TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Computer Science Institute of Systems Architecture

Chair for Computer Networks

Diploma Thesis

Evaluating the Use of Gamification in Higher Education to Improve Students Engagement

submitted by

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DIPLOMA THESIS TASK ASSIGNMENT

TOPIC: Evaluating the Use of Gamification in Higher Education to improve Student Engagement

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GOAL

The general goal of higher education is to prepare students for employment with qualified demands; hence, the student should gain extensive knowledge in the chosen discipline. To fulfil the requirements the student needs to pass graduate lectures. In this static structure lies a problem, namely that most students are likely to be demotivated in the course of studying. They attend course after course and have to spend a lot of time afterwards to fully comprehend the lecture. Each semester results in exams for each of the courses attended, and they have to pass to further advance in their studies.

Most students are unable to comprehend every part of each lecture topic directly, resulting in a lot of questions. Some of these are hard to answer without the lecturers' help. Without accord amongst the students, this generates multiple instances of similar questions to be answered by the lecturers. This problem hardens with new generations of students asking the same questions with each new semester. This in return might demotivate the lecturers.

Addressing the above mentioned problems, the web application 'auditorium' was created and published at the Faculty of Computer Science of TU Dresden. 'auditorium' is a platform for questions and discussions with the focus on higher education and shall therefor establish the starting point for the thesis.

Application of gamification in higher education environments like 'auditorium' shall be investigated in order to maintain a motivated user group of students as well as lectures an third parties not directly involved in current lectures, e.g. alumni. In this sense, diverse gamification techniques must be investigated; for each technique the performance and acceptance amongst the users of 'auditorium' a compulsory measurement with qualified methods must be conducted. A comparison to the current state of 'auditorium' is mandatory.

A focus shall be set on the following gamification elements and techniques:
- points, badges and leader boards,
- quests for more interactive courses,
- progression and levelling to gain experience,
- rewards and achievements for motivational aspects, and
- privilege systems to unlock features for experienced and active users.

During the investigation of the before mentioned is conducted, additional features should be considered, e.g. ones that allow the users the collaborative creation of sets of question for learning.

During the processing of the thesis, the impact of gamification as a didactic technique on how to teach students to be more voluntary in their learning and helping activities should be constantly considered.

MAIN FOCI
- Selection of appropriate literature,
- brief overview of the scientific state of the art,
- investigation of different gamification techniques,
- implementation of a prototype within 'auditorium,'
- conception of suitable evaluation measures,
- evaluation of the results, and finally
- consideration of the impact on learning and sharing voluntariness.

Prof. Dr. rer. nat. habil. Dr. h. c. Alexander Schill
(responsible professor)

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Abstract

Using Gamification in applications can help to motivate users to engage more. This statement is the motivation in order to design, implement and deploy an achievement system into the online platform auditorium.

Beginning with refactoring auditorium, the second release provided a solid foundation in order to integrate a Gamification System. That system has been conceived based on the theoretical foundations laid out by previous researches and veteran game designers. After releasing the achievement system, a pilot-test has been used in order to provide useful data for the evaluation. The evaluation aimed to analyze the impact of Gamification in order to improve student's activity. This has been accomplished during the pilot-test period.

An enhancement in activity could be derived from given data. Due to some shortcomings and problems during the implementation, the author suggests to iteratively enhance the system by adjusting the current implementation and by adding or removing game elements to evaluate the individual impact.

In the context of learning and sharing voluntariness, the author concludes, that it is important to provide an environment where students can live up their sense of competence, autonomy and relatedness. Summarizing, auditorium can help to provide this kind of environment and it can help to shape the future of communication at university, in order to be more transparent in communication and altruistic towards students.

Introduction and Motivation

In 2011, the idea arose to create a platform where students can ask their open questions risen during the preparation of lectures or exams. After finishing the intermediate diploma, the author only had to pass a handful of oral examinations in order to obtain the authorization to write this thesis. The problem was that most of the author's friends did not learn at the same time for the same exams, which led him to learn by himself. Considering the solution for this problem was to build the online Q&A-platform auditorium, inspired by StackOverflow, the author often used to find solutions for programming issues.

During the summer semester of 2012, *auditorium*[1] has been created and released at the Faculty of Computer Science at the TU Dresden.

Asking, discussing and sharing knowledge are key parts of higher education. The challenge is to improve how communication works at the university. Students should gain extensive knowledge in chosen disciplines. Fulfilling this requirements the student needs to attend on lectures. Most students are unable to comprehend every part of each lecture topic by themselves, resulting in a lot of questions. Some of them may not be answerable without the lecturer's help. This may result in emails to the lecturer with the same questions repeatedly and the lecturer needs to answer similar questions individually. Solving this problem is the main objective of auditorium.

Now, more than two years later, a community has established to help students find answers to their questions or to announce important information. Nevertheless, auditorium shares a common problem of online communities:

> *In most online communities, 90% of users are lurkers who never contribute,*
> *9% of users contribute a little, and 1% of users account for almost all the action.*
> — (Nielsen, 2006)

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[1]auditorium `https://auditorium.inf.tu-dresden.de` (visited on 2014-03-03)

Introduction and Motivation

In order to solve this problem, game design elements and techniques are used to enhance user's motivation to participate more actively. This technique is called *Gamification*, "the use of game design elements in non-game contexts" (Deterding et al., 2011b). Since then, Gamification is now an established and widely used technique to enhance the user experience through *fun*. Fascinated by collecting points and earning badges, the author had the idea to enhance auditorium with game design elements. With this idea in mind, the author aims to evaluate the use of Gamification in higher education in order to improve students engagement exemplified by the online community of auditorium.

In short, this thesis aims to document the journey of planning and implementing a Gamification system into auditorium. To provide a golden thread and to assist the reader to fully understand the topic of this thesis, it is divided into levels. The goal of this approach is to guide the reader contextually from novice to mastery.

The reader will be guided through the thesis in eight levels: the first level, (*Level 1: Preliminaries*) helps to understand the foundations behind motivation and Gamification. After proceeding to the second level (*Level 2: Related Work*) the author gives an overview about related work in research and development. This in mind helps to understand the third level (*Level 3: Aims and Objectives*) where the objectives of the thesis were delineated. The journey of building and evaluating Gamification in the context of auditorium, the fourth level (*Level 4: Methodology*) provides an overview of the milestones. To understand the concept behind the system, the reader needs to progress to the fifth level (*Level 5: Concept*). This knowledge helps to understand the actual implementation, pictured in level six (*Level 6: Implementation*). To provide data for the discussion, the seventh level (*Level 7: Evaluation*) aims to evaluate the implementation of Gamification in auditorium. The last level on the journey summarizes important aspects of this thesis and evaluates the results in the context of learning and sharing voluntariness a suggestion for future work. After this brief introduction, the first level waits to be entered.

Level 1: Preliminaries

1.1 Intrinsic and Extrinsic Motivation

The first level aims to introduce the fundamental aspects behind Gamification. One crucial part is to understand what drives peoples motivation. Motivation in general means *to be moved to do something*. Each person is different in level and orientation of their motivation, whereas orientation might be a goal which evokes action. Ryan and Deci investigated the different types of motivation on different objectives that give rise to action within the Self-Determination Theory (SDT) (Ryan and Deci, 2000b). This section will introduce the different types of motivation inspired by Ryan and Deci, 2000a.

REGULATORY STYLES	Amotivation	Extrinsic Motivation				Intrinsic Motivation
		External regulation	Introjection	Identification	Integration	
ASSOCIATED PROCESSES	Perceived non-contingency Low perceived competence Nonrelevance Nonintentionality	Salience of extrinsic rewards or punishments Compliance / Reactance	Ego involvement Focus on approval from self or others	Conscious valuing of activity Self-endorsement of goals	Hierarchical synthesis of goals Congruence	Interest/ Enjoyment Inherent satisfaction
PERCEIVED LOCUS OF CAUSALITY	Impersonal	External	Somewhat External	Somewhat Internal	Internal	Internal

Figure 1.1 A taxonomy of motivation types — (Ryan and Deci, 2000a)

Researchers distinguish between three major types of motivation. Figure 1.1 gives an overview of all types delineated by Ryan and Deci. *A-motivation* represents the "state of lacking an intention to act." This state might be caused when an activity is not valued, or when the person does not feel competent enough to produce the desired outcome. A

person in contrast which is more likely to do something intended by external influence, is affected by external rewards. The opposite of extrinsic motivation is the *intrinsic motivation*; when a person meets this state the person is doing an activity for the inherent satisfaction. There is no external reward or influence which drives the person to accomplish the task (Ryan and Deci, 2000a).

The latter type of motivation is the most interesting type for educators because students mostly are not willing to accomplish tasks they have to do (Lee and Hammer, 2011). Therefor educators should try to help students satisfy their three basic psychological needs: *competence*, *autonomy* and *relatedness*, in order to support their intrinsic motivation. The following sections will describe what this means in detail.

1.1.1 Intrinsic Motivation

Intrinsic motivation can exist within and between individuals (for some activities), but not every person is intrinsically motivated for any particular task. As an example: students whom are interested in mathematics accomplish their homework because they can gain knowledge. Those students are motivated by the activity itself. In contrast other students whom are not interested in mathematics are doing their homework because they need to. Which lets the homework tend to either be an a-motivated or extrinsically motivated activity.

Individuals innate three primary psychological needs: *competence*, *autonomy* and *relatedness*. If an activity conduces at least one of the mentioned needs, the activity or task might be intrinsically motivating for the individual. Those three needs are the most important factors to consider when building a Gamification System.

As Werbach and Hunter write: "Games are perfect illustrations of the lessons of SDT" (Werbach and Hunter, 2012, p. 59). Games mostly satisfy the three basic needs: autonomy is satisfied because nobody forces players to play a game, a player can promote competence by accomplishing a mission by themselves and relatedness is satisfied by "sharing achievements with friends." (Werbach and Hunter, 2012, p.59) Those mentioned intrinsic motivators also being used in Gamification.

It is necessary to know which factors tend to either *undermine* or *facilitate* intrinsic motivation: virtual rewards are not inherently compelling, they might undermine intrinsic motivation, in its worst case resulting in a-motivation (Werbach and Hunter, 2012, p.

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60). When a player could gain bigger benefits for performing an activity it could cause less willing and worse performance than without the benefits (Werbach and Hunter, 2012, p.61). Kohn wrote a book about this topic "Punished by Rewards" in which she is discussing the phenomenon of external rewards in schools.

> *Whoever must play, cannot play.* — (James P. Carse)

Foremost contingent, tangible and expected extrinsic rewards damage intrinsic motivation and interesting tasks (Werbach and Hunter, 2012, p.60). The other way around, extrinsic rewards can also have a positive effect when people need to accomplish boring tasks (Werbach and Hunter, 2012, p.62).

Ryan and Deci introduced the Cognitive Evaluation Theory (CET) which is a sub-theory of SDT. The focus of the theory lies in specifying the "factors in social contexts that produce variability in intrinsic motivation" (Ryan and Deci, 2000a). The theory says that "interpersonal events and structures" can improve intrinsic motivation when the feeling of competence is conducted. Examples are *optimal challenges*, *effectance promoting feedback* or *freedom from demeaning evaluations*. But it is important to know that the feeling of competence will not enhance intrinsic motivation *unless* the feeling is followed by the sense of *autonomy*.

To enhance the intrinsic motivation individuals need to experience their competence and behavior as *self-determined*. Another factor to enhance intrinsic motivation is positive *performance-feedback*, whereas negative performance-feedback would cause reduction. Virtually every *expected tangible reward* causes reduction of intrinsic motivation. Even worse *non-tangibel threats* like *deadlines*, *competition pressure* or *directives* will be experienced as controlling which also causes undermined intrinsic motivation. Whereas *oportunities* and *choice* enhances it, by managing a "greater sense of autonomy" (Ryan and Deci, 2000a). Going further in detail would go beyond the scope of the thesis. More information about this topic can be found in the researches of Ryan and Deci.

1.1.2 Extrinsic Motivation

The opposite to intrinsic motivation is *extrinsic motivation*. Most activities are not intrinsically motivating. An individual is mostly extrinsically motivated to act. The previously mentioned SDT is an important theory to understand the different characteristics of extrinsic motivation. Additionally Ryan and Deci introduced the Organismic

Integration Theory (OIT) within the SDT to determine the different characteristics of extrinsic motivation and the factors which persuade promotion or hinderance of the regulation of internalization and integration.

> *Extrinsic motivation is a construct that pertains whenever an activity is done in order to attain some separable outcome.* — (Ryan and Deci, 2000a)

The biggest problem of education is that the most activities are not intrinsically interesting to the students. That is why it is important to investigate how a teacher can motivate students for doing the needed activities. The teacher needs to balance the external influence, so the student can learn to *value and self-regulate* the activities. And it is important that external pressure could lead to a-motivated students. SDT tries to propose a solution for the described problem. It analyses fostering "internalization and integration of values and behavioral regulations" (Ryan and Deci, 2000a). *Internalization* is the process of taking in a value or regulation and *integration* is the process by which individuals transform regulation into their own so that it will emanate from their sense of self.

Figure 1.1 shows different characteristics of extrinsic motivation: *external regulation*, *introjection*, *identification* and *integration*. Those different types of extrinsic motivation are described within the OIT (a sub-theory of SDT).

External regulation is the first type of extrinsic motivation. A person perceives the external regulation as controlling. The person does not take action by autonomy. The person takes action to gain an external reward or to avoid punishment.

Introjected regulation is the second type which also might be perceived as controlling. An action might be performed in order to enhance self-esteem. The introjected behavior is also not fully part of the person.

Identified regulation is more autonomous and self-determined. A person values an activity as important them self, because the person identifies them self with the activity. The locus of causality is partly internally.

Integrated regulation is most autonomous when the identified regulation is gathered by the person. The difference to intrinsic motivation is that the goal of the activity is somewhat instrumental.

As previously discussed, external regulation could provoke a perception of controlling; when this external regulation is not perceived as controlling, the person could experience the activity as intrinsically interesting and motivating. This could lead to an orientation shift related to the former externally regulated to a now somewhat intrinsically motivated activity. Nevertheless, a person could also shift their orientation the other way around to less intrinsically motivated. If a person perceives controlling, this could lead to a shift to external regulation.

> *The lesson for Gamification is simple: Don't mindlessly attach extrinsic motivators to activities that can be motivated using intrinsic regulators.* — **(Werbach and Hunter, 2012, p.62)**

Above and beyond the fact that autonomy should be supported by an activity, competence and relatedness also help the person to do a task more likely. A person feels related when their behavior is valued by others. A person feels competent when two factors are satisfied: a goal is adopted and internalized by the person and the person understands the goal and has the essential skills to accomplish it (Ryan and Deci, 2000a).

Another important motivator is *feedback*. Giving unexpected, informal feedback or reinforcements about the progress of the player could provoke increased intrinsic motivation and autonomy. Feedback also could generate behavior changes when metrics are provided through the given feedback e. g., when companies are informing their employees about customer satisfaction rather than sales numbers this could lead to a behavior change that the employees now care about the customer satisfaction (Werbach and Hunter, 2012, p.65).

To process and to not go beyond the scope of this thesis, the section ends here. Further information towards this topic can be gathered by understanding the SDT in Ryan and Deci, 2000b and Ryan and Deci, 2000a.

1.2 Gamification

1.2.1 Motivation and Gamification

The previous section discussed motivation which builds the foundation of Gamification. Without understanding motivation, it is hard to implement a meaningful Gamification System. This section aims to describe what Gamification is and how one can use it to motivate users or change their behavior. Werbach and Hunter describe three different types of Gamification: *internal*, *external* and *behavior-change Gamification*. The internal Gamification is used by companies to motivate their employees to be more productive. In contrast, external Gamification tries to improve the relationship between the business and their customers. The third type of Gamification tries to form new behavior (Werbach and Hunter, 2012, p.23).

To build such a system, *Game Elements* are the key; the "toolkit for building a game." The goal of Gamification is not to build a "full-fledged game;" it is about to use *Game Elements* which enriches the application to engage and motivate the users (Werbach and Hunter, 2012, p.26). Just implementing *Game Elements* is not enough. To prevent problems the understanding and usage of *game design techniques* is crucial. The most significant difference between games and Gamification is that gamified applications operate in *non-game contexts*. Deterding et al. describe what one can understand behind this statement (Deterding et al., 2011a).

> *Your players aren't there to escape from your product into a fantasy world;*
> *they are there to engage more deeply with your product or business or objective.*
> **(Werbach and Hunter, 2012, p.29)**

The biggest flaw of the most tasks is that they are not intrinsically motivating; people are not inherently motivated to do things they need to do. Games on the other hand are played by people mostly intrinsically motivated. As said, players are not forced to play them. But what is more important is the fact that games do *encourage problem solving* by challenging the player with *challenges broken down into manageable steps*. With those steps players gain experience which helps *sustaining interest* when progressing from *novice to expert to master*. When playing a game, players can feel the *sense of control*, which supports the autonomy and also increases the intrinsic motivation. As distinguished from the real world, players are rewarded for *out-of-the-box thinking* by experiments and failure (Decker and Lawley, 2013). This leads to *reduced fear of failure*

(Werbach and Hunter, 2012, p.41).

The goal of Gamification is to utilize those features which let players enjoy the game into real-world-applications, to get players playing and keep them playing.

> *No one can force you to have fun.* — (Werbach and Hunter, 2012, p.38)

Building a Gamification System is not that easy as it might seem. When building such a system Werbach and Hunter suggest to consider four main parts of Gamification: *Motivation*, *Meaningful Choices*, *Structure* and *Potential Conflicts*.

To apply the previously mentioned aspects of motivation for Gamification, it is crucial to know what the players need to get motivated in a specific task: players do not care about an activity when they cannot associate a meaning with it. Motivation is the underlying toolkit to build a sustaining experience and to keep the player motivated to accomplish tasks. Players also need freedom of choice with related consequence which can be imagined by the player. Nevertheless, tracking of activities is a major part of Gamification. They are satisfied in seeing how their progress is and the next step they need to accomplish in order to gain points, experience or rewards. The evidence for this behavior lies in the basic psychological need for competence, this need is satisfied by progression and rewards for their accomplished activities. To track activities, algorithms are crucial; they help to build a significant structure and the player's progress can be visualized through levels and points.

At this point it is crucial to know that leaderboards can be frustrating; a scenario might be, when a player just began playing the game for the first time: the player does not have gained points which is reflected by the leaderboard. If the other players have a tremendous amount of points and badges the new player is more likely willed to quit the game because the experience seeing the leaderboard and the ranking of the players and their own rank can be demotivating.

1.2.2 Points, Badges and Leaderboards

As learnt in the section 1.1, external rewards can engage non-intrinsically motivated users to do an activity. The most gamified applications are built upon the game design elements Points, Badges and Leaderboards (PBL).

Points are being used to represent the score of a player and to build a connection

between external rewards and the progression of the users. They also provide feedback which is important to sustain motivation. With points it is possible to track the users activity. One decision to make is which role points need to take in: when points should encourage a competition, points should be used as *scores*; otherwise, when the goal is to give the user constant feedback, the progress of each individual user should not be shown to others (Werbach and Hunter, 2012, p.74).

Badges are the visual representation of an achievement a user can gain. Antin and Churchill investigated five psychological functions that badges can have in a social media context; but they suggest to explore those functions in other specific contexts. The most important function a badge can have, is *goal-setting*; it is an *effective motivator*. The primary reward is often the *fun and interest of goal seeking*. When the progress towards reaching the goal is presented to the user, the badge then is most effective. Without presenting the path towards success, there is no feedback provided on which users could orient themselves to progress towards the right direction (Antin and Churchill, 2011).

New users should be introduced to the system, otherwise they might feel left alone. This is often called the process of *onboarding*. That is why Antin and Churchill argue that a successful badge system should encompass badges which provide instruction about the activities a user can strive for. Those badges could also introduce the "social norms of a system by exemplifying the types of activities and interactions that are highly valued" (Antin and Churchill, 2011).

With badges, users *reputation* is represented based on the information the reward provides. When a user collects badges and gains experience, the information of the badge-collection can represent his interests, expertise and past interactions.

Besides reputation, the fourth psychological function is *status* and *affirmation*. Antin and Churchill cite: "the power of status rewards derives from the expectation that others will look more favorably upon someone who has undertaken the activity represented by a badge". For a user those badges could provide *personal affirmation* like *trophies*.

Status and affirmation not only are engaging for individuals, they also could be engaging for groups. That is the motivation for the last psychological function they discuss, which is *group identification*. A user might build *solidarity* when he gains badges which are similar to those a group collected.

Badges not only provide positive effects; there are some pitfalls when using a badge

system. Antin and Churchill argues that the "corruption effects of extrinsic incentives could make some badges harmful to intrinsic motivation" (Antin and Churchill, 2011).

Leaderboard is the most problematic game element. Users like to know where they stand compared to others, this could lead to demotivating users when they perceive the way to go to get on top of the list. The latter could cause players trying everything to be the first on the list. Werbach and Hunter suggest that leaderboards should not be used isolated, because this could reduce the performance of users. The biggest benefit of implementing a leaderboard is the fact that it provides contextual information about the users progress which could have a motivating effect for the user (Werbach and Hunter, 2012, p.76).

1.2.3 Abstraction Layer

Werbach and Hunter suggest to build a Gamification System organized in a decreasing order of abstraction. They introduce three abstraction layers: *dynamics*, *mechanics* and *components* (Figure 1.2).

Dynamics
are the big-picture aspects of the gamified system that you have to consider and manage but which can never directly enter into the game

Mechanics
are the basic processes that drive the action forward and generate player engagement.

Components
are the specific instantiations of mechanics and dynamics
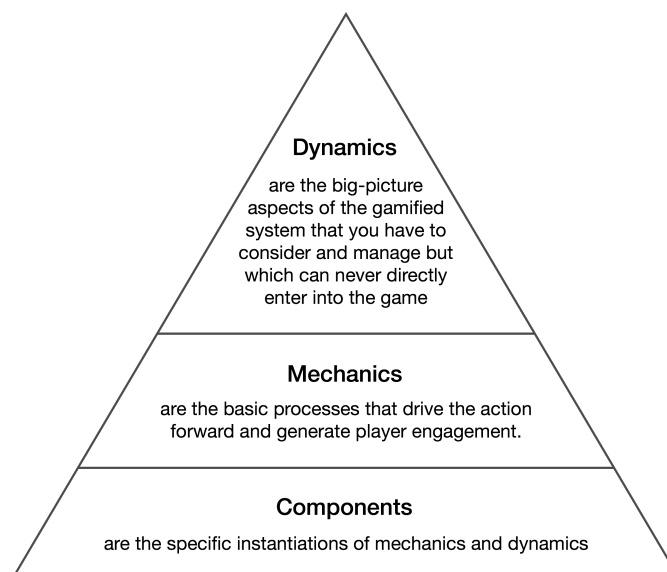
Figure 1.2 The game element hierarchy — (Werbach and Hunter, 2012)

The dynamics layer provides the highest level of abstraction; this layer represents *constraints*, *emotions*, *narrative*, *progression* and *relationships*. A Gamification System should always target the dynamics behind, otherwise the users might not have the chance

to value the system.

The mechanics layer defines the basic processes "which drive the action forward" (Werbach and Hunter, 2012, p.79). In this layer the player's engagement is generated. The elements to evaluate are *challenges*, *chances*, *competition*, *cooperation*, *feedback*, *resources*, *rewards*, *turns* and *win states*. More on this can be read in (Werbach and Hunter, 2012, p.78ff.).

The components for the Gamification System represent the third and most specific layer. It would go beyond the scope of the thesis to list all components. For 'auditorium' the most useful elements probably are *achievements*, *avatars*, *badges*, *collections*, *content unlocking*, *levels*, *points*, *quests*, *social graph*, *teams* and *virtual goods*. Werbach and Hunter is listing fifteen elements one can use to engage users (Werbach and Hunter, 2012, p.80).

1.2.4 Designing a Gamification System

Werbach and Hunter introduce a six step guideline for building a successful Gamification System; for better memorizing they all begin with a **D**:

Step 1: Defining the business objectives In detail, one should know what the goals of the Gamification System are. The definition process is shown in Figure 1.3:

Figure 1.3 The Objective Definition Process (Werbach and Hunter, 2012)

Step 2: Delineate target behaviors In order to know what behavior the users should internalize, they should be described. This helps to choose the most necessary and helpful elements to provide a meaningful and satisfying environment for the community.

Step 3: Describing the players The player types targeted can be delineated based on three questions Werbach and Hunter has defined: *Who are they?*, *What is the relationship to the application?* and *What does users motivate and demotivate?*. A-motivation

could be invoked by the users *lack of desire* or *lack of capability*. The former problem could counteract with an engagement oriented approach. To solve the latter, a progress oriented approach might be successful. Bartle defined four different player types: *achievers*, *explorers*, *socializers* and *killers*. Every type has its own elements which they are more or less likely motivated through. For a successfully Gamification System one should consider implementing and providing *Game Elements* which attract each type.

