before there were computer games solitaire-games formed a real exception. So it is not astonishing that “despite the [game] industry's initial (prenetworking) focus on single-player games or games played against the machine (an era on which we are still involved), just about all of today's computer games have become multiplayer in one form or another.” (Prensky 2007)

Playing a (social) game almost naturally creates the feeling of relatedness, of being part of a social group or community. These are features which also strengthen self-recognition and learning attitudes. So a game can “support means to discuss strategies and solutions with others, which is a way ‘to make thinking visible’ and to create a more tangible context for what has been learned, building the conditions for situated learning.” (Garzotto 2007).

As already mentioned there are different forms of social interaction which may promote the immersion into a game and the educational effectiveness of a game. The main spheres of social interaction in games are: in general connection, and specifically cooperation and competition (Garzotto 2007). To make cooperation in games useful for game experience and for learning it needs clear shared goals in the cooperative phases. The need for more than one person to be involved has to be obvious to the players, i.e. the mutual benefits of working together have to be visible. The cooperation should e.g. not affect too much the pace of the game; i.e. the need to cooperate should not force a suspension of other activities. The desire to compete with others is a very common impetus (that motivates individuals also to cooperate). It has already been remarked that challenge – which can be compared to the achievements of others – is one of the most effective game elements in relation to affective learning. This does not only apply to the winners, even – in a fair game – losers can uphold their enthusiasm for the game.

As already mentioned our two modules use different interaction patterns with specific aspects to learn. In the competitive part we want groups to compete for profitable ‘contracts’ with different attitudinal relevant specificities in different rounds. So we have relatedness in the groups and strict competition between them. Due to this set, there is common understanding of the forms of interaction and thus the motivational dimension is obvious. The interaction design in the negotiation module is more complex. The players are alone (depending on the group size they have however the opportunity to discuss their negotiation strategy with other players with same ‘role’). During negotiation they continually have to generate a common understanding of the way they are going to cooperate with the other players, i.e. they have to create their own (meaningful) field of action.

6. Educational dimension

Main aspects of the educational interaction dimension have partly been discussed already. It is the differentiation of the exogenous or endogenous relation of learning content and the game which reflects the specificity of the fourth sphere. This differentiation clearly shows the crucial issue of transfer

from inside to outside. Hence the meaning in this dimension is created due to its use outside the context of the game in regard to the learned skills, attitudes etc.

This conscious extra-ludic aim concerns the complex relation between immersion and reflection of the learning process. Particularly in more formal learning contexts reflection or debriefing is a salient part of game based teaching. While immersion is crucial for the inside game experience, reflection takes place at the outside in between or after a game (immersion can only be re-presented there).

For educational games both sides are essential, thus "rather than choosing between the two approaches, the game-design should be able to switch between them, thereby utilizing immersion and reflection in a fruitful combination. Game immersion should be used for staging a problem relevant to the participants, after which the problems are conveyed to the participants, who will then solve the problem." (Henriksen 2006) The specific phase of educational reflection after the game or between different turns is conceived as debriefing. Such a phase gives the learners the opportunity to reflect on their experience under the guidance of an instructor/teacher. It is particularly important to foster understanding of how the game experiences support the instructional objectives (Hays 2005).

For our game modules we will thus develop debriefing manuals for the trainers which will be specific for the different target groups. In regard to our general aim to foster entrepreneurial attitudes a main aspect of debriefing will be to provide transfer scenarios, including redirecting possible frustrations (of losers, of inefficient strategies etc.).

Depending on the course of the game the debriefing also has to discuss an occasional paradox inherent in this fourth dimension. There is a gaming-learning paradox which refers to the possible contradiction of the two goals inherent in educational games – seen from the player's/learner's perspective. Educational games are usually introduced as such. They might be used in the framework of formal learning or it might be written on their packing. Thus the player/learner knows that he ought to learn while playing or vice versa. "As we adapt games for serious purposes, we must be aware of this tension between the world of play and the world of work. Thus, in one sense, the term instructional game is an oxymoron. Game play is voluntary, nonproductive, and separate from the real world. Instruction or training is typically non-voluntary, undertaken to achieve certain learning outcomes, and related to life or work skills." (Garris et al. 2002) Thus, even if the game allows for playful immersion (which is of course the major problem of so called educational games) there will be an ambiguity whether the conceived goals of learning and playing do sufficiently coincide. Particularly a strong content-orientation might be detrimental to the goal-orientation of a game. "When looking at the current supply of educational games, most of these are based on an assumption that the mere exposure to educational material creates learning, framing the purpose of the game as keeping the participant occupied or entertained with the game." (Henriksen 2006)

7. Conclusion

The different spheres of meaning and especially the complex dialectics of the fourth dimension – always in danger of being detrimental to immersion, i.e. to the game itself – need thorough reflection during the development process of an educational game. In the further process of our project, the concrete game development and its evaluation, we further want to systematically reflect on educational game design and to further differentiate our analytical approach particularly in order to judge the educational effectiveness of game elements. "Because of its status as an emerging discipline, game design hasn't yet crystallized as a field of inquiry. ... Games are one of the most ancient forms of designed human interactivity, yet from a design perspective, we still don't really know what games are." (Salen/Zimmerman 2004: xv)

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