antener

NISTA

3 hónap alatt angolul Hello London STUDIO

SECURE SOLUTION EUROPE

2021. VERSION 1.0.

CLASSM8 REPORT

Erasmus+

PThis publication has been funded with support from the European Commission.This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein

The publication contains educational materials developed by the trainers and participants within the ClassM8 project (no. 2018-1-HU01-KA204-047786).

CLASSM8 REPORT

CLASSM8 REPORT

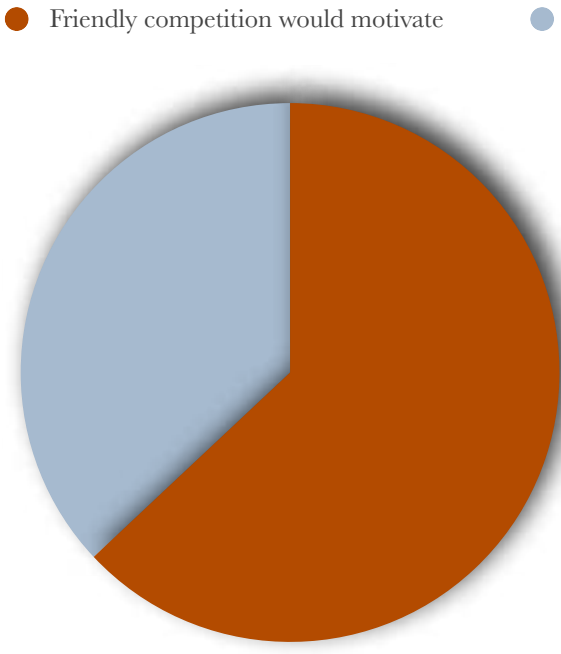
Gamification for Blended Trainings - Developing games

Preface

Our project was based on the idea that there are many trainings - and the traditional, offline exercises they use are (a bit) outdated, too old school and not always engaging enough for the participants.
The offline exercises are done with pen and paper, which makes it very slow and not always reliable - counting points and measuring time of different groups.

Is gamification important in education?
There are many positive effects of gamification in education. The purpose of the games can also be entertaining and non- entertaining such as only education or work, developing certain skills etc. In both cases it makes the participants more interested, the learning process more fun and increases productivity. It also increases motivation and engagement.

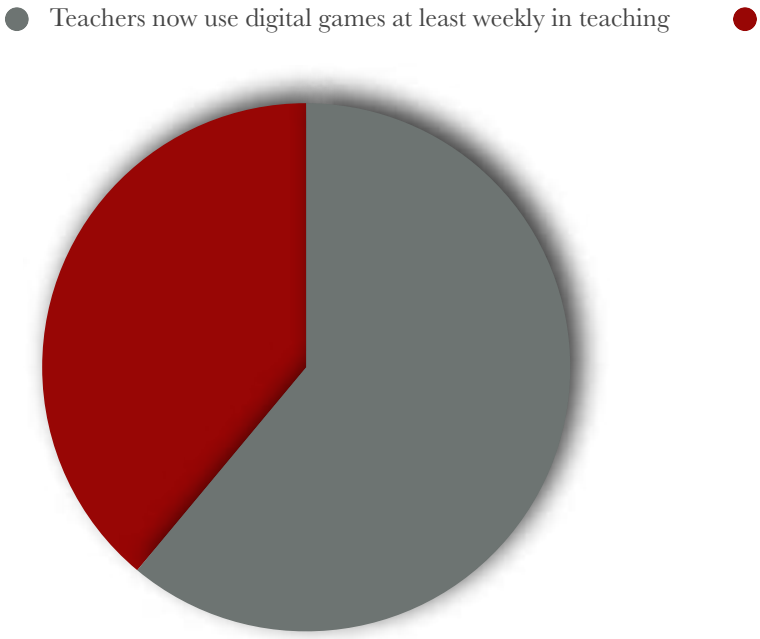
We can use timer, leaderboard and badges visually, which increases the excitement and friendly competition. It also adds to motivation and drive within the training or class.



More than 60% of learners said that leader boards and **friendly competition would motivate them.**[1]

How many people use educational games?

Nearly 60 percent of teachers now **use digital games at least weekly in teaching,** with 18 percent using them daily, according to a nationwide survey of 488 K–12 teachers conducted by researchers at New York University and the University of Michigan. [2]



[1] https://www.gamesandlearning.org/2015/04/27/by-the-numbers-10-stats-on-the-growth-of-gamification

[2] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiolv3ly8LxAhXRzaQKHTtiAn8QFnoECCcQAw&url=https://www.apa.org/monitor/2015/04/gaming&usg=AOvVaw2CnpXjh9i8g5UqXH0DCV_S

Gamification

As there are many advantages besides the above mentioned cases gamification is also used in the business world - by large companies - like Cisco, Samsung, Microsoft, Google, Deloitte Leadership Academy to mention just a few during their training or other processes.

In our society, where each person is constantly bombarded with information (105 000 words - which is 34 Gigabyte of information a day [3]) it is super hard to convey information in a way that is effective and lasting. During the training we also compete with more interesting graphics and visual elements that surround us.

However there is ad or banner blindness - such as ignoring advertisements - some kind of blindness or deafness can also be observed in education or training where people think the theme is boring or is is all the same again - they have prejudices because of their former trainings - and they just bar out all the information you are about to tell them.

Gamification is one of the most effective ways to break this wall.
Unfortunately traditional ways of education are mostly based on necessity and discipline - thus unstimulating and limiting.

It is also important that gamification should be only part of education and training - full gamification cannot be advised. Blended training and classes - where traditional style is mixed up with some modern device and games would arise and keep up interest of participants thus delivering greater results.

[3] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiq9ry1-87xAhXM6aQKHSvNAAoQFjABegQIBRAD&url=https://www.tech21century.com/the-human-brain-is-loaded-daily-with-34-gb-of-information/&usg=AOvVaw2snxd8wId1fRS7aV9hJuFK

Normally participants of trainings and students in classes think “education” must be boring, lengthy and makes them suffer. Most attend just as they are compulsory trainings and they do not want to stick out of the line. Just a very small number can keep up their interest and not to be somewhere else mentally during these classes even if just for part of the training. Most of them can’t wait it to end.

On the contrary gamification can make education interesting. It can create periods, which are more relaxed and do not require 100% of concentration. Thus participants can relax their attention and focus more when it is needed.

Is gamification effective in trainings and education?

Gamification proves to be more effective than traditional e-learning or non-interactive classes or trainings.