Step 4: Devise activity cycles   Activity loops are broken down into a *micro* and *macro level*. The micro level is about *what the players do*, *why they do it* and *what the system does in response*. This is called the **engagement loop**. The macro level on the other side describes the *players journey*, also named as **progression stairs**.

The model of an engagement loop is visualized in Figure 1.4a. Users take action when they are motivated to do so; the action provides feedback. Based on this feedback the user ideally is motivated to take the next step and so on and so forth. The key element of engagement loops is feedback. Feedback is a strong motivator. This activity cycle is the foundation of a successful Gamification System.

(a) Engagement Loop   (b) Progression Stairs
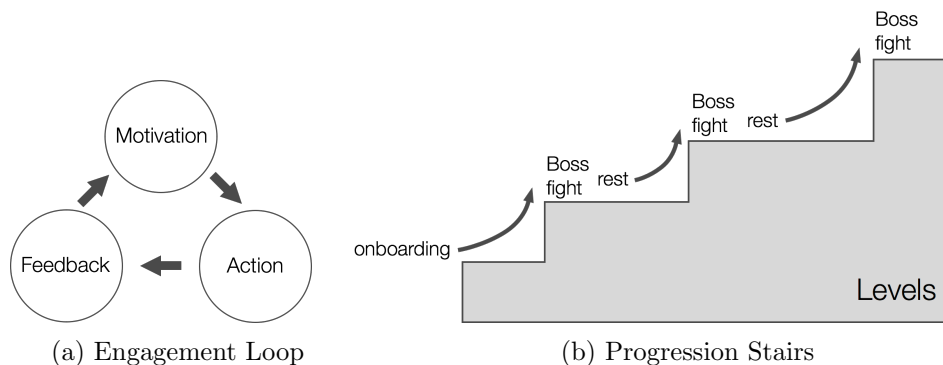
Figure 1.4 Micro and macro level of activity loops — (Werbach and Hunter, 2012)

Progression stairs go a step further: a player gets bored when nothing changes while taking action. Progression is an important factor for Gamification. Without it, players might leave the field and will never come back because of their boredom. Like games, gamified applications should give a structure with *short-term missions* and *long-term goals*, which results in a *rolling series of progression*. As in games the difficulty to reach a new level of competence should not be linear. As in Figure 1.4b illustrated, the first stair should be *so simple and guided that it draws players into the game* (Werbach and Hunter, 2012, p.96). After that, so called *onboarding* phase, the difficulty should increase

with each stair along the road. In games *boss fights* after each level are waiting for the user; like it is illustrated in the Figure 1.4b. In gamified systems this might represent a challenge which the user should master to gain the new level. After this challenge the user gets a phase of *rest*; this is the phase where the difficulty is stable, before the next challenge waits for the player to get accomplished.

Step 5: Don't forget the fun   Fun is one of the most important facts in games and Gamification. Werbach and Hunter suggests to *take a step back and ask a simple question: Is it fun?*. Lazzaro introduces four types of fun. It starts with *hard fun*, which represents a challenge or puzzle. The *fun* lies in the *pleasure of overcoming it*. The next is *easy fun*, which describes *casual enjoyment*. *Altered states* is about experiments, this fun is perceived when a player tries out new experiences. When players interact with friends or other players they perceive fun, which is called *the people factor*. The four categories are described in detail in Lazzaro, 2004.

> *Fun is an emergent, contingent property that can be fiendishly hard to pin down. The best way to tell if your system is fun is to build it and test it and refine it through a rigorous design process.* — (Werbach and Hunter, 2012, p.99)

Step 6: Deploying   The last stage on the journey towards a functioning Gamification System is the deployment. Werbach and Hunter calls this steps a *roadmap rather than merely picking elements out of a hat*. Following those steps makes sure that the purpose of the system and who the users are is clear. This stage is *just* pulling the previous together. The most important thing to build a sustaining Gamification System is to iterate the design and implementation, because things change fast in the technology world.

1.3 Conclusion

In order to summarize this level, one can derive that the previously introduced motivational aspects and the differences between intrinsic and extrinsic motivation are crucial to understand to build a meaningful and engaging Gamification System. Another important fact is that the three basic psychological needs shall be satisfied by the system, which might be a challenge, because extrinsic rewards can lead to undermining ones

intrinsic motivation. In order to prevent this, it is necessary to balance the system. One approach is to define the targeted player types and then creating the system around their incentive to take action. This level has build the foundation to understand the following facts and applications discussed.

Level 2: Related Work

2.1 Research

Gamification gets a lot attention. Deterding tried to find a suitable definition for the term *Gamification*. He defines it with "the use of game design elements in non-game contexts" (Deterding et al., 2011b). Mostly used for marketing it now is adopted in more and more web applications. For developers the best known is the online community *StackOverflow*[2], a Q&A-platform for developers. It makes extensive use of *Game Elements* like *points*, *badges* and *privileges* to encourage users to contribute to the community. Like mentioned before the most online communities suffer from the imbalance of the activity of their users. Ninety percent of all users only using the web page to find information — called "lukers"; then there are about nine percent contributing from time to time; only one percent of all users account about ninety percent of all activity of a major online community. To solve this problem Nielsen suggests to use rewards in order to engage users to participate more (Nielsen, 2006).

An important problem which might arise is that rewarding users replaces intrinsic by extrinsic motivation (Nicholson, 2012). They explored different theories to answer the questions which one "is useful for user-centered Gamification that is meaningful to the user and therefore does not depend upon external rewards." The key point of their research is that Gamification should be meaningful to the user:

> *Meaningful Gamification is the integration of user-centered game design elements into non-game contexts.* — (Nicholson, 2012)

When designing the Gamification System the key question should be "How does this benefit the user?" A non user-centered Gamification System can cause the feeling of controlling. To reduce this feeling the system should be transparent. When using *points*

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[2]StackOverflow `http://stackoverflow.com` (visited on 2014-03-10)

it is important to provide information about what the points are for. Providing information can make a system more transparent and meaningful to the user; by knowing how it works the users can "create their own games and goals" (Nicholson, 2012). That means, that users can create objectives by themselves which they want achieve e. g., earning 100 points a week. This can help the users keep motivated. In contrast to that a meaningless Gamification System is a system which does not rely on the long-term benefits of the Gamification. They focus on the short-term benefits by asking the question "How does this benefit the organization?" *Mechanism-centered design* can also lead to meaningless Gamification e. g., the designer decides to use a new game mechanism that does not really integrates itself into the existing Gamification System. They conclude their research with the statement:

> *If users have a positive and meaningful game-based experience that is well-connected to the underlying non-game setting, then the organization will benefit in the long term. Meaningful Gamification focuses on introducing elements of play instead of elements of scoring.* — (Nicholson, 2012)

This quotation points directly to the problem of education. Joey Lee and Jessica Hammer showing the problem exemplified by the american school system. In this paper they try to answer three main questions for using Gamification in education: "What is Gamification?", "How does it function?" and "Why might is it useful?" (Lee and Hammer, 2011). They showed that the educational system already has a Gamification-like system implemented: students receive points for completing assignments; gained points transform into "badges", also known as marks. Students will be rewarded by showing desired behavior, and they "level up" when performing well. Comprehensible they conclude that "school should already be the ultimative gamified experience" (Lee and Hammer, 2011). However, they believe that the environment is the key to change the engagement of students.

> *It is not good enough to gamify school because it is the next fad, or because we believe students are motivated by points, or because we think badges will cause students to change their behaviors permanently.* — (Lee and Hammer, 2011)

They developed and pilot-tested a "game-layer" as a project of the Teachers College at the Columbia University. This layer incorporates different school-based activities. They conclude that "Gamification can motivate students to engage in the classroom."

But "when making play mandatory" it can "feel just like school." It is necessary that students feel the sense of autonomy, they need the freedom of choice. Students do not want necessarily do what others say they have to do, as in traditional education, where teachers hand out homework or exercises students need to accomplish within a specific time period. As mentioned before, *deadlines* undermine intrinsic motivation.

An open question for educators is "which badges can positively impact student participation." (Denny, 2013) try to answer this question: they analyze the impact of an incorporated badge-based achievement system within the online-learning environment *PeerWise*. It is a tool students can create questions relevant to exams of a course they participate on. They provide answers and related feedback; students can comment and vote for questions. With the help of the voting and ranking system the users self regulate the importance and relevance of each question. After submitting a question they can use the question set to interactively learn for exams. Within four weeks they ran an analysis in which the users were divided into an experimental and a control group; users of the experimental group were able to see the integrated achievement system. The other group was supposed to use the learning tool without knowing and seeing that an achievement system exists.

With the achievement system they tried to encourage students to author more questions and answer more questions. Besides that they also want to encourage them to test their knowledge more frequent. They point out that scoring systems could encourage students to game "their score by focusing on repetition of non-useful actions which yield points." This also could lead to poor learning outcome in educational environments.

Their results are that there is no significant difference between the two groups in the amount of authored questions; that could be because of the low requirements for authoring questions; providing only one question was required in order to achieve. In contrast to the equality of activity in authoring questions they noticed a shift in questions answered by the group with the achievement system available. Also the distinct days the users are active is significant higher than in the group without seeing badges.

They discuss their results because the effort which is required to author questions is higher than answering questions. In both groups more than four times of the required answers were given; they imply that this action is driven by intrinsic motivation. Another result is that badges did have an impact on participation but they did not have an effect on students perception of learning value. They suggest that a Gamification System should reward users on actions they already see value; this could have the most impact.

Level 2: Related Work

Bista et al., 2012 describe how Gamification can help monitor activities of their online community. Their analysis shows that it is possible to monitor active and passive activities with the help of Gamification; whereas passive activities are *signing in* or *reading*. Additionally with the help of a set of *reinforcement badges* they can also analyze how users behave on the platform. Reinforcement badges are badges like "VIP plus" or "Reader plus;" those badges will be rewarded to users which gained the "VIP" or "Reader" badge twice. Their aim was to propose a Gamification model to help improving the three main aspects of an online community: *bootstraping*, *monitoring* and *sustainability*.

A different but important aspect of motivating and engaging users is to recognize and support the different *player types*. Bartle, a web designer, analyzed Multi-User Dungeon (MUD) games and defined four characteristical player types: *Socializer*, *Achiever*, *Killer* and *Explorer* (Bartle, 1996). Those cannot directly be associated to Gamification: e. g., the player type *Killer* can cause problems because those players try to do everything to "win the game". Marczewski tries to describe in his article a better alternative to those four types. He delineates not only four, but eight types: *Philanthropist*, *Achiever*, *Socializer*, *Free Spirit*, *Self Seeker*, *Consumer*, *Networker* and *Exploiter* (Marczewski, 2013a).

In his second article he suggested to combine the extrinsically motivated user types *Self Seeker*, *Consumer*, *Networker* and *Exploiter* into *Disrupter*[3] and *Player*. Whereas the *Disrupter* is associated as the *negative user type* and the *Player* represents the users which are extrinsically motivated (Marczewski, 2013b). The *Disrupter* is associated as a source causing problems. Marczewski suggests that it is worth to consider the modern meaning: "improving the system by breaking down the norms and showing new and improved ways" (Marczewski, 2013b).

> *[. . .] black and white is actually not all that much use when talking about how people behave. —* (Marczewski, 2013b)

The case study of Hulsebosch revealed that player types introduced by Bartle are often ignored when designing and implementing a Gamification System. But when "methods for targeting a specific audience with the right *Game Elements*" are used, this "showed great potential" (Hulsebosch, 2013). When a Gamification System should be designed

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[3]More about the user type *Disrupter* by Marczewski - `http://marczewski.me.uk/2013/09/16/disruptors-negative-user-type` (visited on 2014-02-12)

they suggest to determine the *target audience* and a *target set of player types*. After that it is possible to include *Game Elements* to encourage the desired play styles.

To help undergraduate students to have a clearer sense of their accomplishments the project *Just Press Play* was created at the *Rochester Institute of Technology*. The project also allows it to increase the awareness of activities. It is not required to participate on *Just Press Play*; they want to support activities outside of the website of the Institute. To address different activities they determined different types of achievements (Decker and Lawley, 2013). They analyzed the impact of their Gamification System on first semester students; they observed that students get frustrated by failure in computing courses. The achievement "Undying" has been pointed out; they address the introductory course which is passed by only 85% of all undergrad students. Once they announced this achievement upperclassmen started to organize classes to help the freshmen. In this semester 91% passed the test; but it cannot be proved if there is a direct casual relationship towards the achievement system. But they describe it as success because since then upperclassmen organize classes to help new students (Decker and Lawley, 2013).

Gamification currently has still a long way to go to achieve its potential. The current implementations of Gamification use the least interesting *Game Elements*. Bogost says that "most implementations of Gamification represents *exploitationware*" (Bogost, 2011a). In the paper of Deterding, Rajat Paharia explains that it is important to "understand *why* users engage helps to answer and points the way to rewards the user base will find meaningful and valuable;" he continues that when the implementation is done it is necessary to test and analyze until the system is implemented well (Deterding, 2012). He concludes:

> *Copying FarmVille or Foursquare without understanding are designed to fail.* — (Rajat Paharia in Deterding, 2012)

Deterding concludes the paper with the statement, that identifying the motivations behind desired activities and facilitating them is the best way to a successful Gamification System (Deterding, 2012).

This literature review shows that the most implementations of a Gamification System focus only on the *least interesting* game design elements. This thesis will address this problem by describing the most important game design elements and the environment to implement a meaningful Gamification System.

Therefore current work did not describe privilege systems; the online community Stack-Overflow already implemented a basic privilege system were users can gain privileges by earning points and badges. This system is based on *leveling* and could help to encourage the user to be more active to gain more privileges.

Bartle introduced four player types in games; those were analyzed and modified to address the issues in Gamification Systems by Marczewski. Those player types are not considered in most systems; considering those player types can lead to more participation because the users find the Gamification System meaningful to their activities they want to do (Nicholson, 2012).

2.2 StackOverflow

The idea behind auditorium has evolved due to the authors active usage of the online Q&A-platform *StackOverflow*. Due to the questioning and answering style the users conduct helpful and professional answers to the questioner. Jeff Atwood[4] introduced in December of 2008 the *Badge System* of StackOverflow (Atwood, 2008).

> *Stack Overflow will feature a system of badges. Hopefully the non-stinking type. These badges are based on my admiration — and addiction to — the Xbox 360 Achievements system.* — (Atwood, 2008)

In order to different activities, users can gain *reputation points* (StackExchange, 2014). They provide a handful of ways to earn reputation, such as when a user votes up your questions or answers. Or someone accepted your answer. It seems the community has fostered this mechanism to new users, because most of the answers are marked as helpful and questions being voted on. This mechanism is the inspiration behind auditorium. To provide high quality questions, users should self-maintain the content by rewarding or blaming users for there posts, as well as moderating it.

In order to understand the reason for providing the capability to vote on posts, is described on *about page*:

> *Voting up a question or answer signals to the rest of the community that*

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[4]Jeff Atwood, the co-founder of StackOverflow — http://en.wikipedia.org/wiki/Jeff_Atwood (visited on 2014-02-21) and author of the Coding Horror Blog — http://www.codinghorror.com/blog/ (visited on 2014-02-21)

> *a post is interesting, well-researched, and useful, while voting down a post signals the opposite: that the post contains wrong information, is poorly researched, or fails to communicate information.* — (About Page of StackExchange[5])

A badge system is not worth the name without providing *badges*. Badges can be *earned* by numeric algorithms. They provide their badges in three categories: *bronze*, *silver* and *gold*. A subset of those badges is illustrated in Figure 2.5.

Figure 2.5 Screenshot of a Subset of Badges — (source:
`http://stackoverflow.com/help/badges`, visited on 2014-02-21)

If a user is a statistics fan, the site provides a tremendous amount of details:

· How much and why they gained or lose reputation,
· which badges they earned,
· when did someone voted on a post,
· from whom the user got responses by comments or answers and so on.

Each user can see those statistics on their personal profile page[6].

The achievement system of StackOverflow also helps to regulate the community through feedback loops. Their moderators are elected by users, which provides a sense of autonomy, because users can select their favorite moderator through voting for them.

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[5]About StackOverflow: "Why is voting important?" — `http://meta.stackoverflow.com/help/why-vote` (visited on 2014-02-21)

[6]Jeff Atwoods Profile Page on StackOverflow as example— `http://stackoverflow.com/users/1/jeff-atwood` (visited on 2014-02-21)

Level 2: Related Work

The idea for auditorium, as well as the motivation for implementing an achievement system results from the active usage of StackOverflow and the perceived motivational effect on the author.

2.3 Open Badges

Another example for the successful use of Gamification Elements is the project *Open Badges*[7] created by the Mozilla Foundation[8] in collaboration with the MacArthur Foundation[9] and HASTAC[10]. They believe in lifelong learning. This collaboration aims to provide an infrastructure for achievement systems.

The infrastructure provides a starting point for each one of the three categories: *Issuer*, *Earner* and *Displayer*. For those categories, they provide further information about how to issue[11], earn[12] and display badges[13].

The driven motivation is nicely described within their background story:

> *Learning happens everywhere. Yet it's often difficult to be recognized for skills and achievements that are gained outside of school. Mozilla's Open Badges project is working to solve that problem by making it easy for anyone anywhere to issue, earn, and display badges. The results: broad recognition of twenty-first century skills, unlocking of career and educational opportunities, and learners everywhere being able to level up in their lives and work.* — Mozilla Foundation[14]

With the help of badges one can share skills and interests gathered on different sites and store them into the so called *Mozilla Backpack*[15] provided within the Open Badges Infrastructure. The Mozilla Backpack can then be embedded into the own website or linked within social network sites to represent received badges. The process is illustrated

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[7]Open Badges Website — `http://OpenBadges.org` (visited on 2014-03-05)

[8]Mozilla Foundation Website — `https://www.mozilla.org/en-US/foundation` (visited on 2014-03-05)

[9]MacArthur Foundation — `http://www.macfound.org` (visited on 2014-03-05)

[10]HASTAC Webpage — `http://www.hastac.org` (visited on 2014-03-05)

[11]Get startet issuing Open Badges — `http://openbadges.org/issue` (visited on 2014-03-05)

[12]Earning the first badge — `http://openbadges.org/earn` (visited on 2014-03-05)

[13]Display badges across the web — `http://openbadges.org/display` (visited on 2014-03-05)

[14]Why is the Mozilla Foundation creating Open Badges? — `https://wiki.mozilla.org/Badges/Onboarding-Issuer` (visited on 2014-03-05)

[15]Mozilla Backpack — `http://backpack.OpenBadges.org` (visited on 2014-03-05)

on their about page of the project[16].

The author already uses Open Badges for badges achieved on the learning platform *Code School*[17]. The collection of badges can be stored in the personal backpack (Figure 2.7) provided by the Open Badges Infrastructure. The process of storing a badge from code school into the backpack is visualized in Figure 2.6 exemplified by earned badges in Code School:

Step 1: Sign in to Mozilla Backpack via Mozilla Persona[18].
Step 2: Proof and accept the badge transfer.
Step 3: Confirmation that the badge has been stored in the users backpack.

(a) Step 1   (b) Step 2   (c) Step 3
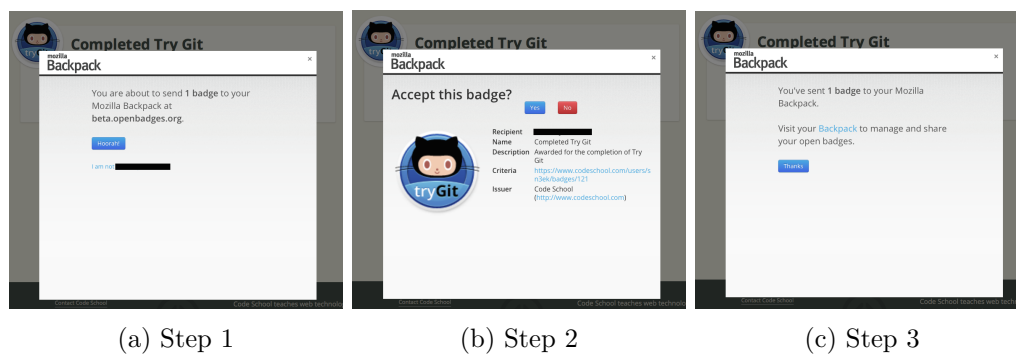
Figure 2.6 Storing a badge from Code School into the Mozilla Backpack

They define a *digital badge* as "online representation of a skill [one has] earned". Those badges can help to verify *skills* and *interests* through legit organizations. To provide this they built an open standard which can be used by everybody. Everyone can "create, issue and verify digital badges."

When all badge from Code School have been referred to the distinct backpack, it might look like the backpack of the author, represented in Figure 2.7.

Due to the mentality to be an open minded community which is distributed all over the world, they provide a community page for information how one can contribute to their project. The author has started to get in touch with the side-project "Open Badges Discovery"[19] to visualize and integrate pathways with the help of the Open

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[16]About Open Badges — `http://openbadges.org/about` (visited on 2014-03-05)
[17]Code School — `http://codeschool.com` (visited on 2014-03-05)
[18]Mozilla Persona, a sign-in system — `http://www.mozilla.org/en-US/persona` (visited on 2014-03-10)
[19]Mozilla Open Badges Discovery — `http://discovery.openbadges.org` (visited on 2014-03-10)

Figure 2.7 Backpack

Badges Infrastructure. More information about this project can be found on the project repository on Github[20].

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[20]Discovery tool for Open Badges including Pathways and Directory — `https://github.com/mozilla/openbadges-discovery` (visited on 2014-03-05)

Level 3: Aims and Objectives

Evaluating the impact of Gamification in higher education environments to engage and motivate students to participate and behave as desired, exemplified by the online platform *auditorium* is the main target of this thesis. Hence, the main focus lays in maintaining motivated user groups of students, lecturers and others e. g., alumni. For the evaluation, Gamification elements and techniques will be investigated related to the performance and acceptance with qualified methods. To achieve the purpose it is important to define subgoals which need to be accomplished for further investigation. The following sections the subgoals are delineated.

Attention: The listed objectives in this section do not represent a defined ordering, they are just numbered for referencing.

3.1 Evaluation of Gamification Elements and Techniques

As laid out in Level 1: Preliminaries, Gamification is based on *game design*; game design is a powerful concept to attract players. Through Gamification those techniques and elements also can be used for real world applications. Though, it is mandatory to evaluate each game design element and technique individually related to the use in the online platform auditorium. Based on the previously discussed *Game Element Hierarchy* (Figure 1.2) to design a successful Gamification it is recommended to be guided by this hierarchy, which consists of only three layers: *dynamics*, *mechanics* and *components*. Derived from this approach the following goals need to be contemplated:

Objective 1: Delineate the dynamics for the achievement system

Evaluate the dynamics considering the meaningfulness for the user experience in auditorium. Based on the suggestion of Werbach and Hunter, the following dynamics will be considered: *constraints*, *emotions*, *narrative*, *progression* and *relationships*.

Objective 2: Discuss the mechanics for the achievement system

After defining the dynamics of the achievement system the next goal is to discuss the mechanics layer. This step is necessary because mechanics help generating player engagement for the long-run. The following mechanics will be examined in detail: *challenges*, *chance*, *competition*, *cooperation*, *feedback*, *resource aquisition*, *rewards*, *transactions*, *turns* and *win states*.

Objective 3: Evaluate components for the achievement system

The most concrete layer defines the *components* which help to convert the previously defined dynamics and mechanics into implementable methods. Due to this consideration the third goal is to weigh each of the following enumerated game design element related to the results of the former steps. The most important game design elements, based on the collection by Werbach and Hunter are: *achievements*, *avatars*, *badges*, *boss fights*, *collections*, *combat*, *content unlocking*, *gifting*, *leaderboards*, *levels*, *points*, *quests*, *social graphs*, *teams* and *virtual goods*.

3.2 Cooperation and Collaboration

Within this thesis additionally to the core objectives, described in the previous section, a collaboration system for creating sets of learning questions will be discussed and designed in theory.

Objective 4: Conduct a collaborative tool for creating sets of learning questions

The goal is to elaborate the motivational and educational aspects of providing a collaborative tool for creating interactive sets of learning questions. This tool should give the students and lecturers the possibility to collaboratively create and share questions relevant to e. g., a seminar or exam.

3.3 Prototype

After choosing the elements which are appropriate for the online platform auditorium the next step is to concept a prototype in which the chosen elements shell be implemented. The goal is to directly implement the Gamification System directly on top of the online

platform. Based on the six step designing guideline by Werbach and Hunter the following steps represent the roadmap for implementing the Gamification System:

Objective 5: Describe which behavior is desired

The most important step on designing the prototyp is to define the desired behavior. With this in mind it is possible to describe the mechanics within auditorium which will be supported by the achievement system.