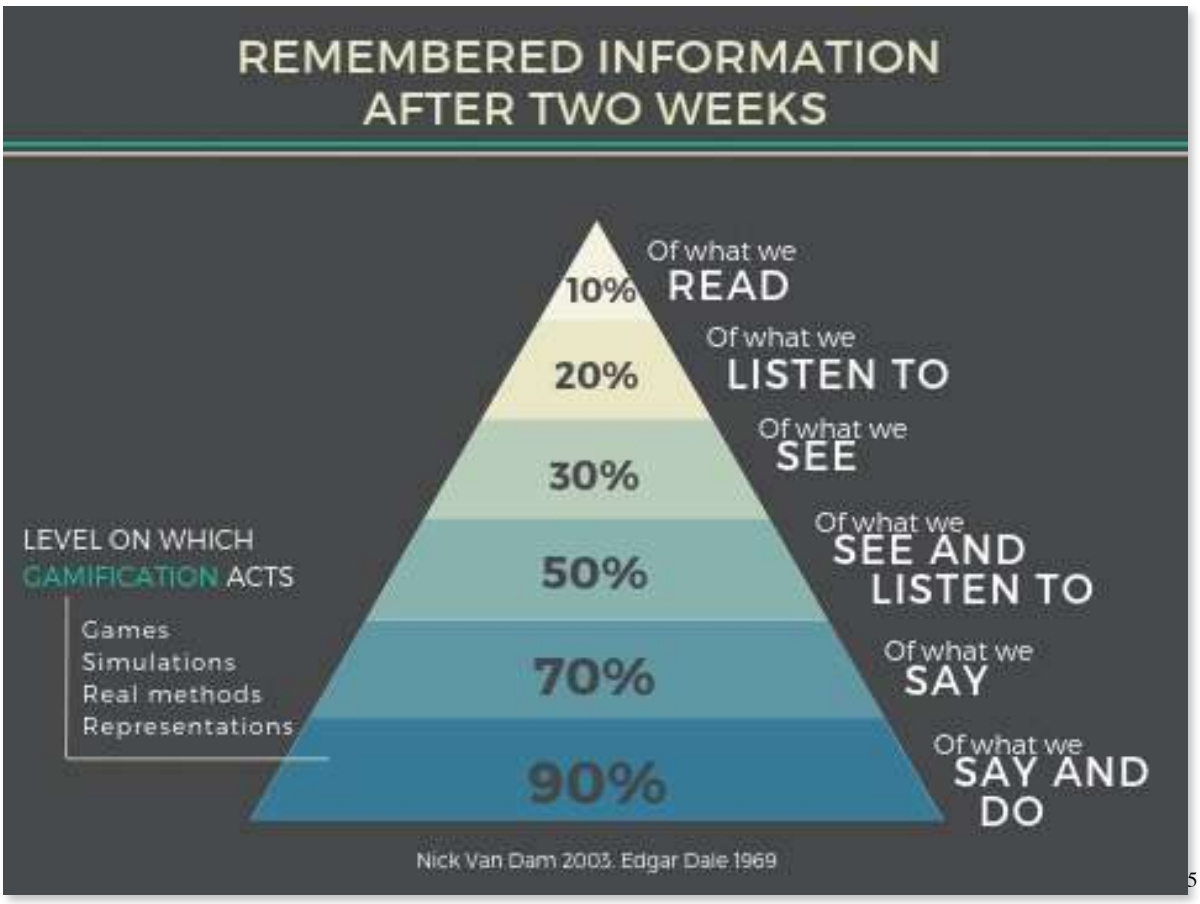
In 2005 at the National Summit of Educational Games a research was shown about how we remember information in 2 weeks. The research presented that the effectiveness of the memory depends on the way how we receive or learn the information. This research was based on the model of Edgar Dale and Nick Van Dam.

We can see from the chart that by only reading 10% of information is remembered, and if we listen to a presentation or lecture, we have 20% - which is very low.
If we see and listen at the same time - such as using a presentation it increases to 50%. But if we also apply what we learnt - either in an exercise by gamification or in real life - that is 90%. This is where our development comes.

In Europe in recent years we have seen some better or worse attempts to introduce gamification and games into education. Spain stands out but the rest of the European countries really fail to use these modern tools. The gamification in Central and Eastern Europe is locally is rather non-existent. Only Spain and Portugal[4] stand out in the field of online gaming.

Corporations - as they are profit based organizations therefore care more about efficiency than state schools- are faster to realize the positive impact and adopt the revolutionary technology of gamification in their corporate inner trainings and the also have access to funds to develop their training and educational portals adjusted to their needs.

[4] A European effort to explore games and the gamification of official statistics (https://coms.events/cess2018/data/x_abstracts/x_abstract_35.pdf)



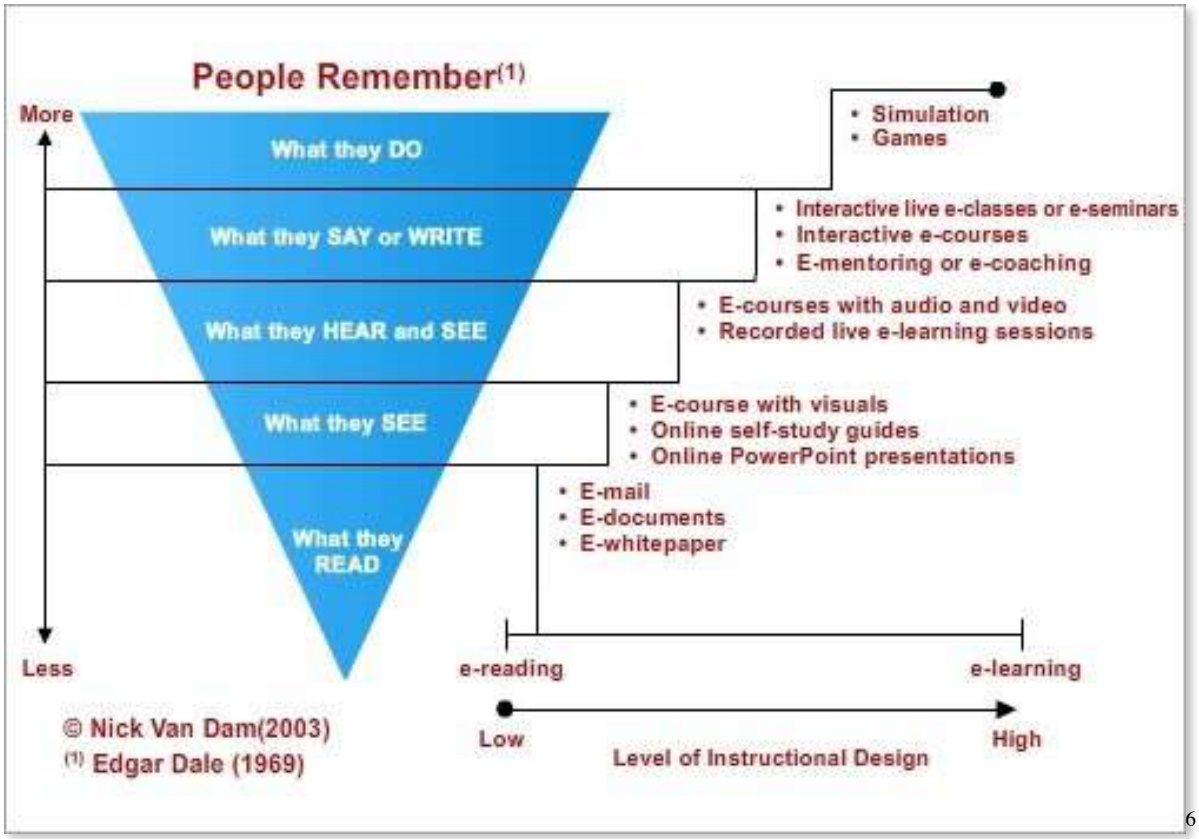
[5]

The below chart also shows the above pyramid without the percentage of effectiveness of each but mentions the educational tools at each step.

Here we can see the whole range of instruments that can be applied during training or education and their effectiveness.

As the experience shows we should not rely only on one tool - as it becomes monotonous and boring - but blended application of these educational and training tools leads to the most effective trainings and best results.

[5] https://www.getplayoff.com/wp-content/uploads/2019/03/reminded-information-after-two-weeks.jpg



[6]

There is another study the results of which we should take into consideration as well.

This is The Impact of Computer Usage on Academic Performance: Evidence from a Randomized Trial at the United States Military Academy by Susan Payne Carter Kyle Greenberg Michael Walker in 2016 [7].

The research tested what is the most effective form of study - measuring the results of classes using tablet/ computer and not using any technology. The findings showed that computerized classes had worse results than traditional education. However it was not tested whether the increased availability of distractions for computer users (email, facebook, twitter, news, other

[6] https://media-exp3.licdn.com/dms/image/C4E12AQEoLAZX41od8w/article-inline_image-shrink_1000_1488/0/1520486255792?e=1628121600&v=beta&t=yMTtUI2GTeHjlYGzVB8rjcjVWW0TpxK1-AAIeMWHOp8

[7] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjYip-N6dXxAhUiIcUKHewzA6sQFnoECAMQAA&url=https%3A%2F%2Fseii.mit.edu%2Fwp-content%2Fuploads%2F2017%2F06%2FSEII-Research-2016-Carter-Greenberg-and-Walker.pdf&usg=AOvVaw0xbPm3B8NcqdDavvWawUUN

classes, etc.) leads to lower grades, or whether professors teach differently when students are on their computers.