Objective 6: Describe Game Elements for the prototype

After the Game Elements have been discussed in detail, they should be delineated for the prototyp which are most meaningful for the users to get engaged with the system.

Objective 7: Describe the player types to consider for the prototype

One of the most important aspects of a successful Gamification System is to attract the different player typed such as defined by Bartle, 1996. He defined four player types: *Achiever*, *Socializer*, *Explorer* and *Killer*. The third step is to apply the previously discussed mechanics and dynamics to each of the player types. It is an important fact that each player type is sensible to game mechanics in a different way. By knowing this fact, it is necessary to investigate them in detail.

Objective 8: Define the activity cycles to provide feedback

As introduced previously there are two activity cycles to consider: engagement loop and progression stairs. These are powerful instruments to motivate the users on a long run. Engagement loops give feedback regularly and progression stairs help the player proceed from novice to mastery by providing new levels of difficulty or challenge.

Objective 9: Deploy the achievement system

In order to analyze the effect of the achievement system in auditorium it is essential to deploy it to the production system.

3.4 Evaluation

Designing a successful Gamification System is an iterative process. For that reason it is mandatory to analyze and refine the system constantly.

Objective 10: Delineate appropriate methods for analyzing the system

In order to refine the implementate useful data needs to be provided. The goal is to define appropriate metrics which help to analyze the impact of the achievement system on the activity of the users.

Objective 11: Pilot-Testing the achievement system

When the system has been deployed the system will be tested by the users themselves. For an appropriate analysis it is necessary to divide the users into two groups: control and experimental group. After finishing this, the online test will run for about five weeks. After that the users will be invited to participate on a survey about the experience.

3.5 Impact on Learning and Sharing Voluntariness

As previously laid out the biggest problem of education is that students tend to be a-motivated on tasks they need to do. As Lee and Hammer argue that it is important to adjust the learning environment for students. Ordinary educational environments like school do not provide an optimal environment where students can maintain their passion on specific tasks. In games, player get the environment where they can try and experiment until they succeed, whereas in schools they feel the pressure to succeed the first time.

Objective 12: Evaluate the impact on learning and sharing voluntariness

Because traditional education lacks in motivating the students, it is important to provide an engaging environment which motivates the students to do things intrinsically motivated. Traditional education does not provide such an environment. The goal is to evaluate the possible effect of Gamification on learning and sharing voluntariness.

Level 4: Methodology

After the objectives were defined before, this level aims to describe the overall methodology to integrate a meaningful Gamification System in auditorium. The process consists of individual steps. The first step is to lay out a foundation, after that the Gamification System will be described conceptual. The third step then is to actual implement the system and to provide useful statements for future implementations and enhancements, an evaluation is planned.

Those steps will be described in the following distinct sections. The milestones for this thesis are laid out in Figure 4.8. This illustration aims to give a sense of the overall schedule.

Figure 4.8 Milestones to evaluate auditorium and the Gamification System

4.1 Preliminaries

In order to integrate the Gamification into auditorium the first step was to refactor the first version to provide a solid foundation. The first version of auditorium was implemented by a group of students during the *summer semester 2012*. Because this version was already established in the Faculty of Computer Science at the TU Dresden, it was no option to rebuild the system from scratch. The only option was to refactor the existing implementation.

Because auditorium only is used by members of the Faculty, the system should be accepted and user friendly as possible. To assess the current usage, a survey has been created to ask members of the Faculty how they use the platform, which features they perceived and use and which features they do want and do not like. Invitations for participation for the survey were send on the 8th of October in 2013 and the survey has been closed on the 31st of October in 2013. To reach as many possible participants as possible, the *public mailinglist* of the Faculty was used and an announcements directly on the platform was made.

Based on the data of this survey, the second version of auditorium has been developed and deployed on the 1st of December in 2013. To evaluate the usage and activity of auditorium the open analytics platform *Piwik* (version 1.12) has been used. It is deployed on the same server as auditorium is running to be confirm with the privacy policies, this is the advantage in contrast to the web analytics tool provided by Google[21]. This tool provides web analytics data such as *daily visitors*, *page impressions* and *average visit duration for returning visitors*. This data helps to evaluate the overall usage next to the data directly from the database.

4.2 Conception

After the second version of auditorium was released on the 1st of December in 2013, the next step is to concept the actual Gamification System. In order to establish a meaningful Gamification System, it is important to evaluate each Game Element earlier described. The designing process of the Gamification System for auditorium will consider the six steps defined by Werbach and Hunter and discussed in section 1.2 to build a solid

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[21]Google Analytics — `http://www.google.com/analytics` (visited on 2014-03-08)

foundation which can be enhanced in future work. The designing process will consider the theories delineated in Level 1: Preliminaries.

4.3 Implementation

After the system has been designed for the context of auditorium the implementation is the next step. The achievement system will be directly integrated into the online platform auditorium. The Level 6: Implementation will provide the description of the implementation process in detail. After deploying the

4.4 Evaluation

The system will be deployed at the 27th of December in 2013. To evaluate the impact of this system the user base will be divided into two groups: *experimental group* and *control group*. The experimental group is able to see and interact with the features provided by the Gamification System. This allows to derive the direct impact and difference of activity between those two groups. This period of testing is called *Pilot Testing*.

The system will be pilot-tested from 27th of December in 2013 to the 27th of January in 2014. Next to the data which can be extracted from the web analytics tool *Piwik* and the database data, a second survey shall help to gather opinions directly from the users. This survey is scheduled for the last week in January (27th of January to 2nd of February in 2014). It will be divided into two distinct parts: the first part tries to capture the data for the evaluation of the refactored second release of auditorium. The second part then will help to allocate the opinions about the integration of the achievement system. The statistics gathered during the first and second survey will then be analyzed and described in Level 7: Evaluation.

4.5 Conclusion

Concluding the last point contemplating is the impact of Gamification elements and mechanics on learning and sharing voluntariness. To achieve this goal the discussed derives from a theoretical discussion what learning and sharing voluntariness means related to

the system and how this can be supported by the discussed dynamics, mechanics and components of the built Gamification System.

Level 5: Concept

Since the launch of auditorium in September of 2012, the amount of registered users has been increasing. But the usage is stagnating because the majority of users do not ask questions. Without open questions the intrinsically motivated users, which love to help other users do not have the possibility to answer their questions. Because of that, auditorium needs to attract the passive or a-motivated users to be more active. This level describes the designing process of the Gamification System within auditorium.

5.1 Design Process

After introducing the *Game Elements* of the Gamification System before (section 1.2), those will be delineated more in detail in the context of the achievement system within auditorium. Werbach and Hunter described six steps towards a deployed Gamification System. To recall these steps were:

Step 1: Defining the business objectives.
Step 2: Delineate target behaviors.
Step 3: Describing the players.
Step 4: Devise activity cycles.
Step 5: Don't forget the fun.
Step 6: Deploying.

Based on this six steps and the suggestions from Hulsebosch, the process to concept an appropriate achievement system for auditorium is illustrated in Figure 5.9.
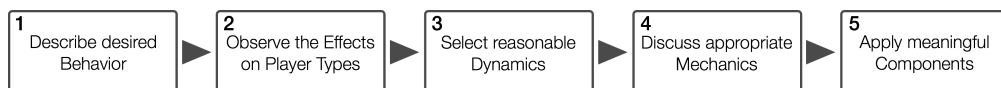
Figure 5.9 Steps to design the Gamification System

Level 5: Concept

Deriving from the defined roadmap, the first step is to determine the underlying objectives which need to be considered when concept a Gamification System for the long run. The next step is to define the player types and how they can be attracted by using appropriate Game Elements. Based on this concept the system will be integrated into auditorium. How this has been accomplished will be described later in Level 6: Implementation.

5.2 Determine Objectives

With the help of the earlier introduced regulation processes of extrinsic motivation the following objectives have been delineated. Because the majority of users seem to be a-motivated in asking questions or interact with the platform in provided ways, the first objective is to try to externally regulate them with rewards. The next step then is to motivate already extrinsically motivated users by using the regulation processes introduced in Level 1: Preliminaries.

> *For effective gamification, it's critical to have a well-developed understanding of your goals. That might sound obvious, but it's easily overlooked. —* (Werbach and Hunter, 2012, p.87)

Although the majority might be a-motivated or extrinsically motivated, there are a couple of intrinsically motivated users, like the author of the thesis. This group of users also need to be considered while preparing the system. The intrinsic motivation of them could be undermined when using external rewards. That is why it is crucial not to try to regulate them like the other motivational types. The following enumeration concludes the three main objectives of the Gamification System:

1. Motivate a-motivated users to take action through internalization and integration.
2. Support extrinsically motivated users through introduced regulation types.
3. Support intrinsically motivated users through due to supporting the basic psychologic needs: *autonomy*, *competence* and *relatedness*

People tend to be a-motivated when the activity is not valued by them, if they feel not competent enough to do it or when they do not think the outcome is as good as desired (Ryan and Deci, 2000a). As described in section 1.1 the sub-theory OIT introduces four stages to enrich extrinsic motivation through different regulation processes. To help users

to overcome their lack of motivation to rise action, they need to be externally regulated. In Gamification this can be accomplished by providing rewards. The goal is to help the user evolve from a-motivated to somewhat intrinsically motivated. This orientation shift can only be applied if the person does not perceive the external regulation as controlling, as described in Extrinsic Motivation.

In order to get an a-motivated person to take action, like asking a question, there are different regulation types, which have been discussed in Extrinsic Motivation. An a-motivated person can shift their orientation to be more likely motivated through the regulation types. The challenge is to use game design techniques and elements through internalized or integrated regulation types. The internalization concept describes how a person's behavior can "range from amotivation [. . .], to passive compliance, to active personal commitment", as described in Ryan and Deci, 2000a.
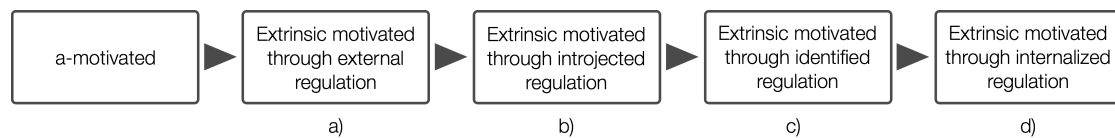
Figure 5.10 Process from a-motivation to become extrinsical motivatied through internalized regulation

With this in mind, the challenge of the achievement system is to internalize and integrate the values and behavioral regulations. The four steps of regulating are illustrated in Figure 5.10. An a-motivated person can be motivated to take action through *a) external regulation*, *b) introjected regulation*, *c) identified regulation* or *d) integrated regulation*. The former regulation types a) and b) are perceived as controlling, whereas c) and d) are more likely internalized by the person. The extrinsic motivation evoked by internalized regulation only differs to intrinsic motivation in the detail, that the goal is still perceived as instrumental (Ryan and Deci, 2000a).

To concept an appropriate Gamification System the *Game Elements* need to be discussed and evaluated. The focus lays on supporting the internalization and integration processes. The system should not be perceived as controlling, which is why the focus lays on supporting identified and internalized regulation. The external and introjected regulations do contrast the voluntary approach of auditorium.

5.3 Desired Behavior

To design a meaningful Gamification System which is appealing to the user, it is furthermore necessary to consider the desired behavior.

As of the basic principles, that students help students, it is appropriate to try to adjust the behavior because some users do not exactly know how the platform can be used because of their experience with *internet forums*. They seem to be not aware of the differences between *comment* and *answer* when providing feedback. This can lead in frustration by users which do understand the differences between comments and answers and how to use the platform as provided. To prevent this, the following discusses desired behavioral patterns, which should be considered and supported by the system.

One of the most desired behavior is that *users should visit auditorium regularly*. Without returning users the platform remains unattractive to (new) users. However this is not the only problem of inactive or a-motivated users. They also should *ask more questions to attract users to interact by giving answers or feedback to solve the problem*.

On the one side, to motivate users, *the community should reward good questions and helpful answers.* On the other side, they should *educate new or less experienced users by editing or blaming their bad posts*, this mechanism also can help to prevent *spam* or *trolling*.

> *Don't feed the trolls* — Nicole Sullivan[22]

Through the introduction of groups into auditorium, users should be enabled to create study or topic groups by themselves. This should drive the activity due to the possibility of adding groups they need for e. g., learning with friends and strangers. To prevent problems, the community should regulate them self by adding moderators to the group and by managing the users and their posts.

Because auditorium is an internal platform of the university, users should provide basic personal information, so one could contact the person directly to request further help or to get to know each other.

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[22]Speech at Fluent 2012 by Nicole Sullivan, "Don't Feed The Trolls" — `http://www.youtube.com/watch?v=ulNSlES1Fds` (visited on 2014-02-18)

As summarization the following lists the behavioral patterns, described before:

· Users should visit auditorium regularly,
· users should provide more content by asking more questions,
· users should reward good questions and helpful answers,
· users should create groups by their own and self-regulate it by managing moderators and posts,
· users should educate new or less experienced users by giving them feedback through either blaming (down-vote) or constructive, textual feedback, and
· users should be aware of how to use the platform.

The description of the desired behavior will help to define which *Game Elements* should be considered. The next step is to identify the player types in order to be able to define which elements engaging them to use auditorium more intense.

5.4 Applying Player Types

In section 1.2, Bartle analyzed the most significant characteristics of players during his investigation of MUDs. He characterizes four: *Achiever*, *Socializer*, *Explorer* and *Killer*.

acting

| KILLER | ACHIEVER |

player ——————————————————— world

| SOCIALIZER | EXPLORER |
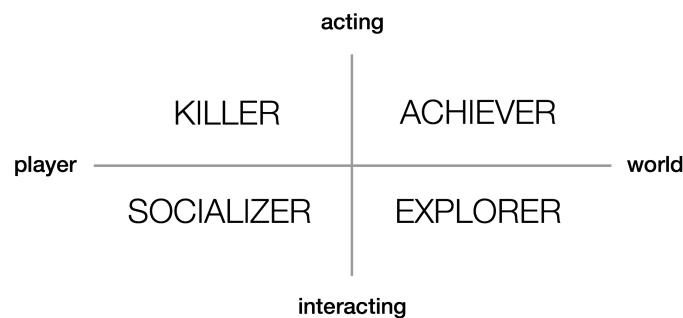
interacting

Figure 5.11 Player Types by Bartle — (Bartle, 1996)

The visualized taxonomy of the player types by Bartle (Figure 5.11), distinguishes between the categories *player* and *world* on the x-axes and *interacting* and *acting* along the y-axes. This taxonomy has been created to represent the different characteristics for each of the four player types: an *Achiever acts within the world* in order to accomplish a quest to gain points or achievements. In contrast, the *Explorer interacts with the world* to see everything of the world. On the other side *Socializers interact with other*

players to extend their social graphs and *Killers act on players* within competitions or to humiliate them, especially Socializers.

> *Much of the research on what motivates people to play games is based around the player types as defined by Bartle or on variations on that.* — (Hulsebosch, 2013)

Furthermore, this characterization can be interpreted as follows:

· The Achiever tries to act in a way to gain as much points as possible and is attracted by achieving badges.
· Explorers see games as adventures. They want to explore everything. Game designer usually add *Easter Eggs* to trigger their motivation. Easter Eggs are virtual gimmicks within a game, vigilant users can find. When such a gimmick has been found by the Explorer it fulfills them with happiness.
· *Socializers* try to interact with other players. They love to attend to multiplayer games. They try to help other users for the social experience itself. They are mostly not attracted by collecting points or badges.
· The *Killer* is a problematic player type, often referred as to be harmful. They interact with other players in the context of challenges and competition. They want to win the game and they do everything possible for it.

This helps to distinguish *Game Elements* to attract the most users of the online platform. Bartle differentiates them by their *action* and *iteraction* with the *world* and other *players*.
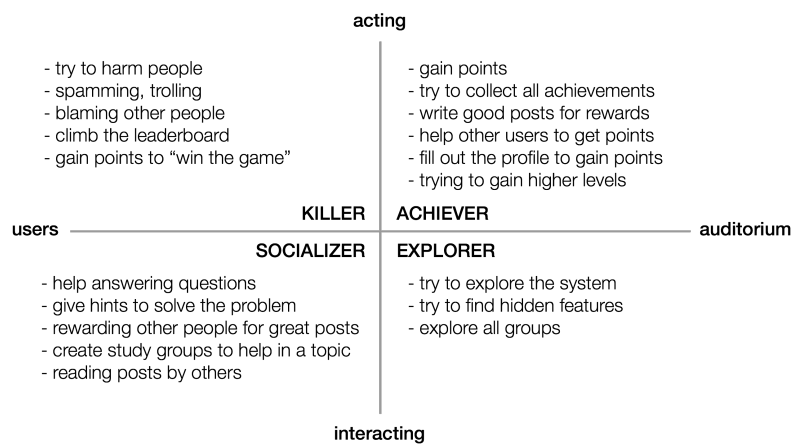
Figure 5.12 Player types applied to auditorium

Those player types can be applied to auditorium, this is illustrated in Figure 5.12. The achiever tries to gain points, to reach new level and also tries to collect all badges. In contrast, Explorers do not really need achievements to be motivated. They gain their motivation on exploring the application, they want to try out every feature. They want to find hidden *Easter Eggs*. Socializers need to perceive relatedness, they love to interact with different users and to help them. In contrast the Killer tries to harm the experience of other players. They need challenges, otherwise they could be bored instead of motivated. This player type could be interpreted as a *troll*[23]. The next sections will refer back to this definition of the player types in the context of auditorium. As Hulsebosch found out:

> *If used, methods for targeting a specific audience with the right Game Elements showed great potential.* — (Hulsebosch, 2013)

With the understanding, the next section uses the characterization to choose *Game Elements* which help making the user experience more compelling to the target audience.

5.5 Game Elements

In order to fulfill the previously defined objectives, the *Game Elements* need to be analyzed and inspected by their effect on motivation. The Game Elements can be seen as a hierarchy composed of the three layers *Dynamics*, *Mechanics* and *Components*. Werbach and Hunter illustrated the hierarchy as pyramid (Figure 1.2). The Game Elements need to be considered in order to their influence on fulfilling the objectives, the desired behavior and the defined player types. Those aspects are significant in deciding which of the elements are appropriate and how to apply them in a meaningful way, without undermining user's motivation.

5.5.1 Dynamics

The dynamics layer defines the most abstract view of the Gamification System. This subsection helps to delineate the most appropriate dynamics for the use in auditorium.

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[23]Troll in the Internet context — `http://en.wikipedia.org/wiki/Troll_(Internet)` (visited on 2014-02-18)

Level 5: Concept

The dynamics which will be investigated are: *constraints*, *emotions*, *narrative*, *progression* and *relationships*.

Hulsebosch suggests to investigate what elements do motivate the player types most. This helps to build a system which is appealing to the target audience. The following will investigate each aspect of dynamics individual. It will be described how each effects the motivation of the target group.

Constraints

Constraints stand for the limitations and boundaries of the system. It is important to define those boundaries in order to guide the users the site, when using it. The player type *Explorer* tries to escape such boundaries to catch different perspectives and to collect *Easter Eggs*. Also *Killers* should be limited in their field of action. Otherwise they would undermine other user's motivation.

Those constraints can be realized through different roles provided by the system. In auditorium there are two different contexts defined: *system-wide* and *group-based*. The system-wide roles include *administer* and *registered users*. Additionally there are group-based roles provided: *moderator* and *normal member*. Other constraints are constituted by the scope of available features. The achievement system should help the user to perceive those constraints.

Emotions

Emotions encapsulate *curiosity*, *happiness*, *frustration* and *competitiveness*. The online platform itself aims to compensate frustration due to get answers to open questions or to *gain a different perspective* (Schell, 2008, p.442).

To set this in relation to the player types, Explorers might be motivated through their curiosity. They are happy when new features are release they can use and most likely will give feedback to the developer. Socializers are happy when helping other users solving their problem. Achievers are curious about to gain experience points and to unlock badges. And Killers try to climb the leaderboard to represent their status. They try to frustrate other users due to competition.

For summary, this dynamic is important for every player type. They all need a sense of emotions to engage with the platform. However, the Gamification System should rather support happiness than frustration, the platform aims to help students solving problems

and connect to other students and lecturers in the scope of the university.

Narrative

In the game context narrative defines a constant ongoing story. The Gamification System of auditorium does not aim to provide a story. But for the users it is important that they can identify themselves with the activity within the system. A user should be aware of the mechanics behind the rewarding system e. g., voting up a question results in points for the author. When users know how much points they get when doing a specific activity, they can define their own goals which can help them increase their motivation. This has been described earlier in section 1.1.

The narrative only describes the connections within the system. And therefore does not provide any additional information like a story, because it is not a full-fledged game as argued in section 1.2.

Progression

Progression is one of the most influential dynamic in such a system. In order to provide the users a feeling of their progress it is useful to use points, levels or badges. When showing the individual progress to others it could stimulate the basic psychological needs such as *competence* and *relatedness*. Also *autonomy* can be satisfied, when the user can decide how to progress. This supports intrinsically motivated users, as well as it can help to overcome the obstacle to be motivated at all.

> *Compared with games, reality is too easy. Games challenge us with voluntary obstacles and help us put our personal strengths to better use.* — (McGonigal, 2011, p.22)

To show users their progress, points will be used. With points it is possible to track the activity in the system. Additionally performance badges might be helpful. With showing the already collected badges related to all available badges, the user also can perceive the overall performance and can compare them self to other users when visiting the profile page. Which attracts the *Socializer*, as well as the *Killers*. The former is satisfied due to the relatedness to other users, whereas the latter tries to succeed and sees those components as competitive elements.

Additionally, *Achievers* feel satisfied to see how they proceed and what they need to accomplish in order to collect all available badges. For satisfying the *Explorer* one idea

is to add hidden badges which only can be unlocked due to exploration.

Relationships

The last relevant to investigate are Relationships. They are somewhat significant for online communities. Without the social aspect, especially the *Socializers* and *Killers* would not evolve a sense of gratification. Because auditorium aims to help students with questions to get answers this dynamic element plays a main role for the system and shall be considered to attract the mentioned player types.

Helping other users could generate the feeling of camaraderie, which satisfies the basic psychologic need of *relatedness*. The system also provides the possibility to gain experience by answering and asking questions. Users might also be altruistic and therefore love to help other people which satisfies *competence* and due to the voluntary aspect the *autonomy*. In contrast, others might want to profile their status. This also can motivate them to interact with the system.

5.5.2 Mechanics

A more specific level of detail to apply the before discussed Dynamics is the layer of Mechanics. They provide the "basic processes that drive the action forward and generate player engagement." (Werbach and Hunter, 2012) To prevent to go beyond the scope of this theses, the following mechanics will not be discussed: *Win States*, *Resource Aquisition* and *Transactions* suggested by Werbach and Hunter will not be discussed, because they do not help to accomplish the set objectives. For auditorium the most important mechanics might be *Feedback*, *Rewards*, *Cooperation*, *Turns*, *Chances* and somehow *Competition* and *Challenges*.

Feedback

The most important mechanic in Gamification System is *Feedback*. As discussed in subsection 1.1.1, users need to be provided with *unexpected, informal feedback or reinforcements about the progress of the player* which *provoke increased intrinsic motivation and autonomy.* In the context of auditorium feedback can be given by points, gained by positively rewarded posts by other users. Performance feedback is given by the amount of points, the ranking in the leaderboard or collected badges.

Feedback motivates every user type: the *Achiever* is happy when gaining experience

points and badges. The *Socializer* loves to interact and help other users and when other users value their posts and actions due to rewarding them, which results in reputation points. *Killers* are motivated by performance feedback and when they compete against higher ranked users. Last but not least, the *Explorer* needs feedback about his exploration progress. This can be given through badges like *Approved Group.*

To summarize, the integration of the mechanic to provide feedback is important to motivate the users. Without this mechanic the Gamification System could suffer, because the users do not know how they progress or that anyone interacted with them. Otherwise without this feedback, users might write "thank" you to show that the user answered the question. To prevent his, each author of a question has the possibility to mark an answer as "helpful" to show the author of the answer that it helped to solve the problem the user had and other users can see, that this question has already been answered and therefore does not need any further investigation. The same counts for rewarding a post: instead of writing a comment that the question has been well-formatted, this user can provide the feedback through an up-vote or a down-vote when the questions suffers.

Rewards

Rewards can be used to provide performance feedback e. g., when the user visited auditorium ten days in a row or he reached a new level. As earlier discussed, the player type *Achiever* is attracted by collectable rewards. But also *Killer* and *Explorer* may be motivated by rewards. Such rewards could be that the Killer is now the top user or the Explorer unlocked all features possible. Rewards also used to trigger emotions, like happiness.

In section 1.1 the three psychological needs were discussed: *autonomy*, *competence* and *relatedness.* When a task satisfies each of the mentioned needs, the user might be more willed to accomplish the task or, better, the user is entirely intrinsically motivated by the activity itself. Thus, rewards can provide a sense of competence. When a user achieved a badge which represents the amount of helpful answers given can enhance the users competence and relatedness because other users value the provided answers. Therefor, achievement system of auditorium aims to provide badges to enhance each of the mentioned psychological needs.