To sum up - the above outcome show us that we should use a limited amount of gamification in trainings and in educational classes - to experience its positive effects and it adds to the performance. At the same time we should avoid using tablets and computers through entire training as it has more negative effects than positive and prevents participants to intake the information and use it. Blended educational and training sessions are the best - which is also backed by different surveys and researches mentioned in this document.

There comes our project - for us it was very important to develop games that we can use in real classrooms and corporate soft - skill training. Games, that we used only online - and now they became a bit outdated and you could not use them with certain audience as they seemed too childish and in adult education people in leading position refused their offline version.

Using the games from time to time with the help of phone - we managed to increase the participation and willingness of participants of training to play them. The participants mostly enjoyed them and we did not have the earlier concerns any more - everybody was willing to participate.

Another aspect of computerization is that we decrease the wasted time of the offline games - when we had top calculate points manually, distribute papers, count time and lose the attention of some students and players at the same time.

By taking the games to phone they became more engaging and participants tend to follow the whole game more than when they were offline.

The major purpose with incorporating the games was to achieve efficiency, increase engagement without distraction. Also to modernize the gamification environment and be able to create games that can be widely used or that can be used to different purposes dynamically by the teacher/ trainer - so we created a frame and the input can be uploaded depending on the subject.

The selection process of the games - part 1. criteria

Criteria
MinimAt least 1 competence defined (eg. Vocabulary improvement)
All tasks should be collaborative
A group should be at least 2 people
Games should be measurable - whether they liked the game - whether they recommend it - if the players feel competence have been developed - If they gained new knowledge

Limitations
❌ Face/ voice recognitions - AI required
✅ Checkbox
✅ Multiple choice
✅ Lists
✅ Missing words
✅ Pictures
✅ Drawing

The partner companies in this project had several different aspects at the first meeting. Then we managed to agree in certain criteria each game has to meet. These are listed below.

‼ The most important things are:

Simplicity

What we wanted with the project is to create very useable games that are fast and easy to implement during classes and trainings with different number of participants of very different IT skills. We also expected the people will have all the types of smartphones and various operating system for the teacher and projector screens. That is why the development had to be web based. All the games had to be simplified or simple solutions: if the participants have to do something complicated or not obvious will result in a chaos.
And if there are technical problems - the training or educational class would be about handling the IT or technical issues instead of the game itself.

Usefulness and effectiveness

Having effective games results in their popularity and widespread usage. People and educators alike do not like wasting their time. So we had to save time for the users with the games and create them values. If the technical realization of the games are faster and more interesting than the usual offline games - the groups can spend more time with learning or ice breaking.

We have to make the offline games more effective, more interactive, more enjoyable, simpler, easier to use and less problematic - so it is worth taking out their phones and a projector.

The game has to be better and more enjoyable on the phone than offline

It is obvious but also one of the main points. It was taken very seriously as we required the partners to justify this part in the specification of the game.

The other criteria that have to be met by each game are:

The lenght: The full time of the game has to be between 15-30 minutes.

We agreed in this criteria because the games should be effective. Either the purpose is to break the ice or to teach something or to let the players experience or test certain theories at soft skill trainings we did not intend to play the game for the full period of a training session or the educational classes, just part of it.

Competence:

The game has to improve at least one competence which has to be named in the specification and description.

We agreed in several different competences that should be improved. As we had a corporate training partner and language schools in the project we mainly selected games that would improve the following competences (some only for soft skill trainings, some games only for educational purposes, but most of the games can be used flexibly in different environments - both educational and even beyond language training - for the variety of purposes):

- Social and interpersonal skills: improves interaction among players
- Helps to improve the non-verbal communication and developing harmony and team spirit within the groups
- Mood, morale
- Presentation skills
- Public speaking - in front of a group
- Active collaboration
- Creative thinking
- Accuracy

- Learning ability
- Grammatical skills
- Builds vocabulary
- Advance usage of second language
- Improves the transparency and effectiveness of group discussions
- Betters problem solving skills
- Intensify engagement ans participation
- Increases awareness of participation of team members
- Improve leadership skills - leading meetings
- Giving instructions, explaining in different ways for different people
- Delegating
- Friendly competition
- Handling pressure and tension
- Being patient
- Decision making
- Group awareness
- Practice how to get and keep attention
- Concentration and active listening
- Improves the ability to withstand stress
- Assertive communication
- Compromising
- Making arguments, persuasive skills
- Proposal making, argumentative language skills
- Expressing feelings in a second language

Collaboration:

Every game has to be collaborative as we wanted to use them at corporate trainings and language school environment.

Every partner participating in our project deals with groups so the natural choice for us was to develop games that can be played by groups rather than individuals. Most of the time the goal was also to improve some communication / interacting skills or to develop friendly contest in the group among members or among smaller teams. When it comes to education - studying in groups has many benefits. The students can motivate each other and learn from each other's mistakes. The same information can also be repeated many times to or by different members of the group without getting boring.

Number of participants:

The number of players has to be at least 2.

See the above. Also many games require the participation of 4-5 members or even bigger groups. In some games we recommended playing it in larger groups so that it is more enjoyable, fun and effective.

We have to be able to measure the games:

Speaking of interactive games one of the most important things is if the game is enjoyable thus evokes the engagement and participation of the players.
So our first question during the tests is :

If the participants liked the game or not

Would they recommend to others?

This is the one metric many companies and organizations are using in marketing. This is how corporations measure customer loyalty and if they could achieve the necessary trust from customers. This is why we also used it - as this is the ultimate metric that tells us honestly if the players like it and enjoy the game enough to promote it to others. It also suggests if the player would play with the same game again in the future. However if you want to get more detailed feedback you can ask this question separately.

Do they feel it improved their competence?

This feedback is also very important as it tells us the subjective experience of the player. It is not only important that we know or see how much the participants improved by the training but it is always helpful if they are aware of their progress as well. It not only encourages their engagement in similar games in the future but also results in less resistance towards online games and higher sense of achievement.

Did the players learn something new (could be anything about their partners, colleagues or mates)

As the primary goal of the games is to educate - either in language or other educational classes (as the framework of the language games does not exclude their usage in different fields thanks to the flexible input we created) and soft- skill training is to educate and convey ideas. The primary goal of the ice-breaking and leadership skill training games is the same: the players are invited to find out different things of each other.

The above criteria is a general reference system for each game in education - speaking of either traditional ones at schools and at courses or leadership and soft-skill trainings.
However we also used other aspects to measure different games. The below list is far from full, I only selected the most important ones and those which can inspire the others to develop and chose games that fits their training.

Some guide questions to measure soft-skill games:

- to find out more about human behavior in groups - if the general behavior changes in a group
- to learn what makes a group to be a group
- If the game helps to develop team cooperation
- If the tested idea proves to be true or not
- If they feel any change in group dynamics[8]
- How the players feel during the game

Some questions to measure language skill games:

- if the player can express himself better in the second or third language
- If he or she understood what others told
- If they understood the explanation

Some questions to measure leadership training games:

- What caused difficulty
- If they manage to delegate tasks easier
- If their communication skills improve

[8] The term "**group dynamics**" describes the way in which people in a **group** interact with one another. When **dynamics** are positive, the **group** works well together. When **dynamics** are poor, the **group's** effectiveness is reduced. (https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwis4-iOrdjxAhXoN-wKHY-1BdYQFjAKegQIDRAD&url=https%3A%2F%2Fwww.mindtools.com%2Fpages%2Farticle%2Fimproving-group-dynamics.htm&usg=AOvVaw1Z8GTVqvyymFLVrwvZubRN)

The selection process of the games - part 2. process

Game ideas	
Activity	Dotting
Thief dilemma	30 circles
Emotion recognition	Find who you are
Personality competition	Word cloud
Word Chain	EU Flag - country recognition
Guilty or not	Splitted into famous people

When the partners of this project agreed in the criteria and aspects of the games we started to select them. There was individual research work and after each partner made a list of games to suggest we again met and discussed the games. We measured them towards other conditions.