Cooperation

Because of underlying idea of auditorium, cooperation is a key mechanic, even without the Gamification System in mind. Cooperation is especially motivating for *Socializers*. They need the sense of relatedness. In general the feeling of being valued by others triggers the basic psychological needs of *competence* and *relatedness*. Users can cooperate with other users in the sense of collaboratively answering questions or delineating solutions for a given problem. One objective in auditorium (section 3.2) tries to feature cooperation due to providing a collaborative tool to create sets of learning questions which may help students to pass exams.

The cooperation mechanic is already provided by the online platform itself. Each user can ask questions which can be discussed with the help of comments and when a user then can provide a solution this user can write the answer. This answer then will be marked as helpful and each user can see that this question has been solved.

The Gamification System can enhance the experience the feeling of competence due to up- and down-votes. Which helps to see which answer or comments provided rich feedback for the author of the question. And due to marking an answer as helpful other users can estimate if it is useful to provide a second answer because the author did not mark the given answer as helpful, yet.

Turns

Turns are foundational for the question and answer system, such as auditorium is. One user asks a question, the other user answers or comments it. This is almost turn-based. This could be extended as a turn-based game with competition: one user could gain special achievements or bonus points for the first comment or answer to the question; which can attract *Achievers*, due to achievements and gaining points; but also *Killer*, due to the competitive aspect.

But for the prototype turns only are applied by the basic system provided by auditorium itself. That means, users get a notification when someone asked a new question in a group the user follows. Due this notification the receiver might be motivated to help and can write an answer. After providing an answer the *turn* is over and this user then waits for another users turn e. g., providing a comment or another answer. Thus turns are implemented into the fundamental system of auditorium and therefore do not need any further investigation.

Chances

Chances are important for auditorium in general. Every user should have a chance of receiving an answer by one or another user. The Gamification System also promotes chances: every user should have the same opportunity to gain points or badges. That mechanic also helps promoting the competitiveness aspect of the system when performance or single-user badges can be achieved, which would attract *Killers*, as well as *Achievers*.

This is applied by the notification system itself. If users activated the option to receive notifications for subscribed groups they will be informed about updates. When a user does not subscribed to the group but answered a question, this user also will receive a notification in order to the activated preference to *receive updates when author*. Thus, the system tries to help users get informed when important updates occur within a group.

Regarding to the planned achievement system, each user needs to have a chance to level up or to gain points. Users with the same abilities, provided by the privilege system, do have the same chances to earn badges. Each user has the same chance to up-vote on a post provided. Hence, only the privilege system can differentiate between the chances users have in order to gain points or to earn badges. In order to implement the achievement system it is necessary to balance the system. If the system was balanced can be analyzed during the evaluation period.

Competition and Challenges

As mentioned, those two mechanics only play a secondary role in the Gamification System for auditorium described in this thesis. Apart from this, Competition and Challenges might be a nice feature for future releases of auditorium. An idea is it to introduce quests for competitive and challenging mission in the scope of courses or as homework to motivate students taking part.

5.5.3 Components

After reviewing the dynamics and mechanics, concrete *components* constitute the most specific level of detail. Those components are the actual elements of the implemented Gamification System to achieve the defined objectives. This section aims to provide an overview and explanation of the components which will be used within the gamified

system on top of auditorium. Based on the analyzed incentives of auditorium and their affect on player types, the following components will be considered for using: *Points*, *Badges* or *Achievements* in general, *Leaderboard*, *Levels and Progress bars*, *Privileges*, *Quests*, *Social Graph*, *Avataros*, *Collections* and *Teams*.

There are more components which are not relevant for the current system to be concept. Such elements are: *Virtual Goods*, *Boss Fights* or *Gifting*. Reviewing them would go beyond the scope of the thesis, because they do not play an important role in building such a system for the application.

Points, Badges and Leaderboards

As earlier laid out, the triumvirate *Points, Badges and Leaderboards* are the least interesting components in a Gamification System. Despite this, they build the foundation for the most successful systems. Points are mostly used to give informal feedback to the user, collecting badges a sense of progress, badges, or in general *achievements*, do motivate *Achievers*. Other player types, such as the *Killer* is motivated to climb the leaderboard, because they love competitions where they can beat others. The *Explorer* is most likely motivated by badges, which represent the exploration state. And last, but not least the *Socializer*, through badges they can be provided with feedback that they helped other users, which helps to create a sense of relatedness.

Points are used to represent the users *reputation* within auditorium. With gaining points users can *level up* and *unlock features*. Figure 5.13 illustrates a progress bar which indicates the current level of the user and how much points the user needs to level up. The new level will unlock the ability to moderate posts by other users. Providing such performance feedback can affect the user to collect more points, thus to be more active in the platform. But it can provoke the user to *play* auditorium e. g., do things in a less desired way only for the sake of leveling up.

Level 5 ▕▇▇▇▇▇▇▇▇▇▇▇▇▇▇▁▁▁▁▏ Level 6
Only 135 points to unlock the ability to moderate others posts.
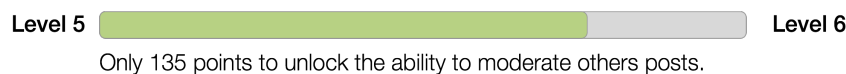
Figure 5.13 Leveling up to unlock abilities, visualized by a progress bar.

To prevent users from *playing*, gaining points depends on interaction with other users. Due to the Q&A aspect, users only gain points on posts, when other users vote their

#	Name	Reputation
1.	Alice	456
2.	Bob	320
...		
287.	You	280
...		
1323.	Jasmin	2
1324.	Jason	1

(a) Concept of a leaderboard containing all users

#	Name	Reputation
285.	Alice	456
286.	Bob	320
287.	You	280
288.	Jason	230
289.	David	182

(b) Concept of a leaderboard listing relative users

#	Name	Reputation
1.	Friend	456
2.	Friend	320
3.	You	280
4.	Friend	230
5.	Friend	182

(c) Concept of a leaderboard listing only users

Figure 5.14 Three types of leaderboards

posts up or mark answers as helpful. But this also could promote spamming with secondary accounts. To prevent this, a privilege system is needed. This system can then set checkpoints, a user needs to pass before e. g., able to up-vote or down-vote posts.

Badges in auditorium serve the purpose to excite users to interact more with auditorium. As mentioned before, a-motivated people can be motivated due to four regulation types: *external*, *introjected*, *identified* and *internalized regulation*. The former two approaches might be perceived by the person as controlling, but can help users to take the first step to shift their orientation to be more motivated due to identification or internalization. This is done through valuing the effect of their activity. Badges might help by providing feedback to support identification and internalization, such as *You helped ten people by providing helpful answers to their questions.*

Leaderboards can have a positive, as well as negative effect on user's motivation. Leaderboards can help to spur users to top the list by gaining points. Especially players who show characteristics of a *Killer* can be attracted by leaderboards. The opposite effect could harm the motivation of new or less active users. They might tend to be less motivated to take action in order to their depression because of other users' progress.

To prevent such feelings, a leaderboard can represent user's progress relative to followed people or friends provided platform. Or, a more convenient approach is to only show the next and previous five users. Figure 5.14 illustrates the three possible approaches to use in auditorium. Figure 5.14a shows the common used leaderboard design, which lists every user. This can be heavily demotivating for the users to see that they are at

the end of the list. In Figure 5.14b there are only the next two and following two users listed to give the user a more motivating listing than the approach before does. And the last used leaderboard in multiplayer-based games is illustrated in Figure 5.14c. This list shows the state of friends or followers, which is the most motivating approach, because relative to a successful application, this list is usually shorter, hence more motivating.

Some users in auditorium, like employees or lecturers, might gain a tremendous amount of points because it is their job to answer students questions, might request an option to hide themselves to prevent users suffering when seeing the amount of points users gained at the top of lists. Also users with a small number of reputation might be willed to hide themselves from the leaderboard. This option will be provided within the prototype. The author of this thesis is one candidate hiding himself, because it is likely possible that the author would stay on top of the leaderboard due to answering support questions which will be rewarded because they helped other users. It would be legit, but it might be depressing for other users never topping the leaderboard.

Level up!

Levels help to provide checkpoints the user can reach when actively using the web application. Users need to gain points in order to proceed towards leveling up, which is informal feedback for the users, which can motivate them. Player types like the *Achiever*, try to level up in order to unlock achievements. The *Killer* might see leveling as a challenge to compete with other users in order to represent the status of success. *Socializers* might use levels to find related users with the same level as themselves. The achievement system within auditorium uses levels as foundation for the privilege system. When users level up they unlock abilities or access to new features, which motivates the *Explorer* and *Achiever* types.

Privilege System

Along the way reading through this thesis, the phrase *Privilege System* was mentioned often. Preventing *trolls* from spamming, levels to unlock new abilities is one approach. A second approach is to use it to build a community-centered system, where the community members self-maintain their platform. Experienced users are able to unlock abilities e. g., which enables them to moderate posts or to create new groups, invite people, write announcements, down-vote or up-vote on posts, etc.

The flaw of such a system is that the obstacles to gain desired abilities can be to hard to

reach. That is why a balanced privileged system is necessary in order not to demotivate or frustrate users. This is an iterative process, members need to be interviewed at regular times to evolve the system. An appropriate privilege system, based on leveling is described more in detail in subsection 5.6.2.

Avatars to represent them self

Avatars are used as visual representation of the persona in the community context. Additionally to the username or real name, the avatar can help identify users within a specified context, such as dialogs or leaderboards. Some users also might use avatars for status representation. But in general, avatars will only be used for representing users themselves. They can be added to distinct posts. Some might prefer adding them only to parent posts, such as questions, answers, announcements or topics. Others want to see the avatar also on comments. But this can be perceived as overwhelming. Which option is the best, can only be analyzed by applying them and asking the users for their preferences.

Quests of Education

One of the most powerful components a Gamification System can provide are *Quests*. They are widely used in adventure games or Massively Multiplayer Online Role-Playing Games (MMORPGs). Quests encapsulate missions a player needs to accomplish in order to proceed or unlock things.

A public school in New York City has opened its doors in 2009 named *Quest to Learn*[24]. This school aims to provide a different way to learn: "Students are engaged in gameful activities from the moment they wake up in the morning to the moment they finish up their final homework assignment at night" (McGonigal, 2011, p.128ff.). The first students will graduate in 2016. McGonigal feels confident to say that those graduate students will become "creative problem solvers" (McGonigal, 2011, p.132).

In auditorium, quests can be used to engage users to get together in order to solve a specific problem. This can be used during seminars or projects. Quests do have the potential to heavily engage students by giving them a roadmap to success. Thus lecturers can create regular quests to get users doing their homework to better understand the subject of the class. After they accomplished their quests the lecturers should then provide rich feedback, so the students are engaged to solve their problems to get better

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[24]Quest to Learn, Public School in NYC — `http://q2l.org` (visited on 2014-02-20)

in the specific topic. This approach would make universities more game-like and most likely will motivate students to be more active. But this topic is too big for the scope of this topic, thus quests will not find their way into the prototypal implementation.

Teamwork and Socializing

Because auditorium is a community-based application *Teamwork* is important. An open question can only be answered through cooperation between the community members. Without a growing community the platform itself will fail to succeed. To motivate *Socializers*, auditorium should provide components to support camaraderie, socializing and cooperation. Thus the platform is kind of turn-based, as delineated earlier, the cooperation aspect is provided by the web application itself. Users need to help each other in order to gain points and to succeed.

Apart from this community members should be able to connect to each other. This can be realized through friendships and thus *Social Graphs*[25]. When applying social graphs, they could give users the ability to get to know each other and to contact other users via messages. But this implementation would go way beyond the scope of the thesis. This might be relevant for further investigation and work.

Thus describing the Game Elements and how they connect to each other, lays the foundation for the Gamification System. The next step is to describe how they can be intertwined to provide an engaging user experience. Hence, the next section describes Activity Cycles, introduced in section 1.2, to put those elements together in a way to motivate the delineated player types and to achieve the determined objectives.

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[25]Social Graph, Wikipedia — `http://en.wikipedia.org/wiki/Social_graph` (visited on 2014-02-20)

5.6 Gamification System in auditorium

A major step towards a functioning Gamification System is to put those elements and motivational aspects together. It will be described how the chosen and described elements will interact and how they can help to achieve the determined objectives.

5.6.1 Gaining Points

One of the basic elements needed to calculate and evaluate the progress of a user are *Points*, also sometimes referred as *Experience Points* or *Reputation*. Gaining points can help to accomplish the first defined objective to get *a-motivated user* on board. When those users characterize a little bit the instincts of an *Achiever*, the chance is quite high to get them motivated by gaining reputation. This also counts for the *Killer*, as mentioned in section 5.4.
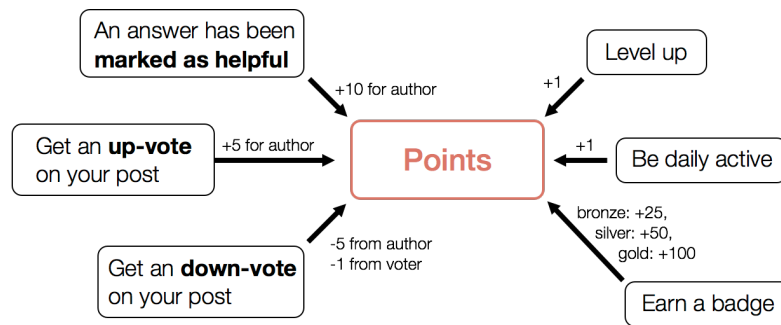
Figure 5.15 Earning points in auditorium

Users can earn points due to a range of different activities in auditorium. How much a user can gain through a particular activity is represented in Figure 5.15. Users earn +5 points when someone else voted on one of their posts or when a given answer has been marked as helpful, then the author of the answer will receive +10 points. Apart from this users also gain points when they get badges or level up. How much points a player earns depends on the category of the badge (bronze, silver or gold) and which level he just completed. But it is important to observe the motivational aspect of the amount of points. If it is too much, the point system can be perceived as overwhelming and with less points, it could cause less engagement, thus the activity is not worth it to earn the small number of points.

Level 5: Concept

The underlying system tries to balance the amount of points: earning a badge is therefore more valued as a simple up-vote a user can provide. That is why the amount of points gathered due to an up-vote is +5 points and a badge brings between 25 and 100 points, dependent on the category the badge holds. When a user down-votes on a post the author will loose 5 points, which is the same amount as of an up-vote. But the user taking this action, will receive a penalty with the amount of −1 points. This penalty might prevent trolls from down-voting each post on the site. To go one step further, users can only down-vote when they at least have gained one point for their site-reputation, otherwise it would not be possible to take this action, because the user would then have minus points, which is not possible from the system side.

It also would be interesting to know which effect points have when they were provided on a daily basis. That means, when a user visits the site for the first time on a particular day, this user will receive +1 points. This might help to motivate users to visit the site every day. But the latter point is not easy to implement, because each users might be tracked by the daily logins and therefore would go beyond the privacy policy.

5.6.2 Unlock privileges

Based on points, users can level up and thus unlock privileges. This mechanism is used to prevent the community from *trolling and spamming* by bots or harmful users. At the beginning, users can only ask new questions and provide answers. There is no possibility to vote on posts, neither up nor down voting is possible during the entry level. Thus auditorium is an educational platform, users should be allowed to create at least *Lecture Groups*. But they need to be approved by side-wide moderators or administrators.

If users earn at least 25 points, they will level up and unlock the ability to *up-vote on posts* or *mark answers as helpful*, which is the beginning for the community to distribute points themselves as described in the section before. The basic privilege system is illustrated in Figure 5.16.

Such a privilege system provides the users with a sense of their proceeding. This also motivates them to earn points and thus to be more active. Because the user completely controls if he levels up or earns points, it is perceived as not controlling. But this system can also frustrate users when they are not capable of accomplishing their task, like commenting on a post. This can hinder uses to be more active. That is why the system needs to be evaluated regularly. Which can be accomplished due to feedback

Level 6 — Become a site-wide moderator
400 Points   Approve new groups

Level 5 — Add own Tags
200 Points   Edit other users Posts

Level 4 — Able to comment on Posts
100 Points   Downvote Posts

Level 3 — Edit own Posts
50 Points   Create Groups

Level 2 — Upvote Posts
25 Points   Mark Answers as helpful

Level 1 — Ask a Question
Entry Level   Answer Questions
              Create Lecture Groups (needs approval)

Figure 5.16 Levels and accociated privileges a user can unlock

forms, where users can rate or comment on distinct features which helps the author of the system to adjust thresholds to gain new abilities or to add more features for a particular level.

The leveling aspect and unlocking features can motivate the player types *Achiever* and *Explorer*. The Achiever tries to gain points and thus aims to progress. Whereas Explorers try to explore the system. Thus the most motivating part for those user types might be the ability to unlock new features when leveling up. This can result in more active users.

5.6.3 Earning Badges

Besides points and levels, the third major aspect of the achievement system is to provide badges. Users which characterize the Achiever type are more likely motivated when they earn something for their activity. The Explorers on the other hand might see badges as an indicator for their exploration of the system, assuming that such badges exist.

Socializer feel more likely related to other users with the same subset of badges. Thus they might try to connect or interact with them for satisfaction (Level 2: Related Work).

Hence, auditorium provides a collection of badges the users can earn due to different activity. The majority of badges are based on collecting points and ratings by other users. Some badges, such as the "Explorer" badge represent the progress of exploring the system, which affects especially Explorers. Badges, like the "Critical", are most likely attractive to Killers and Achievers. The badges listed should be extended from time to time to give the users more stuff to collect and to experiment with.

Learning	Nice Question	Great Question
Commenter	Nice Comment	Great Comment
Cooperative	Nice Answer	Great Answer
Something to Say	Interesting Topic	Fascinating Topic
Attention	Important	Significant
Nice to Help	Helpful	Wise

Figure 5.17 Collection of badges earnable through votings

The Figure 5.17 shows a collection of badges which can be earned due to votes by others, such as the "Learning" badge can be achieved when one question has at least a rating of plus one. Those badges are categorized into bronze, silver and gold. This shall represent the difficulty to earn them. In case of the "Learning" badge, the silver or golden badges can be earned when the question has five for the former badge or ten points for the latter. Those badges shall regulate the behavior as well as the motivation. Because those badges need interaction from other users they can help to shift the behavior of users from low-quality questions to high-quality badges because the author of a post wants to have as much positive votes as possible to be able to earn the gold badge.

The categorization was chosen a) because of the inspiration by the implementation of StackOverflow and b) to provide "difficulty levels". Bronze badges are provided for casual users. They are relatively easy to earn: one up-vote for a question to earn the "Learning" badge. The author assumes that most of the active users will earn all bronze

badges provided. To keep them engaged the silver and bronze badges were introduced. In order to earn those badges e. g., a post needs five or ten points to get achieved. Due to the small number of users in auditorium, this is a real challenge and only heavily active users might earn those badges by providing great questions. Therefore they might be more engaged to think about what they write before they post the question.

| Welcome Back | Regular | Habitue |

Figure 5.18 Collection of badges earnable through daily activity

To give users an additional reason to visit the platform in order to check recent activity in other groups, users can earn badges due to their regular visits. The Figure 5.18 lists three possible badges. The "Welcome Back"-Badge will be achieved when the users at least visits the platform five consecutive days. To earn the "Habitue"-Badge, the user needs to come back twenty-one consecutive days. This collection of badges helps that users perceive their activity in other groups as well as users without activating email notifications can perceive what they missed on the day before. Those badges can help to regulate the users through identification and internalization. The former might be applicable because the user can identify with other users problems, when new questions come up which the users might miss by not visiting the page. The latter might be applied when the user internalizes the value of the platform.

Moderator	Party	Modern Browser
Biographer	Curious	Rewarding
Curious	Rewarding	Critical
Editor	First Step	

Figure 5.19 Collection of first time badges

The third collection of badges concludes so called "First Time"-Badges. Users can earn those badges when they do different activities for the first time. An example is the "Moderator"-Badge. Users earn this badge when they will be promoted to a moderator within a group. Another badge is the "Biographer"-Badge. To earn this badge, the user

need to complete the personal profile page with personal information like *role at the university*, *name*. With those badges, the users shall get a roadmap what they can do such as *rewarding users* or *being a moderator*. If once the users know what they can do they might also use this features more frequently than not knowing what is possible.

5.6.4 Onboarding

Gamification not only helps to motivate users through the usage of PBL. One important aspect is to help newly registered users to get to know the platform or helping to answer the following questions: *What is the application good for?*, *How does the platform work?*, *What can I do?*, *What is the next step?* or *Where can I find this and that?*. To answer this questions auditorium will use *context-based interactive Guides*.
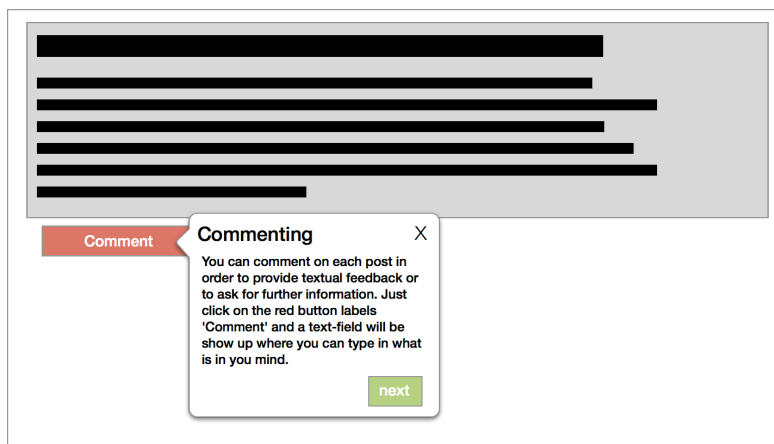

Figure 5.20 Mockup of an interactive tutorial overlay

Interactive guides appear when the user visits a location within the web application. Such location could be the groups overview page. The user then will see an overlay-based tutorial, which automatically scrolls to the next point of action. This helps to guide the user through a process, such as asking a new question. After the user successfully asked a question the next tutorial might pop up to help the user to orient himself on the detail page of the created question and so on.

A mockup of a possible implementation of such an interactive tutorial can be seen in Figure 5.20. This overlay marks the commenting function for a certain post. As earlier described a few users obviously do not understand the difference between comments

and answers. To help them understand those features, such an overlay will be pop-in and explain them how to use this feature. Picturing, those guides can be used all over the application to introduce new features for the user. At the beginning a user can be provided by a step-by-step-tutorial in order to guide them through the first question to ask. This might lower the entrance barrier for the first step towards the activity.

Step-by-step guides are not that easy to implement. A nice-to-have feature would be to show up suggestions for the next step to take. This would be less obtrusive than those guides explained, but also more complicated to implement.

5.7 Conclusion

This level introduced the objectives to accomplish through Gamification. To concept a meaningful Gamification System, this level described the Game Elements in detail introduced in Gamification. With the help of *Dynamics*, *Mechanics* and the application through *Components*, the system has been delineated in detail. Due to this application and interaction of the Game Elements, the accomplishment of the objectives will be evaluated in Level 7: Evaluation and the results analyzed in Level 8: Conclusion and Future Work.

Level 6: Implementation

The concept of the achievement system for auditorium was specified in Level 5: Concept. With this in mind, the following level describes how the Gamification System has been integrated into auditorium, which problems occurred and why it was necessary to refactor the first version of auditorium and what changes had to be applied in order to provide a solid foundation.

6.1 auditorium 2.0

The foundation for the achievement system builds the second release of auditorium. With the release of the second version, an overall refactoring has been applied (Figure 6.21).

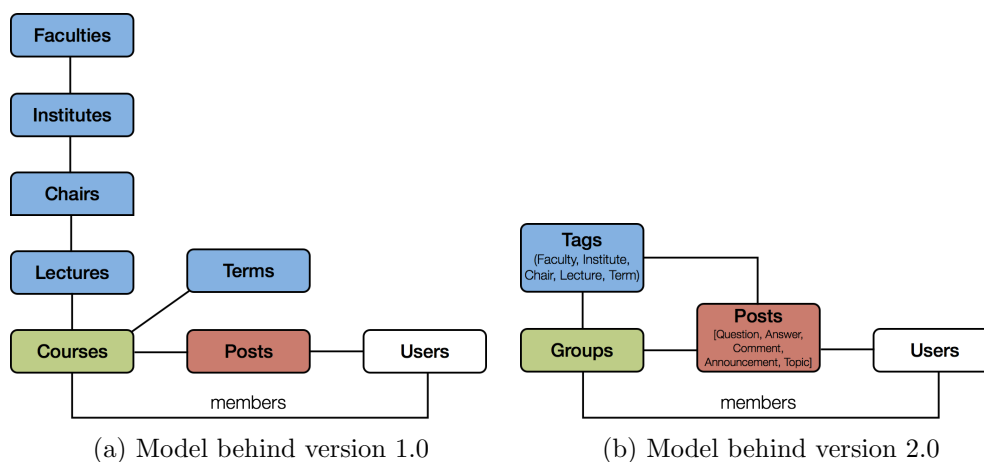(a) Model behind version 1.0   (b) Model behind version 2.0

Figure 6.21 Structural differences between auditorium in version 1.0 and version 2.0

In version 1.0 the goal was to map the administrative structure of the *TU Dresden* into auditorium, which is illustrated in Figure 6.21a. Users were able to follow *term-specific courses*, they were able to ask questions in those courses. Each course was appended to a specific *term* and a *lecture*. Each *lecture* symbolizes a container a courses

in each semester. The facilities *chair*, *institutes* and *faculties* helped to give auditorium a structure and made it possible to filter lectures by navigating from faculty over institutes and chairs to lectures. Another navigation approach was directly by navigating to the term-overview to search for courses available in this semester.