We checked if the game can be used in different scenarios - not just one - therefore where it was possible we created a framework that made the games flexible because of input facility.

I would mention here the detective game - which is suitable for language training, for soft skill training and leadership training.

It is also suitable to be used in other classes to mention a few:

- to learn history or historical events
- museums and schools can use it for interactive programs
- can also be used for team building
- can be used in theatrical education or role plays
- also suitable for birthday parties or company events
- can be played by children and adults

The liar game is also flexible - the training environment and goal can determine what we upload so the game is interesting for the participants of certain age and interest.

Another aspect was if the developers can create the game programming wise. For us it was very important to only chose useful games. Another viewpoint was if the game can be simple and easy to use and understand.

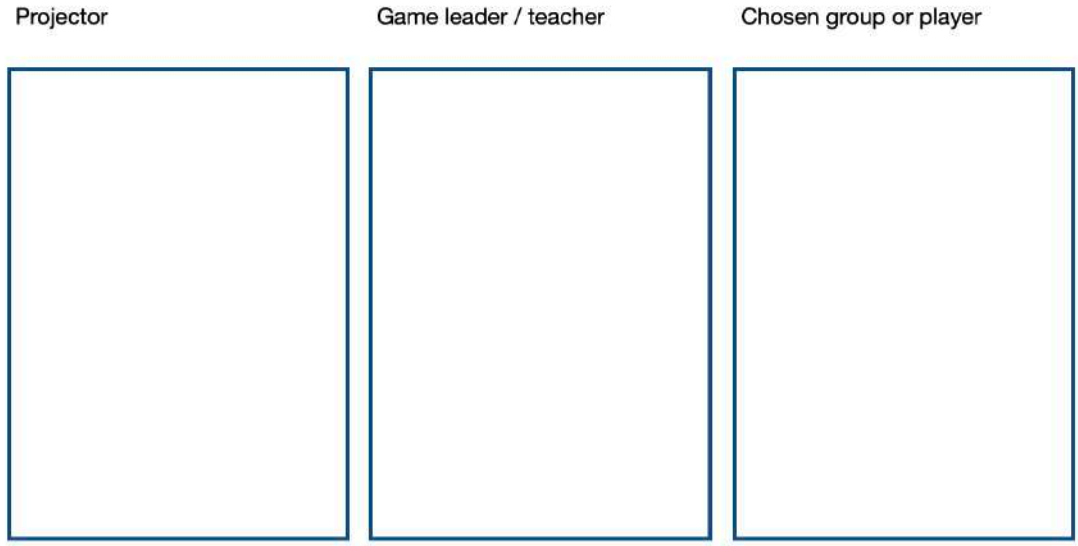
In case during the meeting the partner met difficulty explaining the game to the others we did not accept the game for development but the partner had to look for and suggest other game or games.

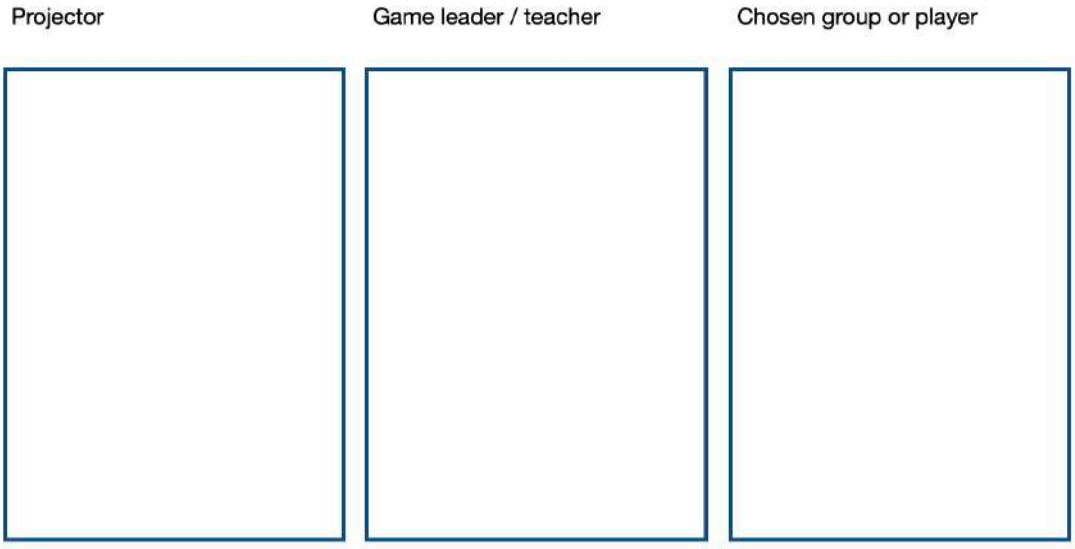
We simulated the games in theory and in 2 dimensional drawings - discussed the whole playing process - and checked if the game can be played by a projector - the teacher's phone which controls the game and the players' smartphones on local wifi or mobile internet. It was important as sometimes trainings are held in hotels where the reception of general mobile networks is poor but can provide wifi access to participants.

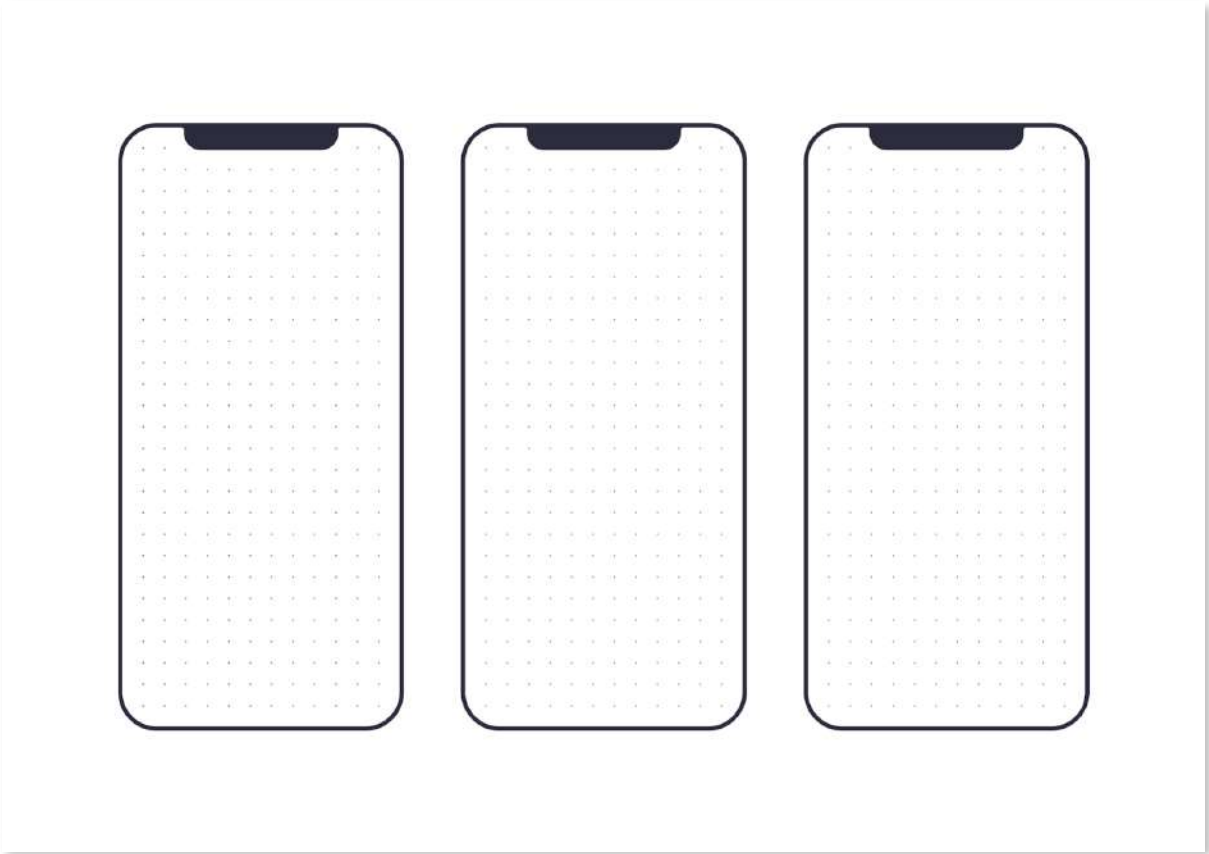
Sometimes the games are played on the side of the company and the language teachers or soft-skill trainers visit the company. There the players can use either local wifi or their mobile internet.