The big drawback of mapping the real administrative structure into the web application made it inflexible. Due to term-specific courses, users were not searching for questions in previously semesters; they were asking the same questions in the current course repeatedly. Moreover some users wanted to create custom courses to teach students e. g., programming languages. To apply this courses, a fictional administrative structure had to be applied.

Due to the mentioned problems, the second version had to be more flexible in order to ease the creation of custom courses and to reduce duplicate questions within the same courses. The applied changes are illustrated in Figure 6.21b. The first step was to merge courses and lectures into *groups*: a group contains every post of all courses from a lecture.

In order to apply the administrative structure in a more flexible way, *tags* were introduced with the second release of auditorium. A tag is a label which can be assigned to groups and posts. With tags the same administrative structure, can be applied and custom groups, which normally would not fit into the given structure can now be just tagged to provide the same information. Moreover, users can also filter posts and groups by tags on the home page of auditorium.

A minor change, affecting the database entries of posts, was to split the post model into separate post types: *questions*, *answers*, *comments*, *announcements*, *recordings* and *topics*. This allows to apply different attributes to each of the post types. This change results in cleaner separation of the different post types in the database.

The second version of auditorium with all major and minor changes was necessary to provide a solid foundation to build the achievement system on top. Without those changes it would have been harder to implement the prototype of the Gamification System which has been described in Level 5: Concept.

6.2 Problems

While planning the implementation of the achievement system, the second release of auditorium was not ready to deploy. Due to this delay, some features of the system needed to be canceled. The complexity of some badges, such as calculating the daily activity, earlier discussed, made it nearly impossible to provide such badges. Those badges also were not provided due to some privacy policy constraints the author had. The author does not like observation platforms where each step of the user is tracked and stored.

A major problem was the first implementation of notifications, when a user earned a badge. This was first realized by flash messages (Figure 6.22). Flash messages show the current user information about the last action, like *adding or editing a group.*
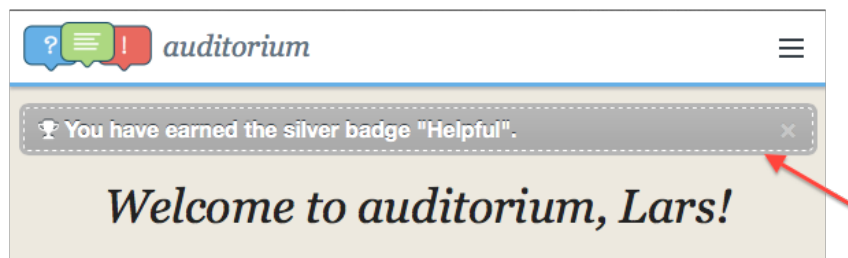

Figure 6.22 Screenshot: flash message for an unlocked badge

But the implementation of the badge system only rewards users with badges due to activities by other users, which results in never showing the affected users those flash messages. To solve this problem the provided *notification system* inside of auditorium was used to provide persistent notifications, when this user earned a badge (Figure 6.23).

6.3 Development Process

The prototype has been developed in three environments: *test*, *development* and *production*. This is a typical development setting for *Ruby on Rails (RoR)* projects (Hansson et al., 2009). The community behind *RoR* suggests to use Test-Driven-Development (TDD) or Behavior-Driven-Development (BDD) (Chelimsky et al., 2010). The latter is an evolvement of the former approach. Thus the suggestion is to write tests *before* writing any
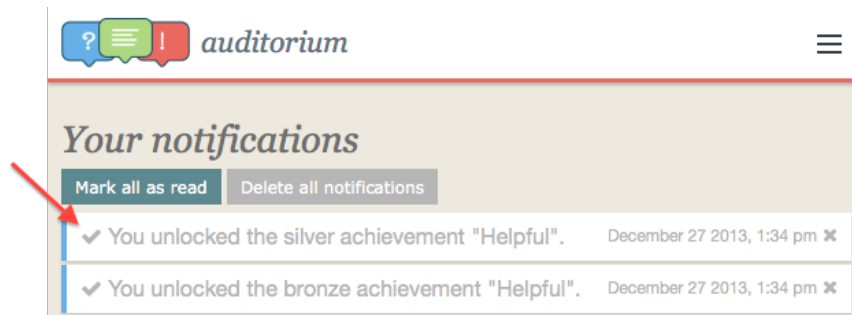
Figure 6.23 Screenshot: notification of an unlocked badge

production code. This should prevent runtime-bugs. The goal of those development approaches is to provide one-hundred percent test-coverage. But when developing auditorium, this has not been achieved, only the most critical parts were tested, like *delivering email notifications* to followers or *earning badges.*

The *development* environment consists of a local installation of the *RoR* application. Hartl provides a nice manual on how to setup a development environment in the chapter "From Zero To Deploy" in his book (Hartl, 2012). Such a development environment is necessary to test the written code on a nearly exact copy of the production environment, without breaking the production data. This setup allows to eliminate runtime bugs, which otherwise would only be recognized on the production server, which could lead to catastrophic problems. An example is, that a user gains administer privileges and drops the whole database due to a runtime bug. Nevertheless a development environment cannot stop the arising of runtime bugs. But combined with solid tests, described in Chelimsky et al., 2010, could reduce the amount of silly bugs in the code tremendously.
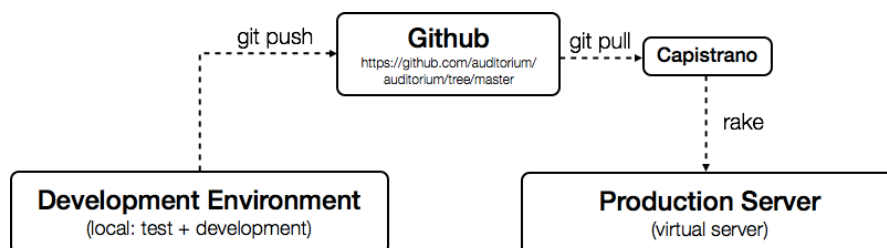

Figure 6.24 Deployment of the current master branch with Git and Capistrano

The third stage is represented by the mentioned *production* environment. The online platform has been deployed onto a virtual server. In order to deploy the last stable

release of auditorium, the simple and powerful ruby gem *Capistrano*[26] is used. It grabs the current master branch from the *Github repository*[27] and setups a new release stage on the virtual server, provided by the *Chair of Computer Networks* (Figure 6.24). To deploy the application, the simple command was used: `cap deploy`. Which runs several commands to setup the production release of auditorium on the virtual server. After finishing this, the application is up and running and can receive requests from outside.

6.4 Shortcomings

The previous level described which achievements and rewards are possible for auditorium in order to motivate the users to be more active. Due to some privacy issues, the author of this thesis does not agree in tracking users activity on auditorium by storing each individual login timestamp in the database. With this constraint some badges were not be possible to provide. Thus the *daily activity badges* are not available in the prototype of auditorium. But due to the timestamps of the posts in general, in future work it could be possible to calculate the daily activity without providing individual log in timestamps.

Besides some badges the whole privilege system needed to be cancelled. Because this thesis aims to analyze the impact of the game elements provided on acceptance and activity increasing, it could have been problematic when users cannot be as active as before, which could dramatically drop the activity rate and would compromise the evaluation and results. The privilege system is still planned for future revisions of the Gamification System. The current prototype only provides the *leveling aspect*, without any meaning behind each level.

6.5 Components

The core parts of the Gamification System are *earning badges* and *gaining points*. The achievement system has been added to the system as represented in Figure 6.25.

The user is in the center. Each user has exactly one level. The user can level up when the score of the user is equal or higher than the specific threshold of the next level.

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[26]Capistrano gem — `https://github.com/capistrano/capistrano` (visited on 2014-02-26)
[27]Github Repository of auditorium — `https://github.com/auditorium/auditorium` (visited on 2014-02-26
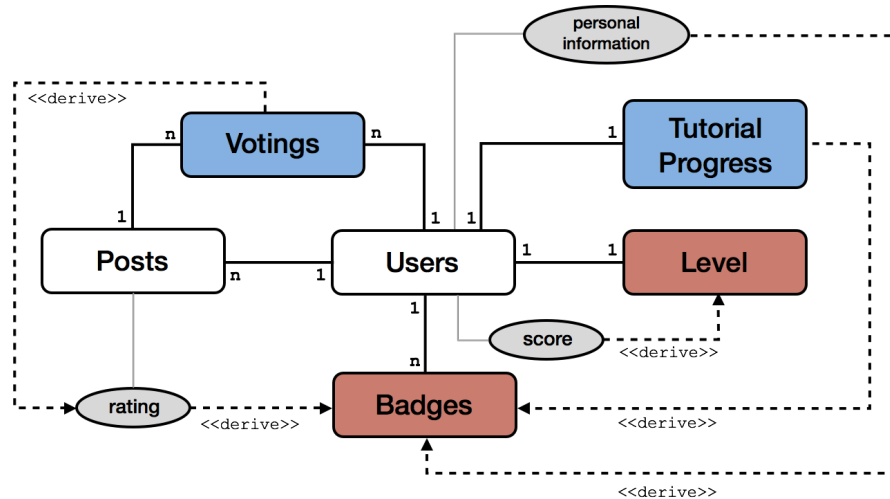
Figure 6.25 Integration of Gamification System in auditorium v2.0

Badges can be earned due to different constraints. The achievement system provides three different categories of earning a badge: *first-time badges*, *post badges* and *progress badges*.

A first time badge is something like providing a fulfilled profile page and thus earning the "Biographer" badge. The progress badge depends on the individual progress of the provided interactive tutorials. And the last category encapsulates the majority of all badges in auditorium. An author of a post can earn badges when other users vote on the post; when the rating of the post reaches a threshold, the user might earn a new badge.

The available badges (1) are represented in the user profile page, as represented in Figure 6.26. The badges are differentiated into three classes: *bronze* (1a) , *silver* (1b) and *gold* (1c). Those classes shall represent the difficulty of earning those badges e. g., the *silver Learning badge* will be achieved if a user has written a question with at least a rating of ten points, whereas the *gold badge* needs at least a rating of 25 points. The profile page (Figure 6.26) also shows the level (2) and progress of the individual user (3 and 4).

The system does not provide hidden badges, every badge, which is visible on the users profile page is also earn-able by active participants. This decision has been made because the player type *Achiever* is motivated by achieving every badge possible. Other elements like the progress bars also try to attract the *Achiever* and *Explorer*. Also the *Killer* might
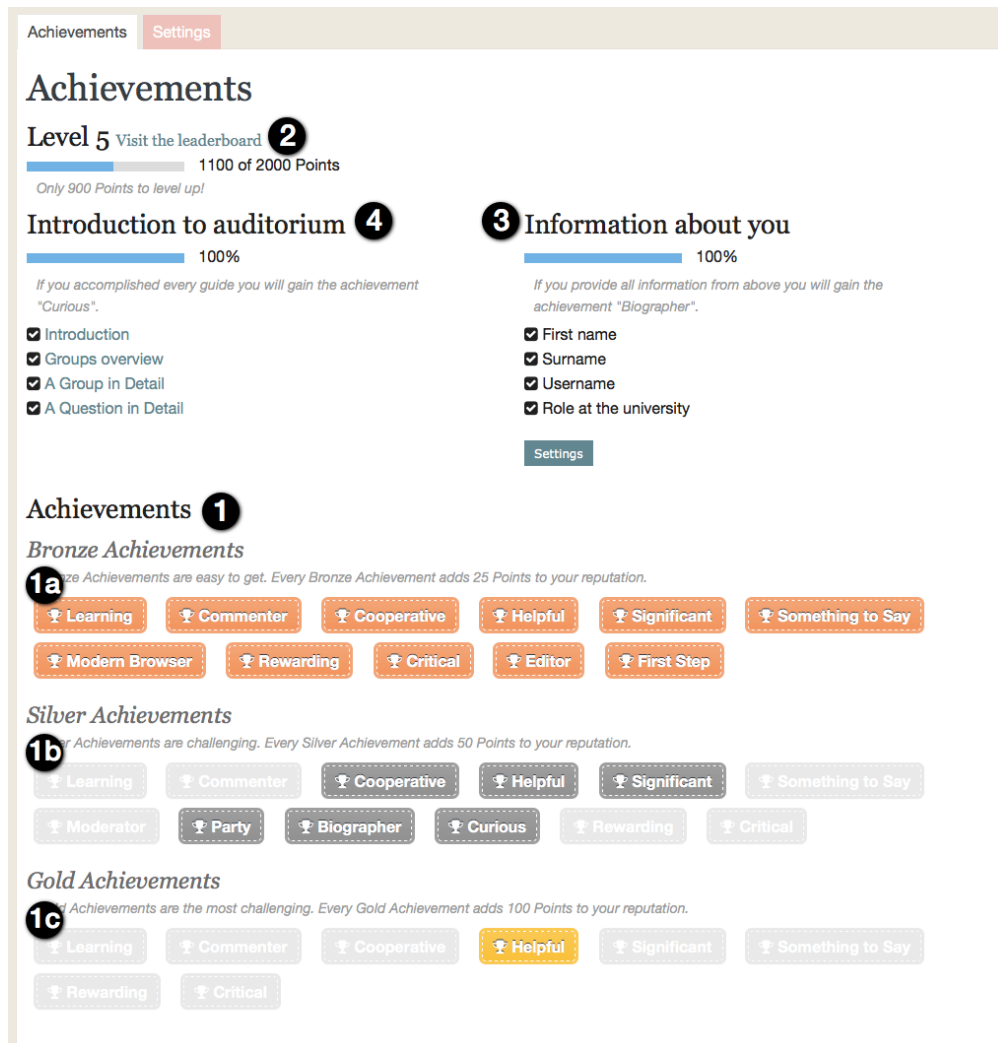
Figure 6.26 Screenshot: achievements in auditorium

be attracted when this user can see which badges a different user has earned, which could lead to a competitive perception and therefore more motivation to earn more badges and gain a higher level as the competitive user.

6.5.1 Badges

To earn a badge Figure 6.27 illustrates the processes of *up-voting a post* (Figure 6.27a) and *marking an answer as helpful* (Figure 6.27b).
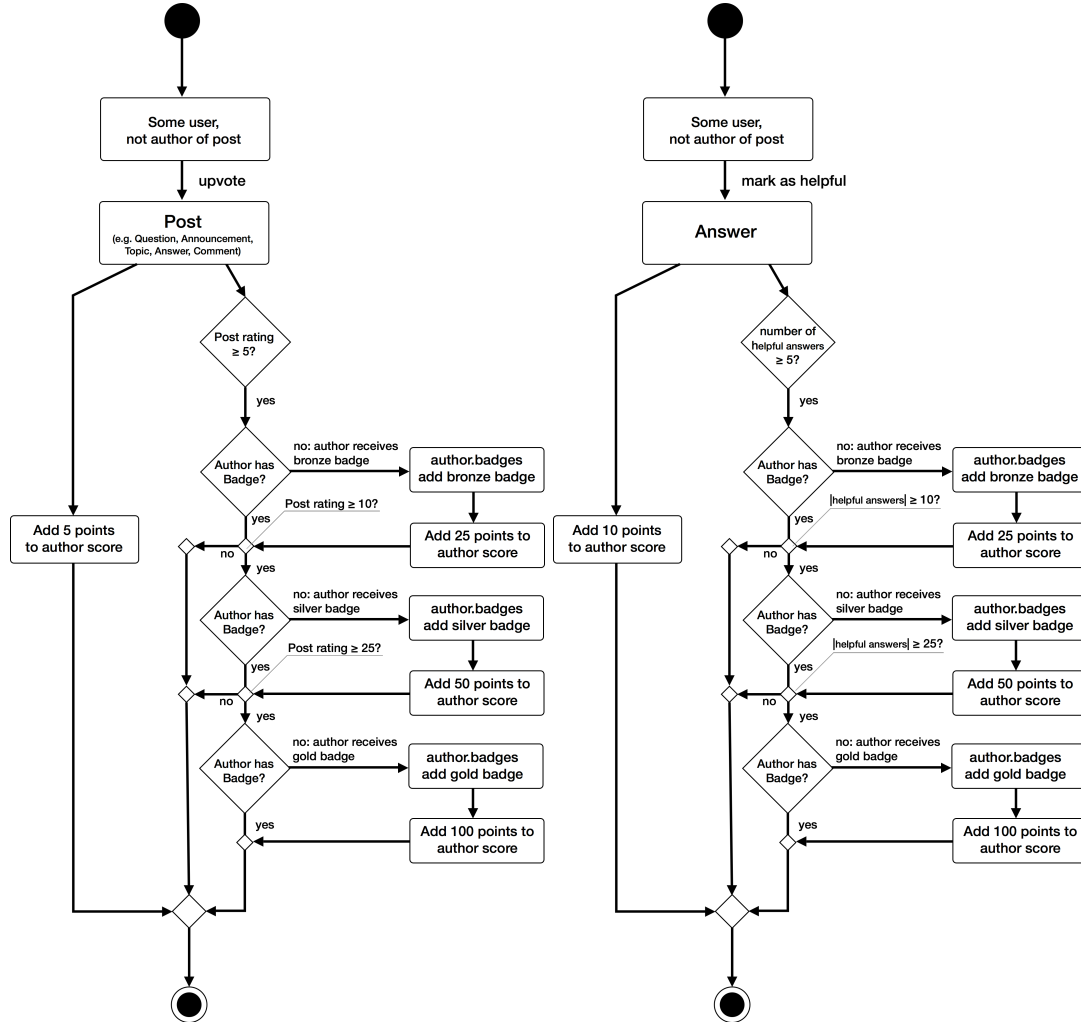
(a) Up-voting process of a post.   (b) Process of marking an answer as helpful.

Figure 6.27 Illustration of the processes when upvoting a post or marking an answer as helpful and earning badges.

Those illustrated two processes are almost identical. The main difference is that the process of *marking an answer as helpful* is restricted to an *answer* and cannot be applied to other post types. Both diagrams show how much points the user gains and which badges are achieved in order to the rating of the post (Figure 6.27a) or the amount of

answers marked as helpful (Figure 6.27b).

When a user visits a post and presses the up-vote-button the system starts two processes:

1. Add five points to the authors score.
2. Check if the author fulfills the conditions to earn a bronze, silver or gold badge.

In order to achieving a badge, the user also gains reputation points, depending on the badge category:

· 25 points for bronze badge,
· 50 points for a silver badge, and
· 100 points for a golden badge.

6.5.2 Points

As described in Level 5: Concept there are different ways in order to earn points. Figure 6.28 shows an overview of all possibilities.
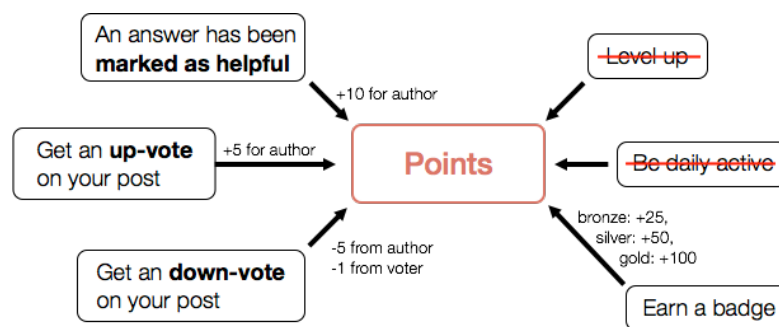
Figure 6.28 Earning points

In the previous level, six ways to earn points were discussed, but only four were considered for implementation. The points for *leveling up* and *be daily active* are not provided, yet. Measuring the daily activity of users was too complicated to implement in the short time. This is a must-have for future implementations of the system. Future releases will be evaluated later in Level 8: Conclusion and Future Work.

6.5.3 Levels

Due to the lack of the privilege system introduced earlier (subsection 5.6.2), levels only provide virtual checkpoints for the user. In Figure 6.26 levels are represented through a *progress bar* (2). A user can see the current amount of points and the threshold of the level. In this case, the user needs another 900 points to level up. In future releases those levels can be extended by the mentioned and discussed privilege system. The provided levels in auditorium are illustrated along a timeline in Figure 6.29.

Figure 6.29 Provided Levels in auditorium
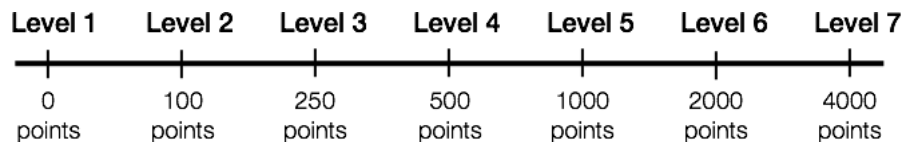
6.5.4 Onboarding

The last major element of the implemented Gamification System is *Onboarding* process. With *onboarding*, newly registered users will see short interactive guides. Those guides aim to introduce the system and how it works. This shall prevent that users get lost in the complexity of the system.

Figure 6.30 Onboarding through interactive, contextsensitive guides

Figure 6.30 shows the actual appearance of interactive guides. Users can proceed by clicking *Next* or close it. Those tutorials are implemented by the *Javascript Plugin Joyride*[28], which is integrated into the underlying CSS framework *Zurb Foundation 4.x*[29].

6.6 Conclusion

The Gamification System inside of auditorium was less problematic to implement. Only a few features were not implemented, yet. Those features will be considered for future releases due to the possible impact on user's motivation. As written, the second release of auditorium provided the solid foundation for the system. Without slimming down the first implementation of auditorium it would be more difficult to implement the Gamification System into the online platform due to the complexity as described in the first part of this level.

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[28]Joyride, a Javascript Plugin which helps to implement interactive guides — `http://foundation.zurb.com/docs/v/4.3.2/components/joyride.html` (visited on 2014-02-26)

[29]Zurb Foundation 4.x is a responsive CSS Framework which provides useful tools to build a web application which works on all platforms (Desktop, Tablet and Smartphone) — Documentation: `http://foundation.zurb.com/docs/v/4.3.2` (visited on 2014-02-26)

Level 7: Evaluation

This level aims to document the evaluation process within this thesis. The evaluation is divided into three parts: the first stage was to evaluate the first release of auditorium and features, users favor the most and which can be removed or need a revision. The second stage was to finalize the implementation of the second version of auditorium internalizing the feedback from the first survey. The third step was to implement and pilot-test the Gamification System on top of the second release of auditorium, which was evaluated through a second survey.

In Level 4: Methodology the milestones to build and evaluate the Gamification System was represented in Figure 4.8. Because the participation rate of the second survey was not large enough, the author decided to add another milestone: *Interviews*, to provide a qualitative method and to compensate the small participation rate. Those interviews took place between 7th and 14th of February in 2014. Those interviews will help to provide qualitative feedback for the evaluation of the system (Figure 7.31).

7.1 Evaluation Methods

Figure 7.31 illustrates the process of implementing and evaluating the Gamification System in auditorium. For measuring the impact on user's engagement and the acceptance, different methods were used. Those methods will be delineated in the following sections.