When we agreed in the games the partner who suggested the game had to create a wireframe of the process of the game. This was discussed with the developers and adjustments were made if they were necessary in coordination with the UK and Hungarian partners.
[9]

[9] The scheme used by us for the framework


Projector
Game leader / teacher
Chosen group or player


Projector
Game leader / teacher
Chosen group or player



10

The framework does not have to be very nicely drawn - just enough for the developer and designer to understand what to put on the screen at each step.

‼ Here the task was to draw the sketches of the screen at each step. It is very important to see the whole process in sketches and the different possible scenarios of the game.

[10] This is an example of the framework and the text we put on - what should appear on screen at each step

⚠ It is also very essential to communicate clearly each step and discuss with the developers. A lot of time and unnecessary steps and development can be saved by planning the project ahead, reasonably and carefully.

Always use visual tools - sketches, flowcharts and drawings - it helps the communication and to understand the process for each party.

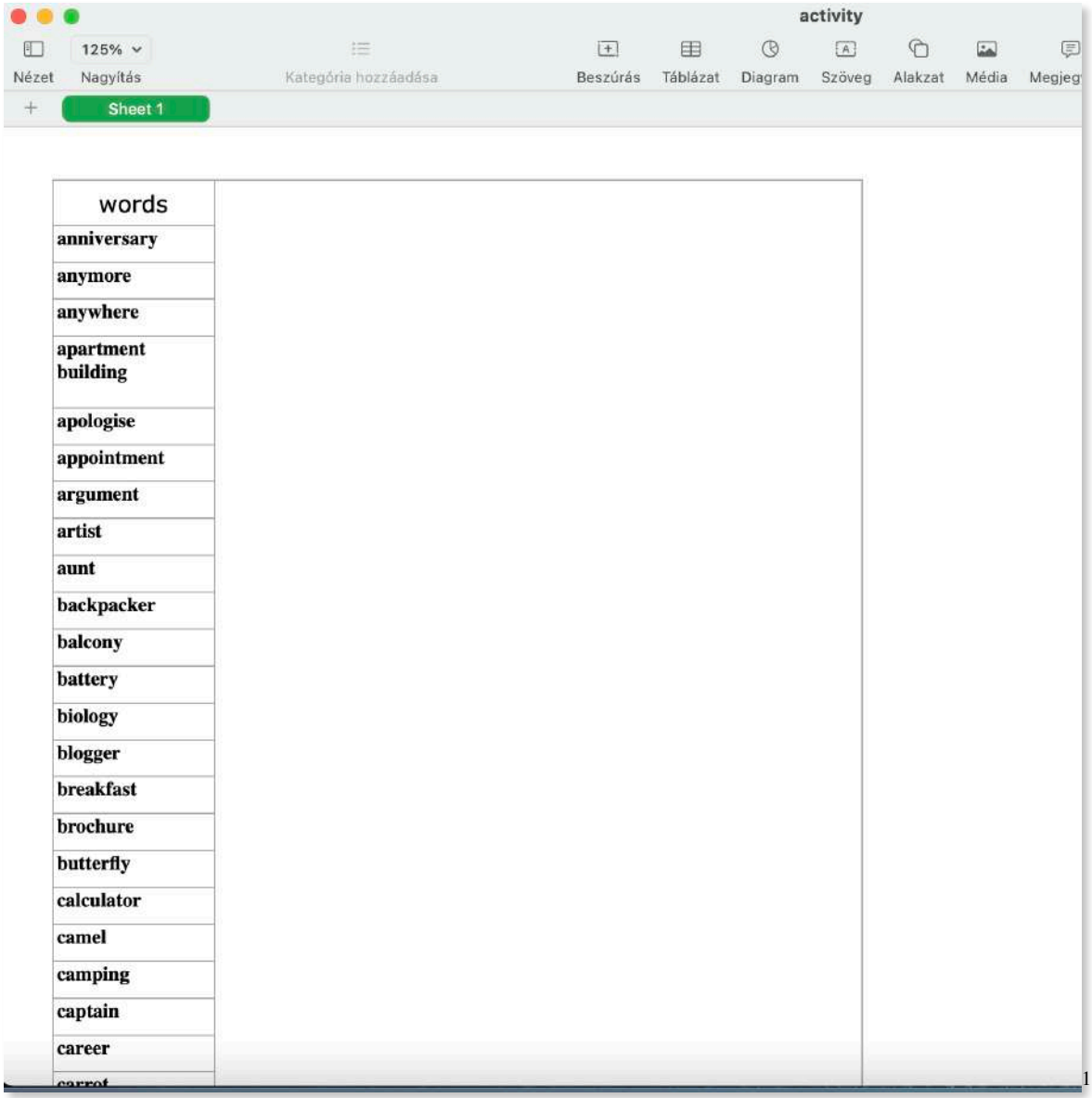
Then specification and instructions had to be created while the development was in progress.

In the instructions the creators of the game had to write everything that makes the game easy to play and understand.

All the steps had to be placed online - which is easy access for the game leaders or teachers who control the game. The format of these files is only xlsx.

There are also sample files that work with the games and one can rewrite their content and upload for the game.

The upload window appears on the screen of the projector.



words
anniversary
anymore
anywhere
apartment building
apologise
appointment
argument
artist
aunt
backpacker
balcony
battery
biology
blogger
breakfast
brochure
butterfly
calculator
camel
camping
captain
career
carrot

[11]

It is very useful if all the input files have the same or similar logic and format.

[11] The sample file we created for the Activity game

The testing process of the games

We wanted to test each game twice.

The first test meant to be a soft test - it meant the partners test the games with their colleagues or staff to see if the games are easy to play. We also reported any bugs we found to the Hungarian and UK partners who repaired the game if that was necessary. The first tests were always interesting as we tested them on different operation systems and with different phones to make sure this does not affect the display and control of the games.

At the meetings we also did tests together:

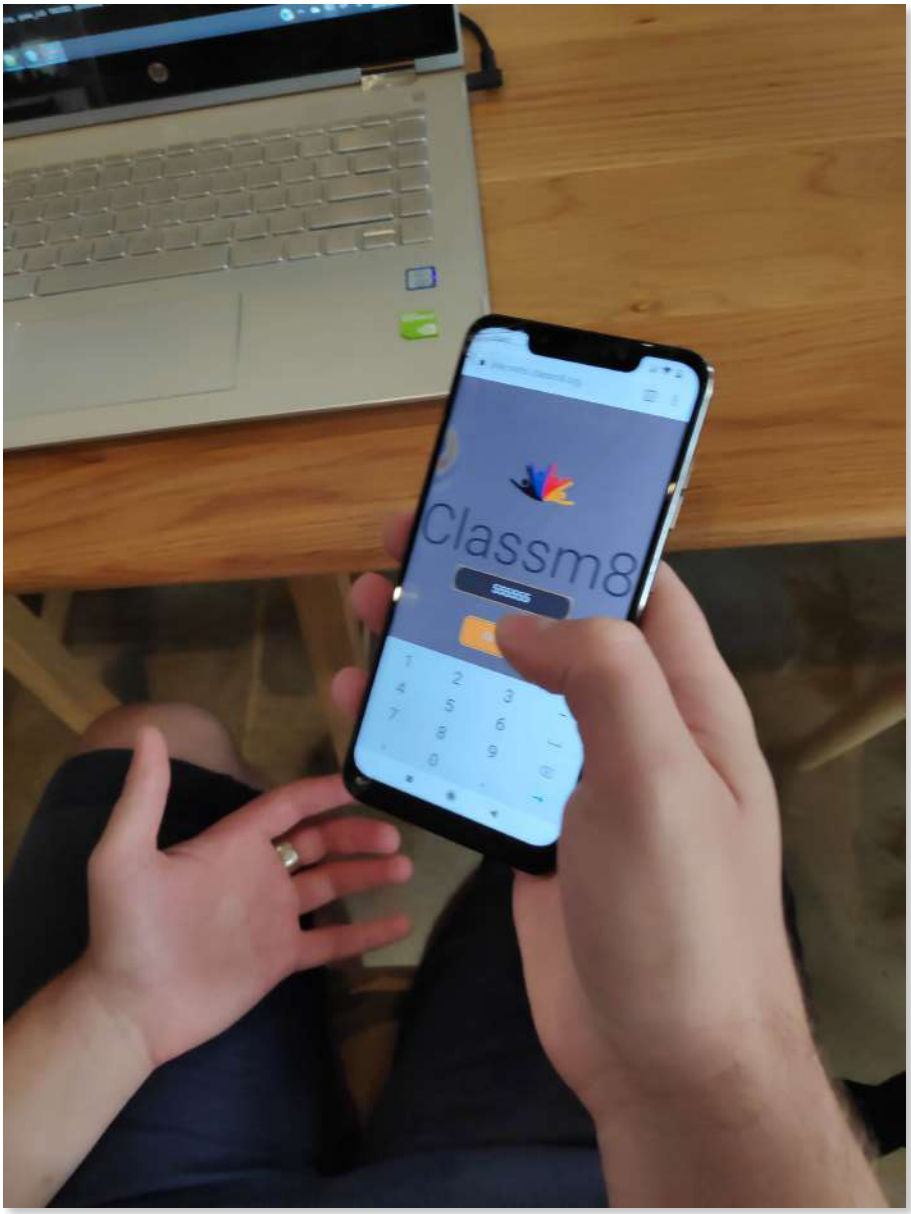
We have to take notes and do it together with the developers and other partners. The developers of the game had different viewpoints than the ones who did not participate in development. It was very important to discuss each point of the game and understand what is needed by the developers and what solutions can be created. It is just a bit different logic from the everyday one - and when we can see how it works the cooperation becomes much easier. I suggest at least one or 2 meetings for this purpose. It makes the development more effective and creates a situation when everybody is on the same page.

This is also a great possibility for barnstorming the ideas, different scenarios and arising problems. It can happen that we do not think of certain cases and playing the game with partners can make it more versatile and prepared for real user tests.

Sometimes a minor technical adjustment can be done immediately on site. This could be even a change of a color - because in one game the color used in design can mean something bad in a different culture.

At meetings or group testings we could also vote when different solutions were presented.

!! It was also important that we could standardize the process of each test and all the partners learnt what to look at each test and how to build up a test.



Our agreement was that the partners if contacted have to answer within 24 hours - which made the development fluid and smooth.

When we worked out the testing procedure at the mutual meeting then each partner did the soft tests separately for each game.

As after the pandemic measures were introduced globally we could no longer test the games offline. Our steps to adjust testing to online environment are described in chapter about the online environment

The second tests meant to be friendly user tests. We tested the games within our language school with our students or with an English club we have access to. So did the Slovenien partner. Other partners tested the games during their trainings.

It contained risks - if we try to test the game and there is a technical bug - it can be very embarrassing for the leader of the training or the teacher. It is even more difficult if the game is tested during paid training or the testers get together only for the purpose of the game.

This is why the partners notified the developers of the date and time of testing so technical support can “stand by” in case we face some problems. Fortunately we did not have to use it - but we all know prevention is better than cure….

Diversification - frame

If certain games can be created with flexible input fields - that is the way we always chose. Because with one programming and creating a framework or core of the game - by changing the input we can always change the game and use it in different settings and for different or slightly different purposes.

This way we can achieve efficiency: we are able to create games that can broadly be used or which can be adopted to different purposes and the online game can thus be multi-dimensional. We created a frame and the input can be uploaded depending on the subject.

It is true of language training games - the teacher can upload different word lists for activity, word chain, phrasal verb bet and the game can continually refresh.
Trainers can also use the same framework at rhetorical trainings as well.

As it was already mentioned in this report (see the chapter The selection process of the games - part 2. process) the detective game can be used in several diverse instances by changing the storyline.

Only online environment

After the Covid 19 hit in and the global restrictions were introduced internationally we could no longer test the games offline. The schools - including language schools, lower and higher education and corporate training switched to a fully online environment. People started to work from home office and it changed all the circumstances.

It was a challenge for us - as we needed to see if the games can be adapted to the new world. Fortunately we worked on the adaption - the partners met online and in the form of brainstorming discussed how the different parts of the games and the testing can be done online.

Luckily the games developed by our team were adaptable to the online environment.

The projector can be used as a projector in the online environment but because of better visibility we advise to use and share a computer screen with the projector page. We have to use a video conference or video call application with screen sharing function:

- Zoom
- Facebook messenger
- Skype
- Discord or any meeting room with a screen sharing possibility.

I list some of the problems we faced when we had to adopt to the online environment as examples or ideas where the future developers should pay attention.

The first online testing was carried out by the Hungarian partner - which was really good as they were also developers. At first only the players could see the task and the leader of the game could not - which was disturbing - especially in an online environment. Offline the trainer could just walk over to the player and have a quick glance at his or her phone.

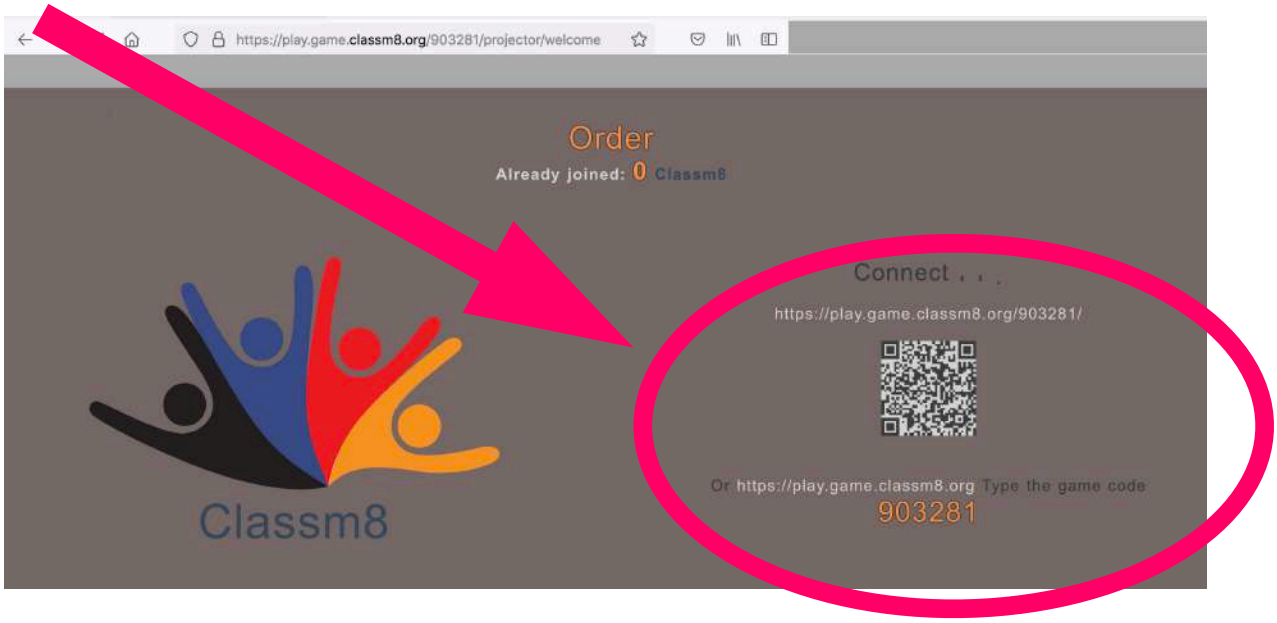
This part of the game was adjusted for online usage.