7.1.1 Quantitative Methods

Quantitative methods are the most used evaluation methods. The advantage when using this method is that they are standardized. A large amount of people can be asked with the same set of questions to answer or tasks to solve. For this thesis two major types of quantitative methods were used: *surveys* and *data mining*.
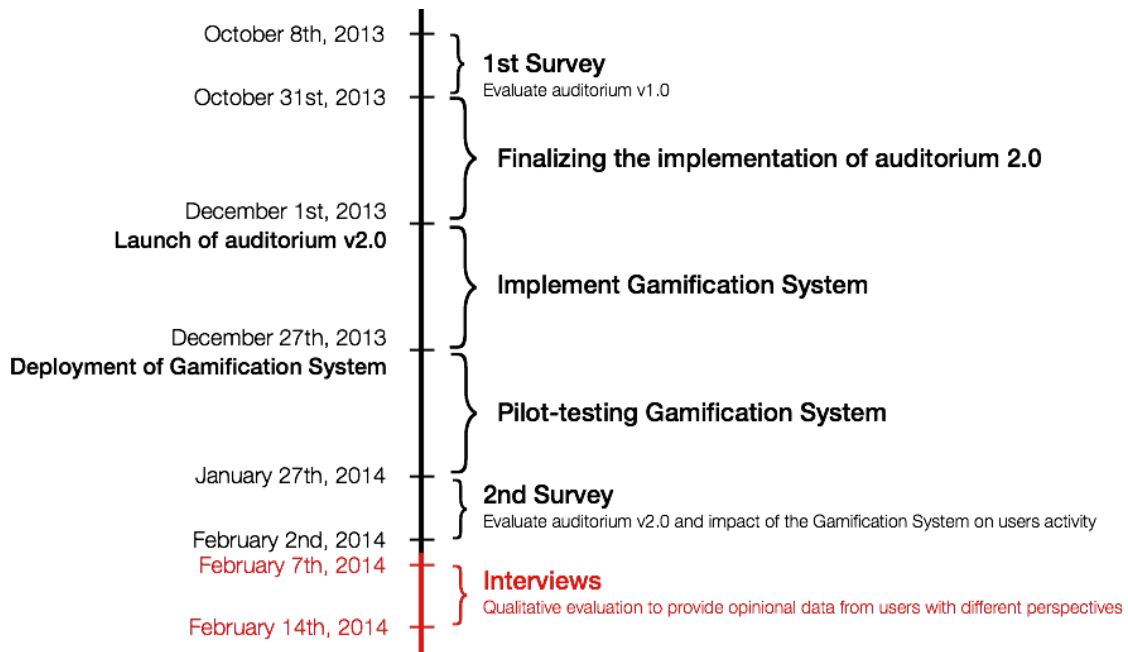
Figure 7.31 Extended milestones overview, additional interview week to provide qualitative evaluation data

Surveys

The approach to investigate the impact of the Gamification System on users' engagement is to ask a large amount of users before this system has been applied and after the deployment. This data shall help to compare the differences in behavior, acceptance and engagement.

As seen in Figure 7.31 the first survey took place from 8th to 27th of December. Within this period of time, members of the *Faculty of Computer Science* at the *TU Dresden* were asked to participate on the survey. This evaluation aimed to investigate which features were used often and the necessity for the participants. The evaluation results were used to improve auditorium during the refactoring process.

The second survey was scheduled between the 27th of January and 2nd of February in 2014. Due to only this one week, the participation rate was quite small (n=18). Because of the small number of participants the author decided to interview an additional number of users to provide their feedback on the system. The second survey was divided into two parts: the first part asked for the feedback about the second release of auditorium. Users were pleased to compare the first and second version. The second part of the

survey considered the integration of the achievement system.

Data Mining

Additionally to the two scheduled surveys *data mining* is used to provide more specific data, such as the actual *amount of written posts*, *active users* or *earned badges*. This data is directly provided by the database behind auditorium. The information to extract is limited to the period of time between the 27th of December in 2013 and 27th of January in 2014. This time period represents the pilot-test of the Gamification System. Additional data will be used to illustrate the number of registered users or written posts since launching auditorium in version one and two compared. To provide comparable data during the pilot-test period, users were divided into an experimental and control group. The former group had the Gamification System activated and users were able to interact with badges, points and levels. The latter group was not aware of the new feature.

A/B Testing

The evaluation of the achievement system has been achieved by the use of a modified version of *A/B-testing*[30], for that the registered users were divided into an experimental and control group. To ensure a balance of active users between those groups before dividing them, an algorithm was defined to balance both groups:

Step 1: Capture all users and sort them by their `activity_index`.
Step 2: Define sets for active and less active users by their activity sets.
Step 3: Shuffle both sets individual to provide randomness.
Step 4: Add half of active users and half of less active users.
Step 5: Set the flag `experimental_group` to `true`.

Those steps were realized by the help of a *rake task*[31]. A rake task is the *Ruby language*[32] equivalent to *shell scripts*[33]. The Listing 8.1 (in the appendix), represents the implementation with the script language *Ruby*, the same language the Gamification System was created with, more concrete RoR.

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[30]A/B Testing (Wikipedia) — `http://en.wikipedia.org/wiki/A/B_testing` (visited on 2014-03-03)
[31]Rake Documentation — `http://rake.rubyforge.org` (visited on 2014-03-06)
[32]Ruby Language — `https://www.ruby-lang.org/en` (visited on 2014-03-06)
[33]Wikipedia arctile about the Unix Shell — `http://en.wikipedia.org/wiki/Unix_shell` (visited on 2014-03-06)

Level 7: Evaluation

After the algorithm was applied to the database, the metrics in Table 7.2 were measured to ensure balanced groups by activity and users. At the end of the pilot-test period the individual activity were measured for each day and compared between the two groups.

	Experimental Group	Control Group
Users	677	678
Activity[34]	2132	2730

Table 7.2 Metrics of Experimental and Control Group

7.1.2 Qualitative Methods

Interviews

As mentioned, interviews were used to provide additional, qualitative data to compensate the small amount of participants of the second survey. Interviewing people belongs to the category of qualitative methods. To provide qualitative data a quite small amount of users were asked between the 7th and 14th of February in 2014. To somewhat compare given answers, a set of questions was defined. During the interviews participants were asked for further information when answering a question to provide individual opinions and critics. The questions the users were asked are listed in Table 8 in the appendix.

7.2 Research Findings

The section before already described the major problem evaluating the system provided. Although auditorium has more than 1150 users, the number of participants in the first survey was around six percent. The second survey was filled out by around one percent of available users participating. This implies that the results of those two surveys are not representative enough to provide solid feedback. To compensate this lack of data, interviews were scheduled after the second survey was closed.

During the interpretation of the provided data, the following research statements were derived:

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[34]The activity was calculated by the accumulation of each users amount of posts and ratings

1. During the pilot-test period the experimental group with the achievement system activated tends to be more active compared to the control group.
2. Voting on posts and gaining points provide meaningful feedback of the individual post-quality and user's progression.
3. Majority of users match the characteristics of the player types *Achiever* and *Explorer*.
4. Majority of users favor the refactored second version of auditorium, the shift from term-specific courses to groups and the use of tags instead of static dependencies.

Based on the knowledge of the research statements, the following sections aim to discuss and argue the derivation of this interpretation. The implication for the first statement was made due the results of the pilot-test period. The second, third and last statement can each be implied by the data provided by the second survey and the interviews.

7.2.1 Usage Statistics
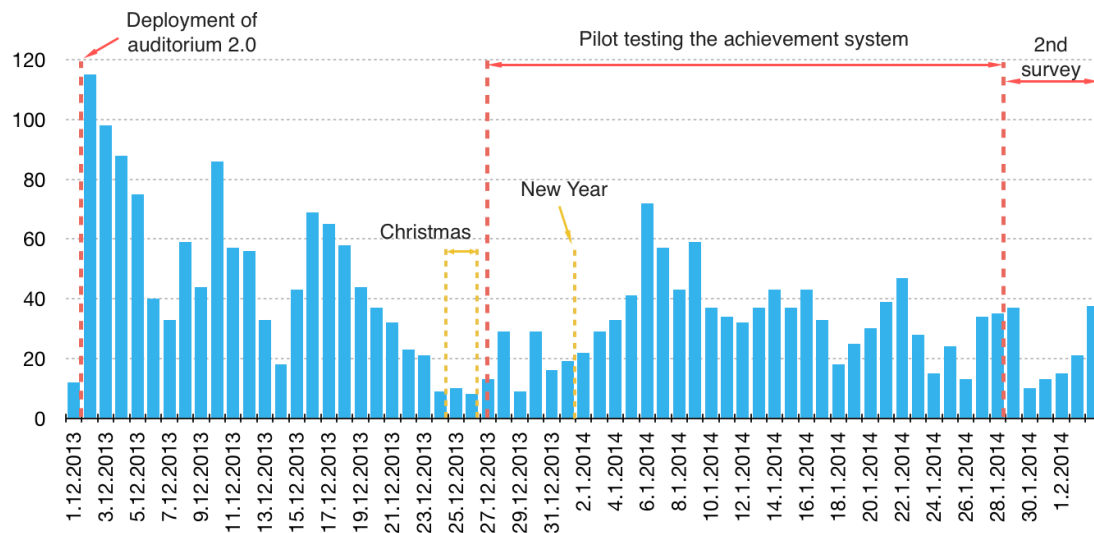
Figure 7.32 Daily visitors since the release of auditorium 2.0

To establish a fundamental understanding of the overall usage of auditorium, the web analytics tool *Piwik* was used. This tool provides anonymous usage statistics of web applications, such as auditorium. In average auditorium was visited 37 times each day (Figure 7.32). Furthermore, users remained six and a half minutes in average on auditorium (Figure 7.33) and they produced 15.253 page views by a total of 2404 distinct

visits during this time period.

Figure 7.33 Page views and duration in seconds on auditorium

Those diagrams also represent the biggest problem of auditorium: users do visit auditorium on an irregular basis, which is derivable by the non-norma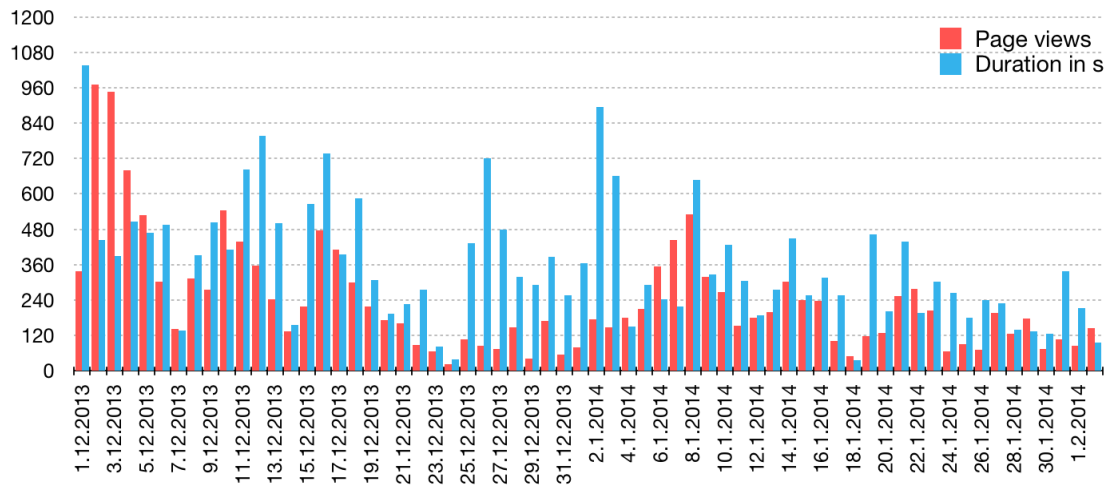l distribution over time. The first days, when the second version of auditorium has been deployed, users visited more frequently. Towards *Christmas* and *New Year's Eve*, the number of visits declined near zero. This can be seen in Figure 7.32 as well as in Figure 7.33. When holidays ended (6th of January in 2014), the activity grew again, but not as much as expected and it declined towards mid of January.

7.2.2 Pilot-Test Period

Daily activity

The pilot-test period took place from 27th of December in 2013 to 27th of January in 2014 as illustrated in Figure 7.32. During this time, the Gamification System was only enabled for the *experimental group*. The diagram in Figure 7.34 reveals the activity metrics segmented in the two groups. At the second glimpse, the activity of the experimental group (blue) is higher than of the control group.

Furthermore, the diagram Figure 7.35 represents the activity difference per day. The calculated arithmetic mean is 1.8 and beyond that, a positive activity trend compared to the control group can be derived (Figure 7.35). During this time period 241 unique users
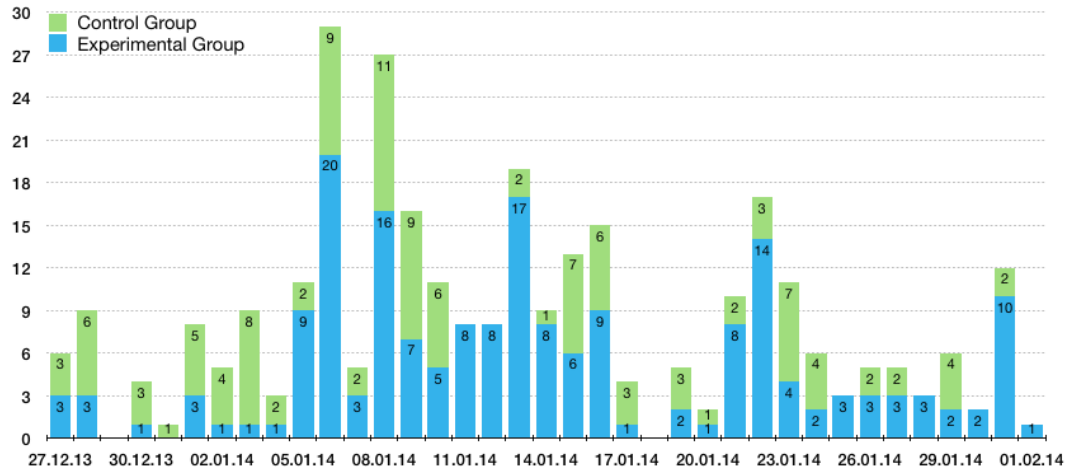
Figure 7.34 Daily activity of experimental and control group combined

were logged in at least once (113 experimental and 128 control group); this number has been derived from the amount of gathered "First Step" badges. This badge represents the first hurdle users need to accomplish in order to visit auditorium and read posts by others. That means, when a user had not earned this badge, the users had not signed in since then.

Figure 7.35 Daily activity difference between experimental and control group

Level 7: Evaluation

Amount of posts before and during the pilot-test

A meaningful metric is to measure the distributed amount of posts after auditorium 2.0 has been deployed but before the pilot-test period. Figure 7.36 shows the distribution of posts on each day. During this time span (27 days) the amount of posts adds up to 37 questions, 66 answers, 163 comments, 20 announcements and 4 topics. Summarized, a total of 290 posts were written from 1st of December to 27th of December in 2013.
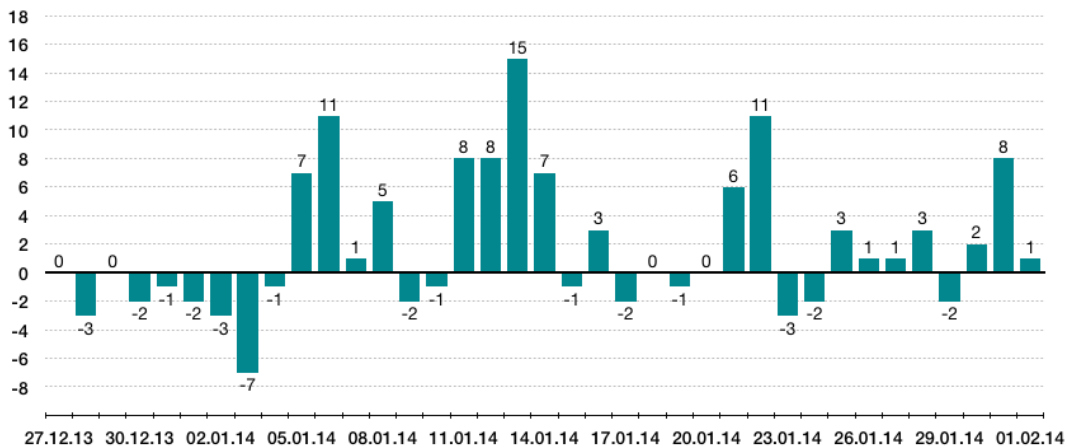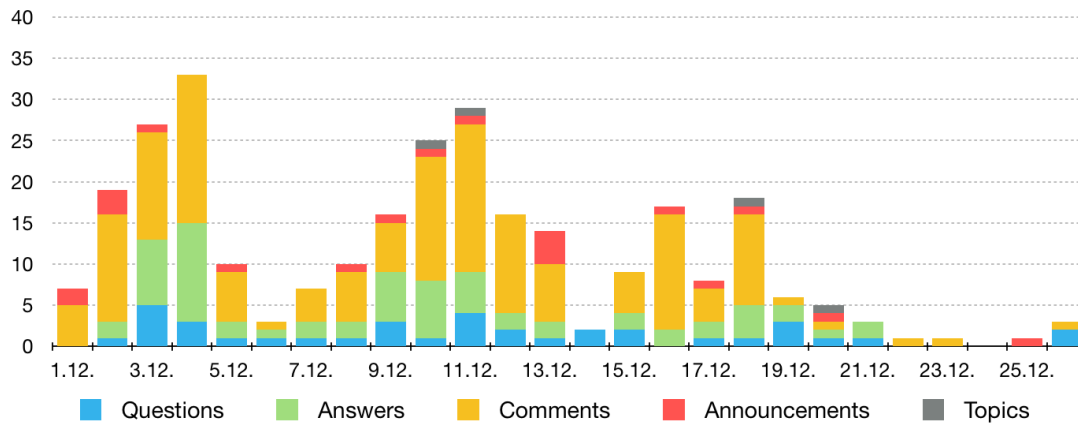

Figure 7.36 Amount of posts before pilot-test period

This graph also nicely illustrates the pattern that during Christmas and New Year's Eve, the activity has dropped towards nearly zero. Because the activity grew again after Christmas, the author decided to deploy the Gamification System to the production server to date. As mentioned, the pilot-test took place from the 27th of December to the 27th of January of the following year, which adds up to 32 days, 5 more than the time before. The next two diagrams show the distribution of written posts and votes separated into the control group (Figure 7.37) and experimental group (Figure 7.38).

The total amount of posts written by the users from the control groups is 94 and 111 by the experimental group users. That means that users from the experimental group wrote around 18.0 percent more posts compared to the control group. In Table 7.4 the amount of posts were split into the different post types provided by auditorium. Additional, the number of votes is also listed.

The Table 7.4 summarizes that the experimental group is more active in writing and voting. This group provided more than twice of the number of questions (+91.67%), but less answers (-23.8%). Another interesting point is the number of votes users gave:
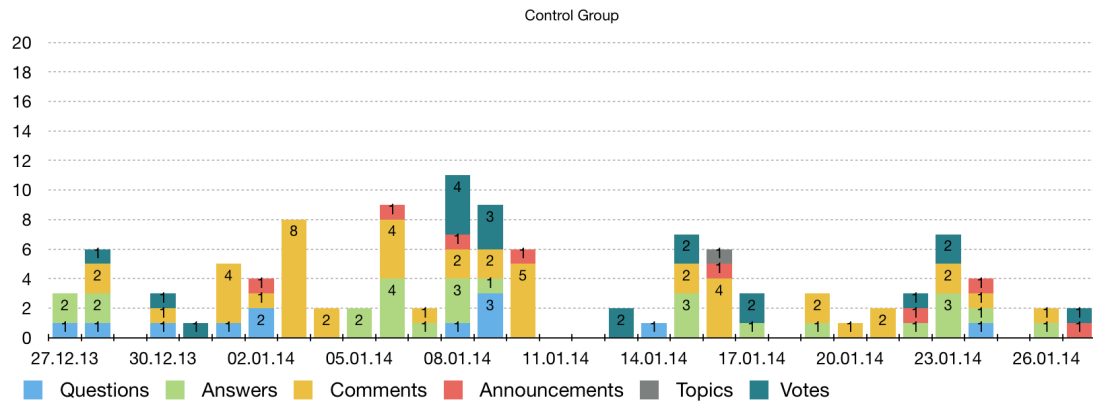
Figure 7.37 Amount of posts by control group
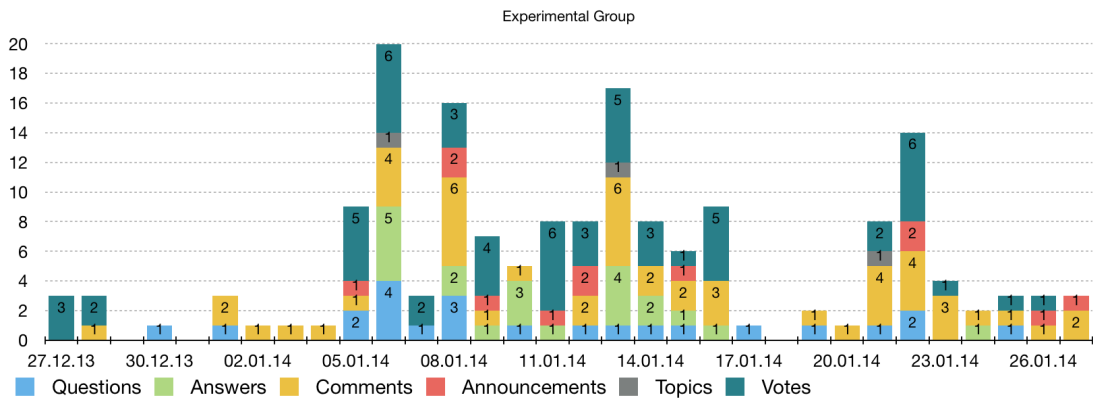
Figure 7.38 Amount of posts by experimental group

almost three times the number provided by the control group (+195.0%). Users also provide almost as much comments (99) as votes (79) compared to the other posts (35 questions, 47 answers, 20 announcements and only 4 topics).

Broken down to a daily basis, they combined provided more than six posts per day. Distinguished into those two groups they wrote around three (experimental group) and exactly three (control group) per day. Summarized, the activity is lower than before the pilot-test period. But the users of the experimental group exceed the activity of the control group by combined 18.0 percent. And the activity is not normally distributed and during Christmas and New Year's Eve most users did not visit auditorium which results in a little activity.

Type	Exp. Group	Control Group	Difference
Questions	23	12	+91.67%
Answers	21	26	-23.8%
Comments	52	47	+10.6%
Annuncements	12	8	+50.0%
Topics	3	1	+200.0%
Votes	59	20	+195.0%

Table 7.4 Written posts during the pilot-test

Earned Badges

Due to the before introduced activity statistics, users can earn badges during the pilot-test. Every user, whether of the control or experimental group, were able to earn badges. The only difference was that the users of the control group were not able to see them and they also did not receive notification messages. Because of that, Figure 7.39 represents the amount of earned badges distinguished into their three categories (bronze, silver and gold). Furthermore these three diagrams show badges earned from users of each group.
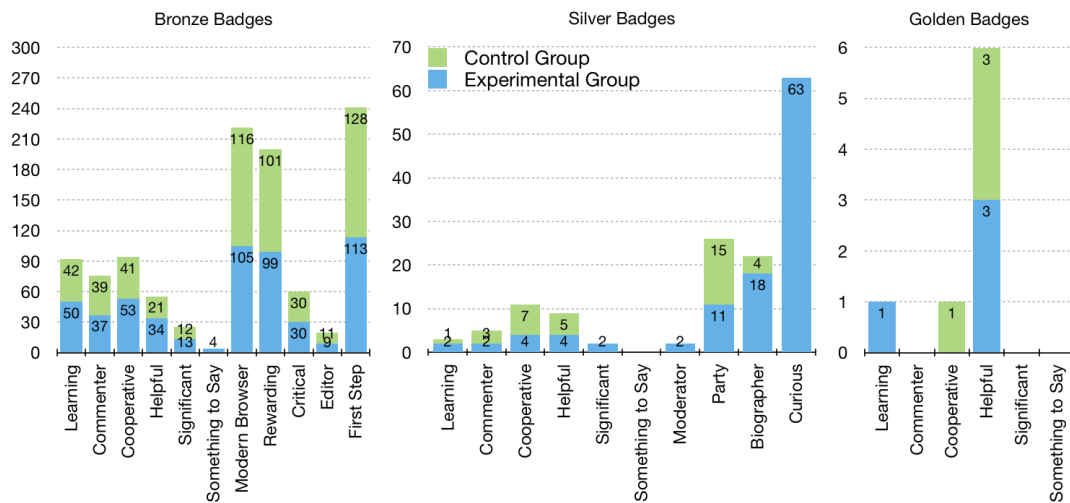

Figure 7.39 Overview of earned badges, split into the three categories bronze, silver and golden badges

Those diagrams allow the interpretation, that the most badges earned are *bronze badges* (1088) compared to *silver badges* (143) and *golden badges* (8). Due to the "First Step"

badge, the amount of users which logged in once since the 27th of December can be noticed (241).

Distinguished, the experimental group's users earned 13.6% more badges in average: 547 compared to 541 bronze badges (+1.1%), 108 compared to only 35 silver badges (+208.6%) and the same amount of golden badges (4). Summarized, this group earned 11.9 percent more badges than the control group.

Additionally to the "First Step" badge, also the "Modern Browser" badge will almost be earned immediately after signing in. There is no further activity required; the user just needs to sign in in order to earn the former badge and to use a modern browser e. g., a current version of *Mozilla Firefox*[35], *Google Chrome*[36], *Apple Safari*[37] or *Opera*[38], to earn the latter. Without using those badges within the calculation, the experimental group exceeds the control group by 329 to 297 bronze badges (+10.78%) compared to around plus one percent before.

Most of the users were not able to earn silver or golden badges due to the lack of activity, as described earlier in this section. This has to be further observed when those badges were improved.

There are some badges every body could achieve by themselves additionally to the before mentioned "First Step" and "Modern Browser" (they do not require any activity from the users perspective): "Biographer", "Curious", "Rewarding", "Critical" and "Editor". Those badges only require a little effort.

The "Biographer" badge can be achieved when the personal profile information has been filled out by the users themselves. Although only 18 users from the experimental and respectively four users of the control group earned this badge. Compared to the 241 users signed in at least once, only 9.1% of all active users completed the profile information required to earn this badge.

The same counts for both the "Critial" as well as the "Editor" badge. The former was earned by on a quarter (24.9%) and the latter 8.3% of the users considered (241 users which earned the "First Step" badge).

Almost all considered users earned the "Rewarding" badge. Whether the amount of

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[35]Mozilla Firefox — `http://firefox.com` (visited on 2014-03-10)
[36]Google Chrome — `http://google.com/chrome` (visited on 2014-03-10)
[37]Apple Safari — `http://apple.com/safari` (visited on 2014-03-10)
[38]Opera Browser— `http://opera.com` (visited on 2014-03-10)

earned badges represented is not restricted to the pilot-test period, the amount of earned badges matches the somewhat large amount earlier discussed (Table 7.4).

The "Curious" badge only could achieved by users from the experimental group. This results from the exclusive feature, the interactive tutorial, included in the deployment of the achievement system. Almost half of the active users of this group earned this badge. Which means, that only 55.7% of considered users explored the site as provided.

Level up

Additionally to badges, users could level up by earning points. The system provides seven levels which can be extended if needed. As discussed in Level 6: Implementation, levels are only a visual representation of the amount of earned points. Users will not earn points when leveling up or achieve a badge, nor unlock features. Those capabilities will be considered during the Level 8: Conclusion and Future Work.
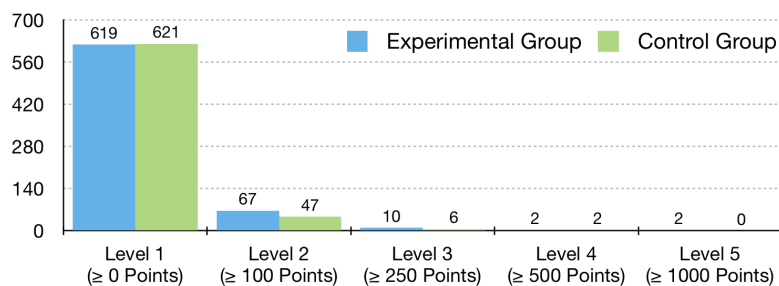
Figure 7.40 Minor amount of users leveled up equally in both groups

The majority of users owns between zero and 100 points (Figure 7.40), which represents *level 1*; the entry level. The next level has reached by 67 users from the experimental group and 47 users from the control group. That means they gained at least 100 and at most 249 points. Only two users reached the fifth level by accumulating more than 1000 points each, one of them is the author himself.

To earn that many points requires a lot of users rewarding posts. Additionally badges provide a definitive amount of points when achieved; up to 100 points, dependent on the category of the badge (bronze: 25 pts., silver: 50 pts., golden: 100 pts.).

The data in this subsection was provided by the open web analytics tool *Piwik* and database data from the application itself.

7.2.3 Evaluation of the survey data

To derive numeric data from the database or web analytics tools is one approach to evaluate the online platform. Another approach is to ask users directly. This has been accomplished by two surveys. The first survey tried to capture data about the first version of auditorium for future implementation work. The second survey asked users about the second release of auditorium and its provided features and the implemented Gamification System.

Both surveys are not statistically expressive due to their small amount of participants: the former had 61 participants (5.5% of all users) and the latter only 18 (1.6% of all users), which needs to be compared to the 1100 confirmed users of auditorium. But for completion, captured data will be illustrated within this section.

(a) Signed up?   (b) Reason for sign up   (c) Role at University
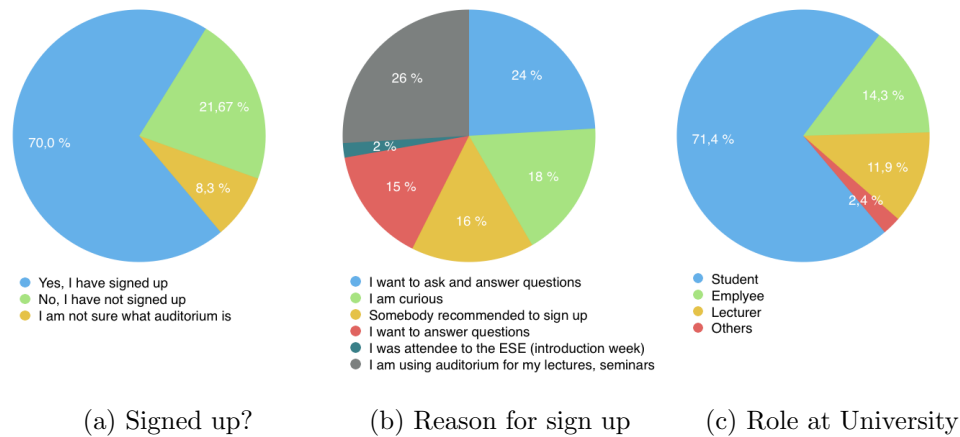
Figure 7.41 Reason for sign up and role at university

One of the interesting aspects captured during the first survey is the reason of the users to register at auditorium; 42 out of 61 participants have already signed up (Figure 7.41a) and provided their reason to be part of auditorium (Figure 7.41b). Most of the users (26%) use auditorium due to their lectures and seminars. Almost the same number of users (24%) is using the platform because they want to *ask and answer questions*. The interesting part is, that surprisingly some of them signed up for the sake of their curiosity (18%). Furthermore, the majority of the users are students (71.4%), provided by the data from Figure 7.41c. Lecturers and employees only represent little more than a quarter of all users (26.2%) combined.

auditorium 1.0

The first survey aimed to provide data to guide the implementation of the second version of auditorium. Although the number of participants was quite low, the captured data is interesting for the author because they accurately represent the assumption from the author.

At the beginning the participants were asked to assess available features of the first version and then they should score features which might debut in the second version. The results can be found in the graphs illustrated by Figure 7.42a and Figure 7.42b.

(a) Available features   (b) Planned features
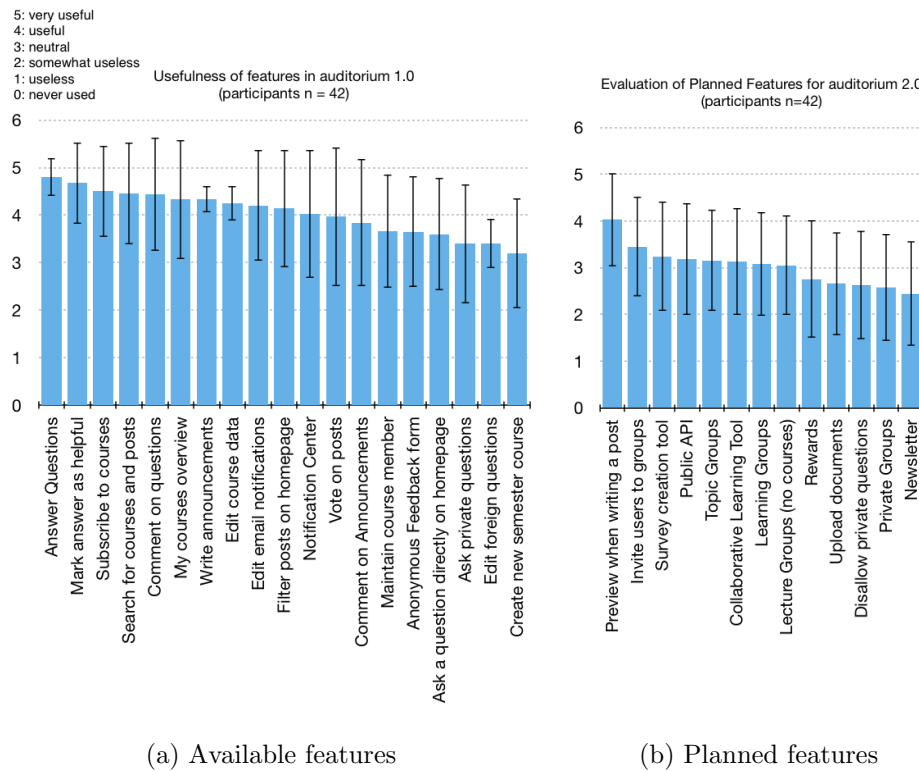
Figure 7.42 Evaluation of available and planned features in auditorium

In average the feature to *answer questions* has been valued as *very useful* ($\varnothing 4.8 \pm 0.40$), otherwise this would be irritating, because the fundamental approach of auditorium is to provide a location to ask questions which can be answered by arbitrary users.

Other, as *very useful* valued features are: *mark answers as helpful* ($\varnothing 4.68 \pm 0.86$) and *subscribe to courses* ($\varnothing 4.5 \pm 0.96$). Every other feature listed in the diagram has been

valued as at least *useful* ($\varnothing 3.5\ to\ 4.4$), but to *ask private questions* ($\varnothing 3.4 \pm 1.25$), *edit foreign questions* ($\varnothing 3.4 \pm 0.52$) and *create new semester for courses* ($\varnothing 3.2 \pm 1.15$); which existence is valued neutrally towards *useful*.

Furthermore not yet implemented features were asked to assess by the users. The highest requested feature is to provide a *preview when writing a post* ($\varnothing 4.3 \pm 1.0$). All other features are *neutral* towards *somewhat useless* for the users ($\varnothing 2.45\ to\ \varnothing 3.45$).

Because of this analysis, the preview feature has been implemented into auditorium 2.0, but has been valued as only *neutral* towards *useful* ($\varnothing 3.40 \pm 0.80$) in average (Figure 7.43a). Due to the small number of participants (n=15), those graphs are not statistically expressive and therefore do not represent the opinion of all users.

auditorium 2.0

Due to the feedback given by the participants of the second survey, auditorium 2.0 has been enriched by some features, such as the *preview*-feature requested by a handful of users during the survey and inside of auditorium[39].

Within the second survey, scheduled after the pilot-test (Figure 7.31), available and planned features should be assessed. Due to the little number of participants (n=18), the data gathered during the second survey is statistically not expressive, as mentioned and discussed earlier.

The three features *comments and answers for questions* ($\varnothing 3.40 \pm 0.80$), *preview when writing a post* ($\varnothing 3.40 \pm 1.08$) and *voting on posts* ($\varnothing 3.38 \pm 0.62$) have been valued as *neutral* ($\varnothing 2.5\ to\ \varnothing 3.5$) towards *useful* ($\varnothing 3.5\ to\ \varnothing 4.5$). The other implemented features from auditorium 2.0 have been valued from *somewhat useless* ($\varnothing 1.5\ to\ \varnothing 2.5$) to *neutral* ($\varnothing 2.5\ to\ \varnothing 3.5$). The data discussed is represented by Figure 7.43a.

Based on the first survey for auditorium 1.0, some not yet implemented features were assessed. The most likely desired feature is to provide *follow-up questions* ($\varnothing 3.40 \pm 1.08$). This feature was available in the first version of auditorium. In order of the refactoring process, some features were not finalized for the second release but will be shipped with a future release.

5: very useful
4: useful
3: neutral
2: somewhat useless
1: useless
0: never used

Implemented Features in auditorium 2.0
(participants n=15)

Not yet Implemented
Features
(participants n=15)

(a) Implemented
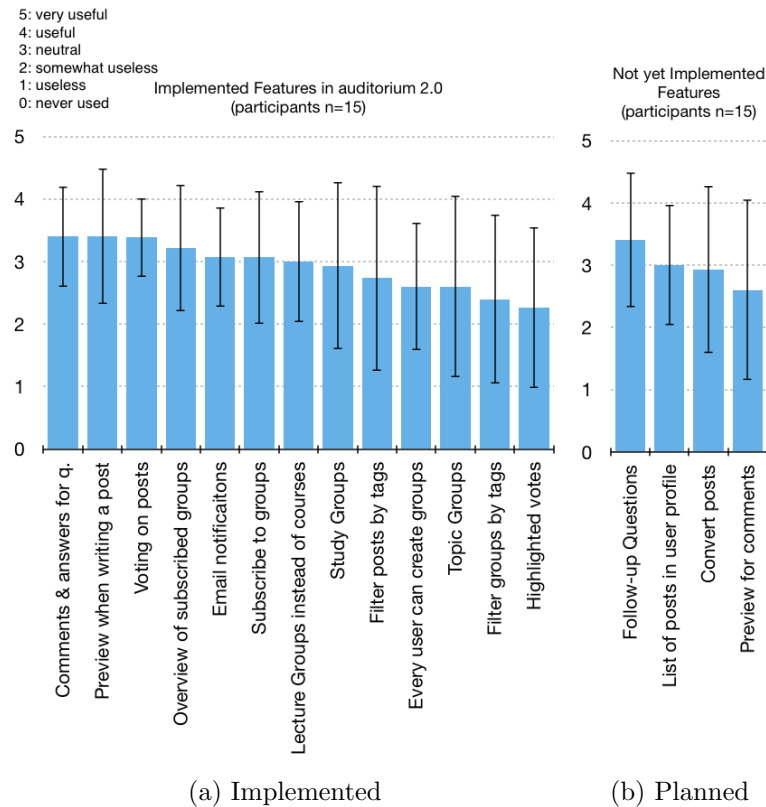
(b) Planned

Figure 7.43 Evaluation of available and planned features in auditorium 2.0

Refactoring

Besides implemented and planned features, the focus in part one of the survey laid in the subjective feeling about the new release. Five different aspects were evaluated: *overall comparison of auditorium 1.0 and 2.0* (7.44a), *New Design* (7.44b), *User Experience* (7.44c), *Tags* (7.44d) and *Groups vs. Courses* (7.44e).

In short, the majority of users appreciate the new design of auditorium (86% in 7.44a and 71% in 7.44b), the use of tags instead of the static structure (93% in 7.44d) and moreover they acknowledge the implementation of groups as detachment of term-specific courses (79% in 7.44e).

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[39]User requests inside of auditorium (german) — `https://auditorium.inf.tu-dresden.de/en/questions/369#answer_824` (visited at 2014-03-04)

(a) v1.0 vs. v2.0   (b) Design   (c) Experience

(d) Tags   (e) Courses vs. Groups
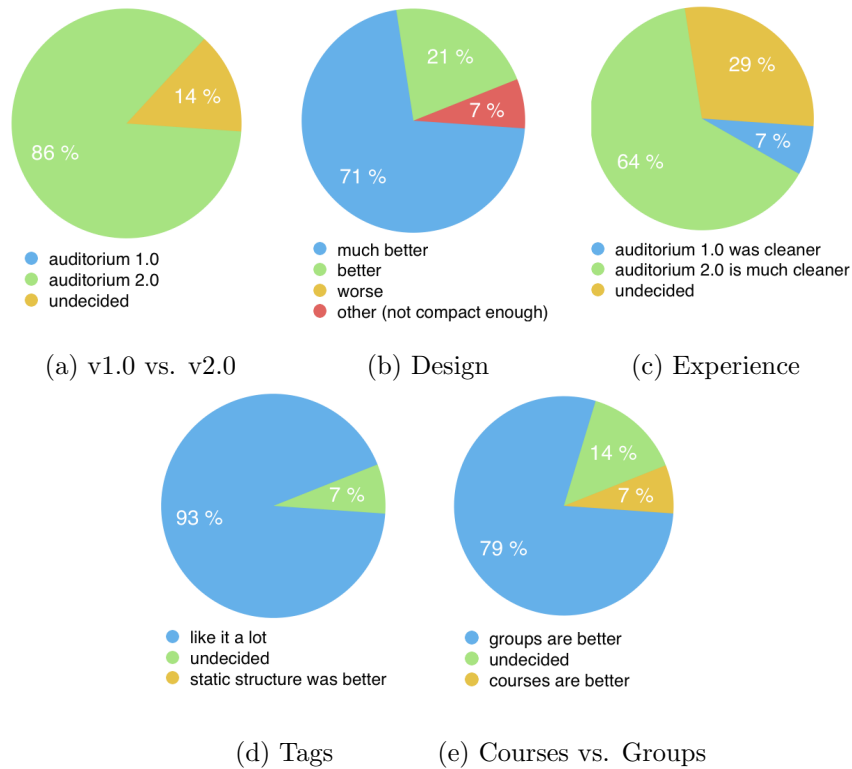
Figure 7.44 Preferences between the first and second release of auditorium

Gamification System

The focus of the second part of this analysis was to evaluate the Gamification System which has been implemented during this thesis. The evaluation has been structured based on the methods by Kirkpatrick (Kirkpatrick, 1975):

Reaction → Learning → Behavior → Results.

Those four steps cannot be accurately be applied to this evaluation, that is why the following steps will be used to interpret the impact of the Gamification System:

Awareness → Motivation → Behavior Change → Results.

With this in mind the following sections describe these three stages. But as always for results in this survey: the data is not statistically expressive and therefore cannot be applied as universal.

Level 7: Evaluation

Step 1: Awareness   The first step is to evaluate the awareness of the users. To provide data for this step, the participants first were distinguished into the *experimental* or *control group*. This has been accomplished due to the question if they are aware of the achievement system. If the participant has checked the option "no", then the user might be a member of the control group.

When the user is a member of the experimental group, further questions were asked. In order to gather data about the awareness of the user inside of the experimental group, multiple-choice questions were presented. The user could give a correct or wrong answer or deny the answer.

The results from this evaluation are represented in Figure 7.45. Only eight participants applied, that is why those results are not statistically expressive. Nevertheless they are quite interesting.
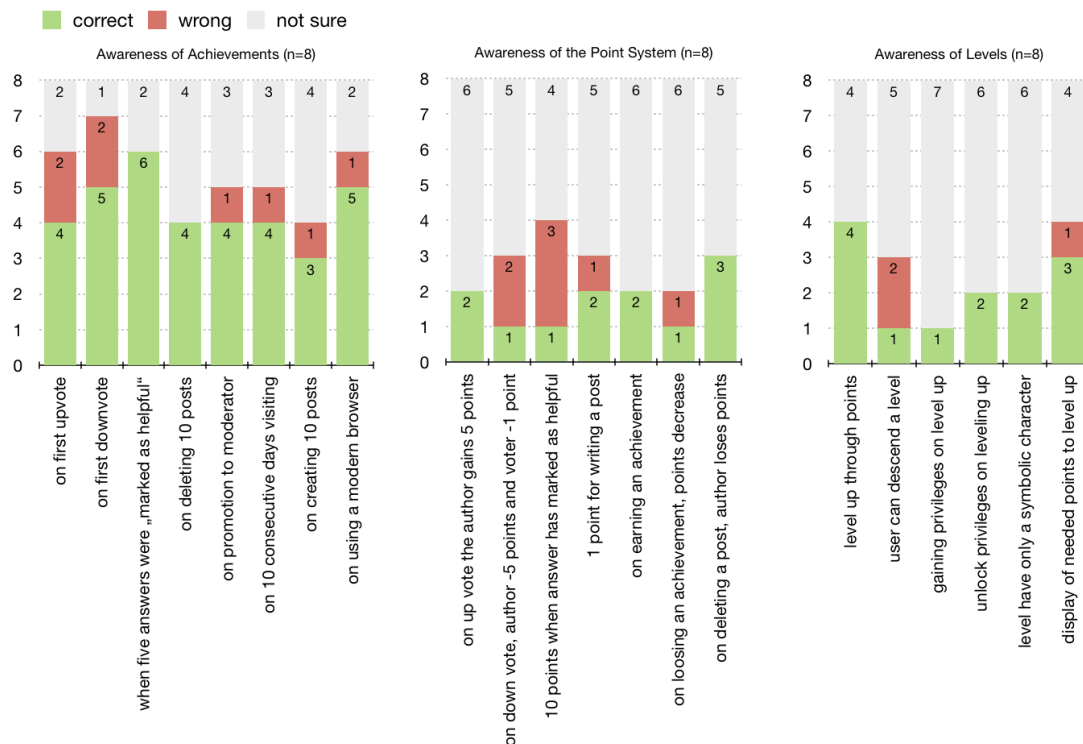

Figure 7.45 Awareness of the functionality behind implemented Game Elementes

The majority of users ($\varnothing 54.6\% \pm 8.9\%$) were able to give a correct answer in the context of *achievements*. Only $\varnothing 12.5\% \pm 6.25\%$ gave wrong answers. But $\varnothing 32.8\% \pm 8.75\%$ did

not answer due to not knowing the answer or not willing to. Due to the large abstinence compared to the overall number of participation (eight).

Nevertheless, those numbers are good compared to the results of asked questions about gaining points and leveling up. Only $\varnothing 21.4\% \pm 7.7\%$ gave a correct answer and $\varnothing 66.1\% \pm 7.7\%$ did not know or did not want to provide their answer. Which results in a limited awareness of the functionality to gain points.

Nearly the same results are applicable for the awareness of the functionality behind levels. A consolation is that every user which provided an answer, is aware of the fact, that they can level up through gaining points and the most users whom are unsure did not provide an answer, so the number of incorrect answers is quite low: $\varnothing 6.25\% \pm 8.3\%$. But overall the number of correct answers is $\varnothing 27.1\% \pm 11.1\%$. Compared to the large number of abstinence votes: $\varnothing 66.7\% \pm 12.5\%$.

Step 2: Motivation   The second step is to gather information about through which activities and tasks users gain motivation from. This data has been distinguished between the control and experimental group as illustrated in Figure 7.46.
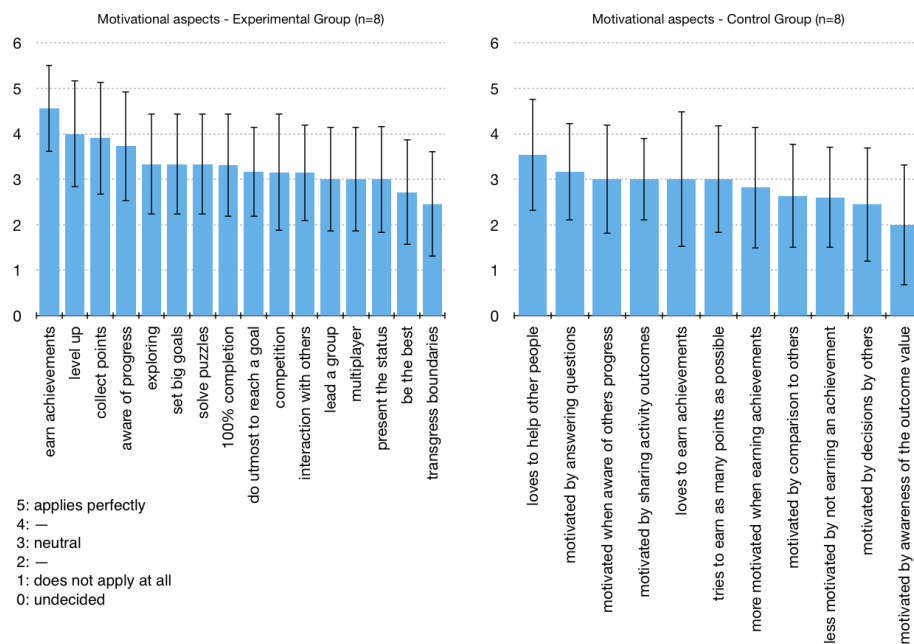

Figure 7.46 Implemented Game Elements and their motivational impact

Level 7: Evaluation

The results of the experimental group lets derive that the majority of users is motivated by *earning achievements* ($\varnothing 4.56 \pm 0.96$), *level up* ($\varnothing 4.00 \pm 1.18$), *collecting points* ($\varnothing 3.91 \pm 1.24$) and *to be aware of their progress* ($\varnothing 3.73 \pm 1.21$). Whereas the control group gathers motivation from *helping other people* ($\varnothing 3.55 \pm 1.23$). The other motivational factors in both groups are not that comparable, they do not affect the user in a positive nor negative way ($\varnothing 2.0 \, to \, \varnothing 3.17$ in control group and $\varnothing 2.45 \, to \, \varnothing 3.33$).

As always for data from this survey, the provided data is not statistically expressive and do therefore not apply to the opinion of the majority of users.

Step 3: Behavior Change The last step to consider before the results can be discussed it the gathering of the information about possible *behavior changes* during the use of auditorium and its activated achievement system. Figure 7.47 lists the four major components and the information about a possible behavior change. The four components were *achievements*, *points*, *levels* and *progress bars*.