Another thing we had as a problem was that the players could not sit next top each other as during offline trainings and discuss the game or task in different groups. So the game leader or organizer had to create different rooms online which the participants can enter.

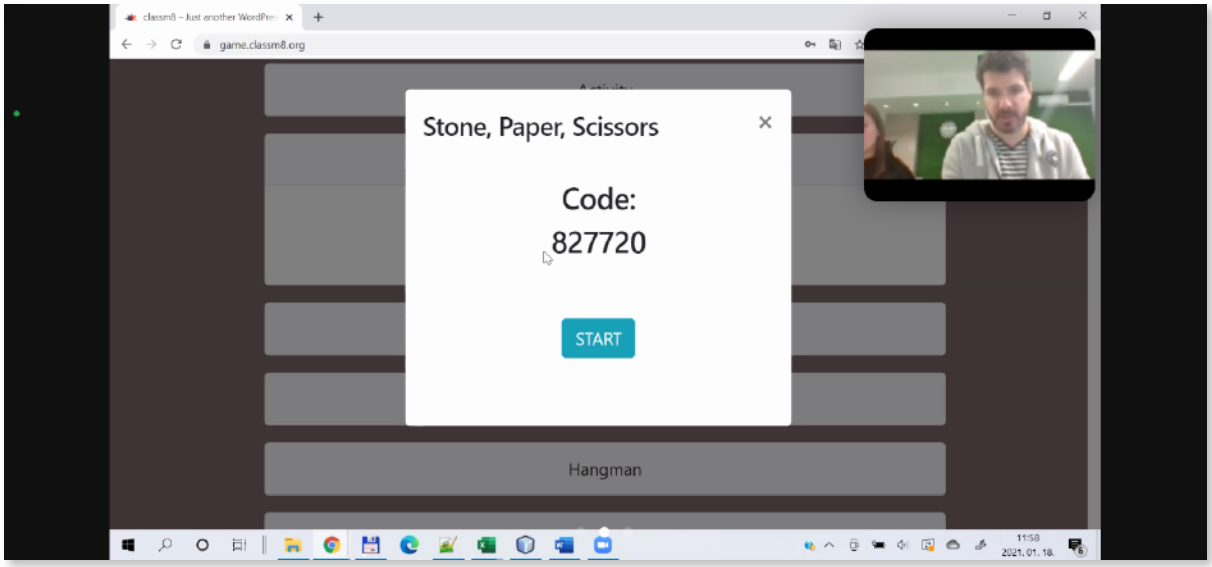
We also had to pay attention to the speed of internet - especially if the participants also use video calls.

Reading the QR code from a screen could cause problems for some participants that is why the games offer 3 solutions for the players to join:

- there is a link over the QR code so that everybody can join the games fast
- The QR code
- The general link and the player has to add the number of the game manually



We also tested a game online with all the partners to make sure everybody knows what to do during the only online testing.



How to find other games?

If you want to boost your classes or trainings with gamification - that does not distract participants but improves engagement and motivation you can look for traditional offline games that are used for certain purposes:

- Ice breaking
- Practicing different language skills
- Games or exercises for soft - skill trainings
- Traditional games
- Offline educational games
- Games that help individuals overcome limitations - such as fear of public speaking
- Improving argumentative skills
- Games that are used during leadership training to target certain characteristics
- Or games that you already use offline

And see if these can be boosted up by gamification - adding some online elements to them. You can think with the original version of the games or modify them slightly by changing some of the rules to make them more interesting.

You can always add badges or reward points to teams or individuals - they not only motivate people but give them immediate feedback of their progress and help them feel rewarded for their efforts.

You can use our process of though or develop your own criteria system that matches your needs more.

Summary

However in the USA gamification and computerized classes are standard nowadays, Europe still lags behind. We can reach the best outcome at the education and training by applying blended training and using both the online and offline tools to make the coaching or tutoring engaging and interesting.

Don't forget the dark side of gamification. Do not overdo it - use it mixed with traditional elements. As recent studies[12] show this part of the world is not yet ready for full time online education. Students prefer offline schools and suffer from the online only version.

The success of the games depend on the effective and simple game mechanism that improves engagement and boosts motivation. It should give the players inspiration to achieve better results and use more from their potential.

Enjoy your work!

[12] https://24.hu/belfold/2020/11/11/koronavrus-felmeres-digitalis-oktatas-online-oktatas/

https://www.feol.hu/kozelet/helyi-kozelet/digitalis-oktatas-diakszemmel-igy-elik-meg-a-fehervari-kozepiskolasok-az-online-tanulast-4427134/

https://www.magyarorszagom.hu/milyen-az-online-oktatas-egy-alsos-szemszogebol-nezd-meg-a-videot.html

CLASSM8 REPORT

Gamification for Blended Trainings – Operator Interface

Preface

When developing CLASSM8 focus was systematically placed on the ease of use. This was also a key consideration when designing the games and the user interface itself.

- By making the games easy to navigate, our aim was to make them more enjoyable for players, allowing them to focus primarily on the games and the competencies they offer.
- The simple user interface aims to allow as many educational institutions as possible to incorporate the games we created into their training and ensure that it is easy for teachers to learn the usage, and as a result, the CLASSM8 system can spread easily.

As a for-profit adult education provider, we have also seen that the degree competing schools want to share a common educational platform with each other, depending on their position, tends to vary:

- Smaller language schools, possibly freelancers, prefer to use a commonly available system
- Larger language schools may rather choose tailor-made, personalised interfaces for marketing or customer data security reasons (e.g. they may prefer to put their own logo on the admin interface or make different games available from their own domain). In addition, they may not have the server capacity to run games for a large number of users, or they may prefer to use games provided by others. Thus, in addition to their own admin interface, they would also use the shared the game server.
- For trainers with specific gaming needs, or in case of self-developed games, they may wish to use a designated game server, completely separate from other users

For the above reasons, we have designed the interface of the games with simplicity in mind and using a modular structure.

For freelancers and minor institutional users , we provide a shared user interface accessible from classm8.org. After a prior registration via email, the admin interface and the games developed are available with a teacher role on this platform.

The admin interface installation package, which can be downloaded from classm8.org, allows institutions to have their own admin interface. Prior e-mail registration is required to download the interface. Installation, configuration, connection to the game server and the use of the admin interface are described in this chapter.

Besides the admin interface, the CLASSM8 game server installer can also be downloaded from classm8.org. This system will be described in the next chapter.