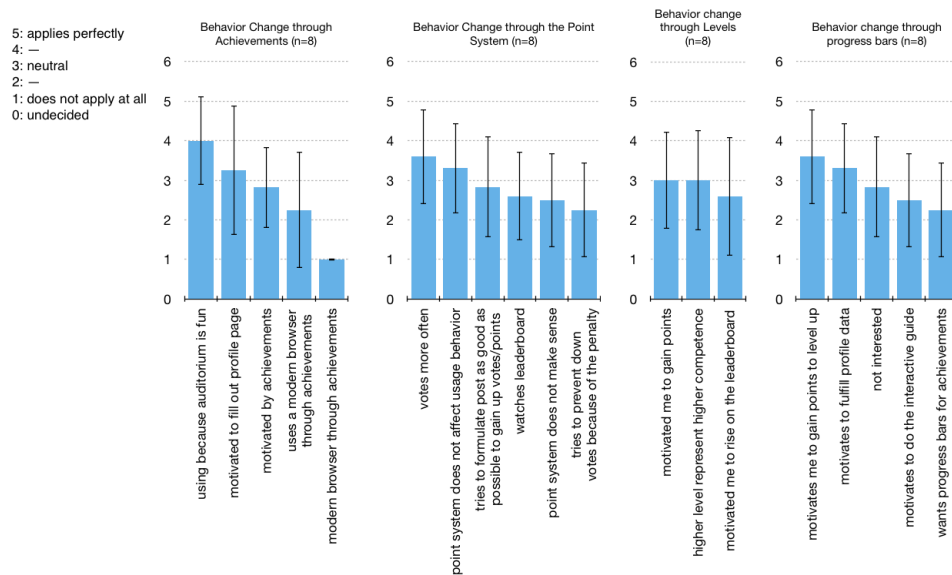Figure 7.47 Implemented Game Elements and impact on users behavior

Most users use auditorium because it is fun ($\varnothing 4.0 \pm 1.12$). As of the provided data some users feel a behavior change due to the "Biographer" badge which encourages the users to fill out their profile information ($\varnothing 3.25 \pm 1.64$). The other three options do not really affect the behavior of the users.

The second feature are points, compared to the achievements, a positive effect can be gathered from this diagram: *users vote more often* ($\varnothing 3.6 \pm 1.2$). Some users think the point system does not affect their behavior ($\varnothing 3.30 \pm 1.14$).

Based on points, levels were introduced in auditorium 2.0 due to the implementation of the achievement system. The majority of users do think that levels do not affect them ($\varnothing 2.5$ *to* $\varnothing 3.0$).

Nevertheless progress bars do have an impact on their behavior: to be aware of the individual progress can *motivate to gain more points to level up* ($\varnothing 3.6 \pm 1.2$) and it motivated them to fulfill their profile information ($\varnothing 3.31 \pm 1.14$). The problem of this statistics are that they do not provide statistically expressive data.

Step 4: Results The three steps before show if a user was aware of the components of the system, what does motivate them and if the implementation evokes behavior change. The last step now is to evaluate the gathered data of those three steps to derive a result.
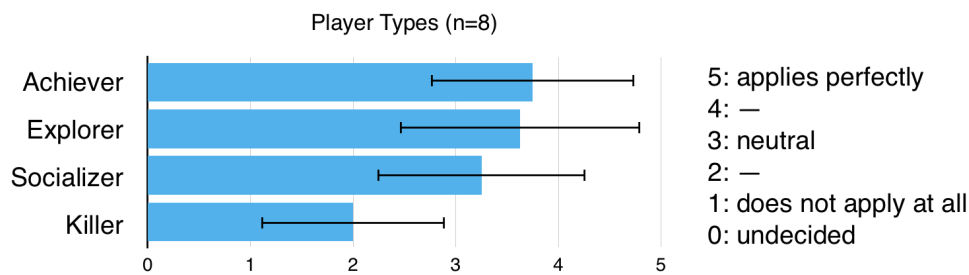
Figure 7.48 Results from the evaluation which player type the participants characterize

As of the results of the awareness section, users are not aware of the functionality. That leads to the consumption, that the system needs to be more clarified to them. The majority of users is more likely motivated by *earning achievements*, *gaining points* and *leveling up*. Those three elements should be considered when trying to improve the system after all. Also the users tend to be vulnerable to the achievement system.

Some users adapted their behavior in order to gain points and badges by e. g., writing high-quality posts to receive up votes. Which correlates to the results from the analysis of the individual player types Figure 7.48.

Users tend to show characteristics of *Achiever* ($\varnothing 3.75 \pm 1.0$) and *Explorer* ($\varnothing 3.63 \pm$

1.17). Which is conform with the results from the analysis. The participants less likely characterize the player type *Killer* ($\varnothing 2.0 \pm 0.9$), which lets imply that the users mostly try to help other people, this is shown by the relatively high rating of the *Socializer* ($\varnothing 3.25 \pm 1.0$).

But this results are not expressive for the whole number of users, registered in auditorium. Thus this data can help to improve the system by iterating and adjusting the implementation and use of Game Elements. This then needs to be evaluated again and should be compared to the results discussed in this thesis.

7.3 Interviews

Because of the fact that the data provided by the two surveys is not expressive enough, a number of interviews has been scheduled. In sum, thirteen people participated on the interviews. The questions asked are listed in the appendix in Table 8. The interviews aimed to provide information about auditorium 2.0 and its predecessor. The users were asked what they think about the idea behind auditorium in general and what should be done better. The second part attends to ask the users what they think about the achievement system and its distinct elements.

7.3.1 Results

Part I: auditorium

The first part of the interviews tried to gather information about what their opinion of the changes applied into the second release of auditorium; the majority of all participants (61.5%, n=13) appreciate the change to the second version, 23.1% say that the changes which have been applied, made the system worse compared to the first version. The change, that most of the participants cherish is the switch from courses to groups (53.9%, n=13). This prevents repeatedly asked questions in new semesters of the same lecture. But they have mixed feelings about the use of *tags*. On one site interviewees said that tags are nice to add the term in which the course is available; but overall, the interviewees perceived the administrative structure more logical. And on the other site, some interviewees do appreciate the use of tags instead of the static structure.

The idea behind auditorium in general has been appreciated by all interviewees. They

like the possibility to interact with students as well as employees at the university to solve common as well as specific problems. All Interviewees do have experience with StackOverflow and therefore do understand how to use the online platform auditorium. They suggest to invite more employees and lecturers to use auditorium, which can led to more activity due to more actively maintained groups.

Part II: Achievement System

The second part of the interview was about the achievement system. The first questions the interviewees were asked was to self-assess which characteristics they have internalized compared to the four player types by Bartle. The distribution of player types is Achiever (41%) and Explorer (32%), the Socializer (18.2%) and the Killer (9.0%). Almost the same as participants chose in the second survey Figure 7.48. After that, the interviews aimed to ask the opinion about the implemented game elements: *interactive tutorials, points, badges and leaderboards, levels, progress bards and avatars.*

Interactive Tutorials   Those were appreciated by 77% of the attendees. Only two of thirteen do not like those elements at all and do explore the system by themselves. Three participants suggest to provide context sensitive guides, such as providing unobtrusive hints for possible next steps. When those tutorials break the flow it annoys them. They also enjoy the functionality to close and hide those tutorials and to activate them later, when they want to use them. Two interviewees were motivated to click through the tutorials in order to achieve the badge associated with. Summarized, the majority do enjoy the usage of such tutorials. The implementation into auditorium is not annoying. But they also wish for an option to completely deactivate those tutorials for the whole platform.

Points   The majority of the users enjoy to gain points. One Interviewee said that points are not necessary when the post is interesting by the content itself. Some participants (3 of 13) associate the rating of posts and the score of users with the competence of the user who wrote the post. Some users also love to gain points. One attendee pointed out that the amount of gathered points represents progress and therefore more points mean more competence and progress. Another Interviewee said that auditorium should provide more possibilities to get points, such as gaining one point when a user opens a post for the first time from an email. This could solve the problem that most users just watch their inbox and read the notifications and only take action when a comment or

answer is needed. A small number of participants said that the voting functionality and therefore gathering points affected the quality of written posts.

Summarized, points are a nice gimmick. One or another user are addicted to gaining points and therefore need to prevent themselves from visiting auditorium massively. This implies that points do have a motivational effect on users.

Achievements Most of the participants enjoy gathering badges. The majority suggests to provide *unique badges*, such as funny badges or negative badges, badges for leveling up or that an *Easter Eggs* has been found, etc. A minority of participants (31%) are motivated by badges. One person needs to actively prevent them from actively chasing those achievements. Another attendee does not like badges at all; for this person, achievements are more likely annoying than enjoyable. Few interviewees suggest to provide more badges in order to satisfy their gathering process.

Overall, achievements were enjoyed by the users of auditorium, especially by the interviewees. They suggest to provide unique badges also some only one user can gain e. g., in a fixed time period, such as the *Major Badge* in Foursquare.

Leaderboard The leaderboard does not attract users. This element is more likely demotivating because of the top users with many points. One interviewee said, that on auditorium highly active through their job at the university have an advantage compared to normal users. Concluded, this interviewee tries to say, that those users gain automatically more points because they answer questions from their students and due to their loyalty they might vote on the employees post more likely that on other students posts. This can lead to an unbalanced system which is more likely demotivating than motivating.

One person said that those leaderboards are useful when each user has a link to the profile and when one can see the progress of those users visited. The leaderboard also provides a sense of the activity at the page, besides the post stream at the home page.

Level They provide a sense of progress. But without any other value behind them, they are quite useless. The majority of interviewees thinks that a privilege system dependent on the levels would be nice. This also could help to prevent spamming and trolling, because they first need to level up by gaining points and therefore write nice posts. The

pitfall might be that users are demotivated by the fact that they need to do stuff which is not valued by them. This in regard could also produce spammers which try to level up through legal methods. Here it is important to watch users behavior.

Progress Bars   Almost all interviewees (84.5%) enjoy the implementation of progress bars. Most of them fulfilled their profile information in order to achieve one-hundred percent and the associated badge. Five of the participants think that progress bars for rational badges would be useful e. g., a badge for five positive votes on one question, but not necessary. One suggested a progress bar to indicate the points to get in order to proceed to the next users ranking. Summarizing, progress bars seem to be powerful in order to motivate users to take the last action to gain points, badges or to beat other users.

Part III: Motivation and Behavior Change

The achievement system was motivating for half of the interviewees, one-third did not perceive any motivational change. The majority of the participants said that they think about the content of their answers or comments in order to gain positive or to prevent negative votes. One added that it would be more likely motivating to visit auditorium when points were distributed on visits.

Two of the Interviewees were lecturers. One of them said, that the achievement system did not had any effect on them, because lecturers should provide helpful answers independent on points or badges. The other one in contrast was affected by the system, not in providing good answers, but in collecting achievements or filling out the profile in order to earn the "Biographer" badge.

The rest of the attended interviewees were students. Those who more likely characterize the Achiever and Explorer, were also more likely affect-able by such systems. They want to collect badges, earn as much points as possible and they also want to lead the leaderboard.

Most of the participants use StackOverflow on a regular basis, so they already knew how the platform works, thus they did not use the interactive guides to gain experiences on how to use the platform at all. Most of them just clicked through them in order to gain the achievement associated. But they think this can help to show inexperienced users how to use the platform at all.

Part IV: Feedback

Additionally the people were asked to provide some feedback for the system. A controversial aspect is anonymity. One interviewee suggests to provide more anonymity and one other wants to remove this by forcing users to provide their real name. Discussing this would go beyond this thesis.

One interviewee wants that *Easter Eggs* shall be implemented, some little hidden gimmicks to make the platform more fun for the Explorer type of users.

Some participants criticized the lack of explanation of the point system. They want to know how much points an activity provides.

During the refactoring of the system, some features are still missing. One often requested is the ability to convert posts into other types of posts, such as comments to answers and vice versa. Another feature is to export comments or answers to *Follow-Up Questions*. This can be useful when some users ask an additional question after the first question was successfully answered. Those two features were already provided in the first version of auditorium.

Because at the university there are a lot existing platforms, such as Forums or Learning Platforms. One attendee suggested to provide a migration manager for the data inside of the other platforms. This could help to migrate users from one platform to auditorium. Because some lecturers gave the feedback that they do not use auditorium due to their currently used application or mailing-lists. This person also requested to provide the same features as those platforms provide.

A lecturer of the interviewees would appreciate when documents could be linked within a lecture group to provide one place where students can find further information. This user also suggested to improve the search engine by using tags. Additionally to the amount of users this participant requested the feature which shows the range of an e. g., announcement to see if it is worth to post on auditorium.

For one interviewee the post type *Topic* was somewhat confusing. The reason might be the name.

As earlier discussed, some users do not understand the difference between a forum and a Q&A-platform as auditorium is. To prevent misleading behavior, an interactive tutorial should be provided which explains the difference to a classic forum.

As last point, some users and one of the interviewees requested a single-sign on mechanism, like $OAuth^{40}$, so users were able to log in via Facebook, Twitter or Google.

7.4 Discussion

The results provided by the surveys and the interview can be summarized due to the four statements listed in section 7.2. To recall those statements are listed here again:

1. During the pilot-test period the experimental group with the achievement system activated tends to be more active compared to the control group.
2. Majority of users match the characteristics of the player types *Achiever* and *Explorer*.
3. Voting on posts and gaining points provide meaningful feedback of the individual post-quality and users progression.
4. Majority of users favor the refactored second version of auditorium, the shift from term-specific courses to groups and the use of tags instead of static dependencies.

The first statement has been derived through the database values recorded during the pilot-test subsection 7.2.2. As illustrated and evaluated, the daily activity difference shows a positive activity trend of the experimental group compared to the control group. The arithmetic mean of this period was +1.8. Which means that each day, the experimental group provided almost two posts more than the control group. Details were provided in subsection 7.2.2.

One of the most significant parts when conceiving the Gamification System were the introduced player types by Bartle. It has been tried to apply the motivational aspects of each of those player types. Due to the research findings, the community seems to be separated into all four player types differently. The most users tend to characterize the Achiever as well as the Explorer. The minority of users characterize the Killer. One surprising result was the number of users matching the *Socializer*. The author expected more users to be socially interested. Because the online platform mostly supports the social aspects. But due to the fact that the data provided is not statistically expressive, this argument might not be represent the characteristics of the community.

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[40]OAuth is "an open protocol to allow secure authorization in a simple and standard method from web, mobile and desktop applications." — `http://oauth.net` (visited on 2014-03-04)

During the interview period, the majority of interviewees said, that gaining points provide meaningful feedback which tends to motivate them. Because most of the users match the characteristics of the *Achiever* and *Explorer*, they try to gather as many points as possible. The interviewees and participants from the second survey provided, that they most likely were affected by the achievement system on writing posts: they try to ask questions as good as possible to earn positive feedback during up-votes but they also try to provide negative votes. Due to this information, the third statement can be implied from.

The last statement has been established due to the results from the second survey and that they match with the results from the interviews. The majority of users enjoy the refactored version of auditorium. Only a small number of users were pleased by the administrative structure applied to the first release of auditorium. But the other users appreciate the shift towards tags to be more flexible. Only the design is a matter of taste. This cannot be argued. Everybody prefers different colors, shapes and fonts. But overall the second version was a success.

7.5 Conclusion

As Bista et al. describes, badges can be used to track users activity. This has been applied for the evaluation based on database entries. Due to the provided data of earned badges, 241 users were active during the pilot-test phase. Which is around 20.5% of all confirmed users in auditorium. This data has been concluded by the amount of earned "First Step" badges which is achieved when a user logs in the first time since the achievement system has been deployed. But the data of earned badges is not expressive enough to say how many users actually are active. Also this data does not represent the amount of badges earned exclusively during the pilot-test period because the badges were bootstrapped based on previous activity because it was an already running system and therefore does not had the necessity to invite people to use auditorium.

As seen, the majority of users uses auditorium because they love to help other people. Those users can be characterized as *intrinsically motivated*. Another large amount of users does use auditorium in order to follow the activity in specific groups. Another interviewee sees in leaderboards the danger to produce spam. Because some users are addicted to those lists and therefore try to gather as much points as possible to be at the top of the list.

Summarizing, the data gathered during the interviews match the data provided by the surveys. That means, the achievement system is a feature which has been appreciated by the majority of users. In order to improve the Gamification System, the next step might be to evaluate the use of a privilege system and to provide unique badges which might be more motivating to the users than currently available badges.

Level 8: Conclusion and Future Work

8.1 Conclusion

At the beginning of this thesis, the plan was to create two surveys: before deploying the second release and after deploying the achievement system. The data provided by those surveys should help to evaluate the impact on user engagement of the second release and the Gamification System. Due to the small amount of participants, it was not possible to provide statistically expressive data. In order to compensate those results at the end of the pilot-test period, interviews were scheduled during the second week of February. This data helped to gather qualitative feedback of the implementations.

The objectives of this thesis were almost all accomplished, but one objective: provide a concept of a collaborative learning tool. Due to time constraints this had to be cancelled to focus more on the actual evaluation of the second release of auditorium and the achievement system. The Table 8.6 represents the overall accomplishment of this thesis.

✓	Objective 1: Delineate the dynamics for the achievement system
✓	Objective 2: Discuss the mechanics for the achievement system
✓	Objective 3: Evaluate components for the achievement system
✗	Objective 4: Conduct a collaborative tool for creating sets of learning questions
✓	Objective 5: Describe which behavior is desired
✓	Objective 6: Describe Game Elements for the prototype
✓	Objective 7: Describe the player types to consider for the prototype
✓	Objective 8: Define the activity cycles to provide feedback
✓	Objective 9: Deploy the achievement system
✓	Objective 10: Delineate appropriate methods for analyzing the system
✓	Objective 11: Pilot-Testing the achievement system
✓	Objective 12: Evaluate the impact on learning and sharing voluntariness

Table 8.6 Summary of objectives

The overall result of this thesis is that the use of Gamification Elements can help to motivate users to be more engaged with the system. The first step towards this result was to provide a fundamental understanding of the term *Motivation* and its characteristics and the differences between *intrinsic* and *extrinsic* motivation. This has been accomplished within the section 1.1.

Based on this, Gamification were discussed in section 1.2. With the understanding of the use of Game Elements and which pitfalls needed to consider, an achievement system for auditorium could be designed (Level 5: Concept). After that the actual system had been implemented into the second version of auditorium (Level 6: Implementation).

The deployment was then pilot-tested. Provided data during the pilot-test period allowed to derive the statement that the Gamification System had a small, but positive impact on the activity of the users. The data of the Interviews matched the results from the surveys in that fact, that users were motivated to gain points and earn achievements. This also has the effect that users try to write more wisely in order to prevent down-votes and to gain positive feedback by other users.

Due to further investigation, students might be more likely willed to accomplish tasks, when the environment of traditional education is changed towards an environment where students can proceed alongside individual pathways. Traditional education does not provide the opportunities for students to gain experience in disciplines they are interested in, because their certificates earned during exams provided by those disciplines is valued by the examination office. To enhance the learning and sharing voluntariness of students, this thesis laid out, that students need to satisfy their three basic psychologic needs of *autonomy*, *competence* and *relatedness*. A sense of competence can be established due to *optimal challenges*, *positive performance feedback* and by the *freedom of demeaning evaluations*. They need to experience their competence and behavior as self-determined. They should internalize the activity to be more likely motivated to do it. Negative performance-feedback and expected tangible rewards can lead to reduce highly motivated students.

Long story short, auditorium can help to provide an environment where students can proof their competence and feel the sense of autonomy as well as relatedness.

8.2 Future Work

This level aims to provide feedback for future work. The results of the evaluation showed that the Gamification System needs to be adjusted and refactored to be more meaningful to the users.

During the conception period, the idea was to use the Open Badges Infrastructure in order to provide a standardized way to store badges, introduced in section 2.3. Due to time constraints this was cancelled and the achievement system was build from scratch. The suggestion is to evaluate the use of Open Badges to provide an infrastructure to store and synchronize gathered badges from the user.

Through the given feedback by the interviewees, the idea came by to provide unique or limited badges which cannot be earned by everyone. Future work could aim to evaluate the use of different categories of badges and their impact of acceptance and engagement. This evaluation could be combined by implementing a tool to create badges which then will be provided to the users of auditorium. To realize this it is also necessary to build a moderation loop to review created badges to prevent spam or low-quality badges.

Another interesting point is to implement a privilege system into auditorium to allow the community to regulate themselves. This is easier than said; in order to build a successful privilege system which is balanced and fair for the users, it is important to analyze which abilities should be unlocked when and to whom, who should be aware of and so on.

Inspired by the online learning platform Duolingo[41] which provides social aspects within its Gamification System, it would also be interesting to analyze the impact on user's motivation when those users can connect with each other on auditorium. The goal would be to implement social network features into auditorium to provide private and group messaging towards collaboratively create things relevant for the study progress, such as a collaborative learning tool, where users can create sets of questions to prepare for exams. This could go further to integrate collaborative features to annotate and edit lecture slides to help other students and the lecturers themselves to improve their material.

Another interesting feature towards collaboration or more interactive lectures might be

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[41]Duolingo is an online language learning web application — `http://duolingo.com` (visited on 2014-03-05)

the use of Quests, little tasks which can be solved solitarily or collaboratively. The idea is to examine a system to easily create meaningful Quests to engage users to prepare their lecture slides during the semester rather than at the end close to the examination date. The use of Quests could also improve the amount of students accomplishing their exercises in order to be prepared for the discussion during the seminars.

To prevent going beyond the scope of this thesis the above mentioned aspects for future work might be enough to be busy for some semesters. The author aims to improve auditorium as a side project. This results from the epiphany that the idea behind auditorium can improve traditional education to provide students with an environment were they can evolve their competence.

Appended Graphics and Tables

Algorithm dividing users into groups for evaluation

```
# Step 1
users = User.all.sort {|x,y| x.activity_index <=> y.activity_index}.

# Step 2
a1 = users.keep_if {|x| x.activity_index >= 5 }
a2 = users.keep_if {|x| x.activity_index < 5 }

# Step 3
a1 = a1.shuffle
a2 = a2.shuffle

# Step 4
experimental_group = Array.new
experimental_group = a1.take(a1.size * 0.5)
experimental_group += a2.take(a2.size * 0.5)

# Step 5
experimental_group.each do |u|
  u.experimental_group = true
  u.save
end
```

Listing 8.1 Algorithm to divide users into experimental and control group for pilot-testing the Gamification System

Interview Questions

General Questions	
IQ01	Are you registered on auditorium?
IQ02	Have you used the first version of auditorium?
IQ03	How to you feel about the second version of auditorium compared to the 1st?
IQ04	Are you an active or passive user? An active user interacts regularly with the platform by rewarding or writing own posts (e. g., questions, answers or comments)
IQ05	How do you think about the idea behind auditorium?
IQ06	Are you aware of the achievement system?
IQ07	Which player types do you characterize?
Interactive Tutorials	
IQ08	How do you feel about the use of interactive tutorials to show users how to get used to the platform?
IQ09	Does interactive tutorials have influenced your user experience?
IQ10	How do you feel about the concrete implementation in auditorium?
Points, Badges and Leaderboard	
IQ11	How do you feel about the use of points for different activities?
IQ12	How do you feel about earning achievements (badges) for different activities?
IQ13	Which kind of achievements does have a motivational influence on you?
IQ14	What do you think about the usage of leaderboards?
Levels, Progress Bars, Avatars	
IQ15	What is your opinion about using levels as overall progression indicator?
IQ16	What do you think about visualizing the progress through progress bars?
IQ17	What do you think about the use of avatars?
Behavior Change and Motivation	
IQ18	Did the achievement system had any effect on your motivation?
IQ19	Did the achievement system had any effect on your usage behavior?
Feedback	
IQ20	Do you have feedback to make the system better?
Person	
IQ21	What is your role at the university?

Table 8 Questions asks during the interviews

II

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Auxiliary Means

The following list represents the used auxiliary means in order to accomplish the thesis:

- Apple Mail
- Apple Numbers (spreadsheet software to create diagrams)
- Apple OSX 10.9.2 Mavericks
- Apple Preview (PDF Viewer and basic image processing tool)
- Apple Safari 7
- Capistrano (deployment of auditorium)
- dict.cc and leo.org (translations en ↔ de)
- friends and acquaintance (proofreading)
- ForkLift (FTP app)
- Github (repository for the code of auditorium)
- Google Chrome 28+
- Google Scholar (search engine for references
- iA Writer (markdown text processor)
- Latexian, Taco Software LLC (Latex editor to write and compile the thesis document)
- Mozilla Firefox 20+
- Ruby on Rails (web framework auditorium is implemented with)
- Sächsische Staats-, Landes- und Universitätsbibliothek "SLUB" Dresden
- Sketch (vector graphics app)
- Skype (communication with supervisor)
- SublimeText 3 (editor for programming)
- SVN (repository for the sources of the thesis)
- Ubuntu Server 12.04 (operating system for the production server)
- Wikipedia (providing references)

Confirmation

I confirm that I independently prepared the thesis and that I used only the references and auxiliary means indicated in the thesis.

Dresden, March 11, 2014