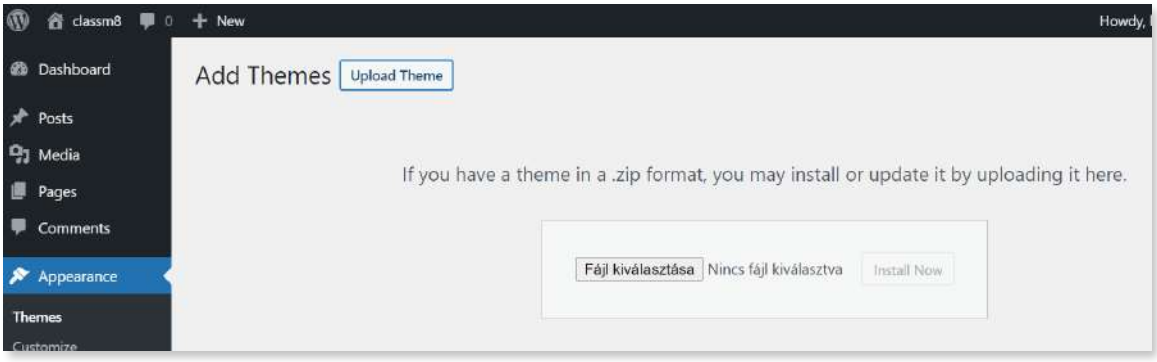
Installing the CLASSM8 Admin interface

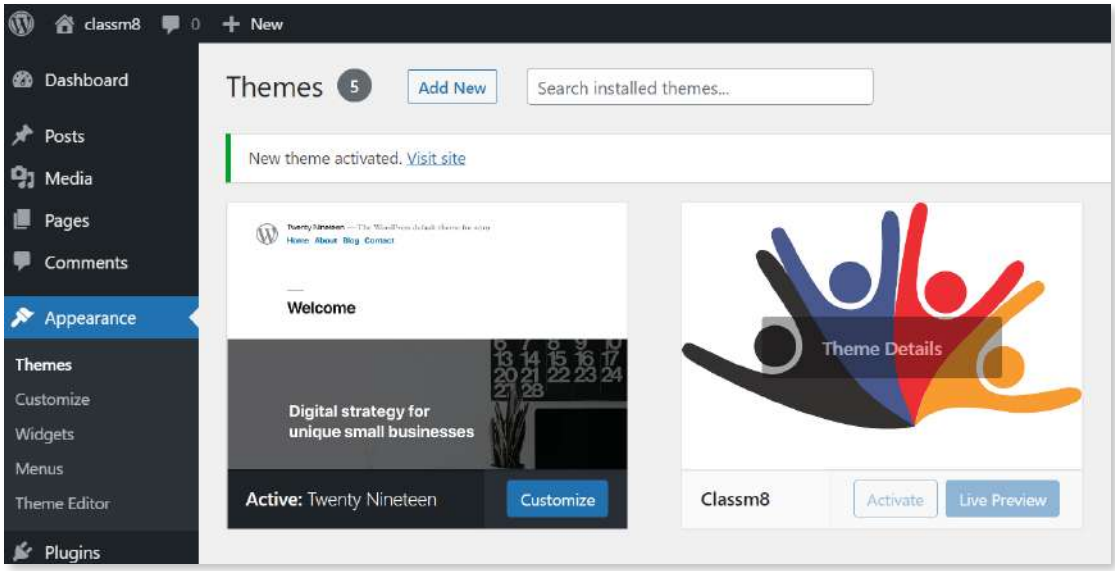
According to a research by w3techs, a service provider continuously monitoring the Internet and Internet usage, WordPress will (still) be the most popular content management system in 2021, with 42.3% of websites created using this system. This is why WordPress has been chosen as the basis for the CLASSM8 admin interface, as there are many descriptions, training materials and tutorial videos for this platform. It is easy for professionals to use and can be easily integrated into the existing web interface of the training institutions. All these aspects are important to facilitate widespread usage of CLASSM8.

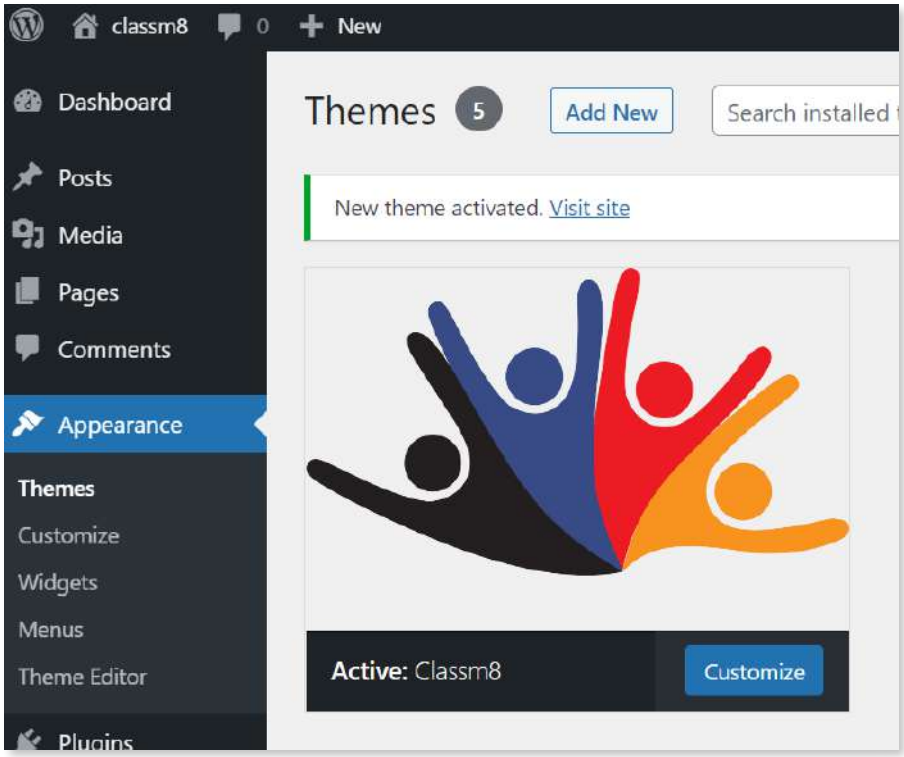
The admin interface of the CLASSM8 system needs to be installed as a separate WordPress theme. This document is not intended to be a guide to the installation of WordPress. If you need support, we recommend you to contact your hosting service provider or administrator for assistance. The template used for the admin interface does not allow the use of the given WordPress site for other purposes, so we recommend that the admin interface itself is set up for a WordPress site installed under a separate subdomain. In order to ensure continuous presentation of the brand, the admin interface can only be installed under a subdomain called classm8 (e.g. classm8.school.org).

Following registration via email, the classm8_admin.zip file must first be downloaded from the classm8.org website, uploaded to the WordPress template installer. The CLASSM8 admin interface will be available once the CLASSM8 template is activated.

If required, more help on installing a customised WordPress template can be found at https://wordpress.com/support/themes/uploading-setting-up-custom-themes/.




classm8
0
New
Dashboard
Posts
Media
Pages
Comments
Appearance
Themes
Customize
Widgets
Menus
Theme Editor
Plugins
Themes
5
Add New
Search installed themes...
New theme activated. Visit site
Welcome
Digital strategy for unique small businesses
Active: Twenty Nineteen
Customize
Theme Details
Classm8
Activate
Live Preview


classm8
0
New
Dashboard
Posts
Media
Pages
Comments
Appearance
Themes
Customize
Widgets
Menus
Theme Editor
Plugins
Themes
5
Add New
Search installed
New theme activated. Visit site
Active: Classm8
Customize

Setting the CLASSM8 Admin interface

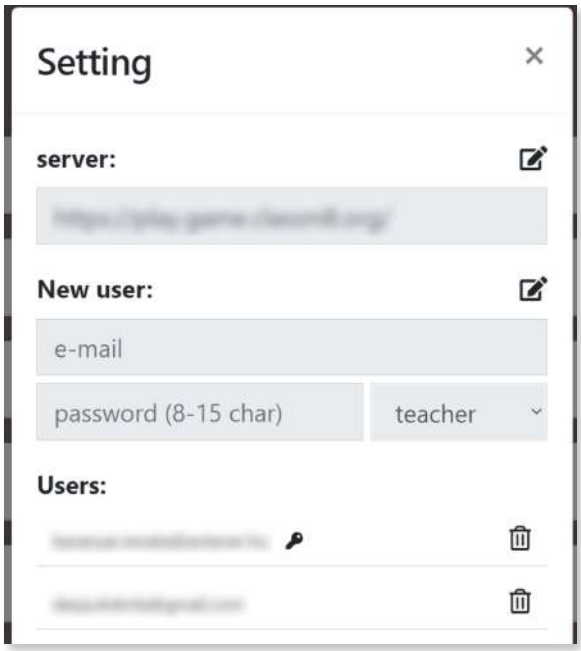
Only authorised users are allowed to access the CLASSM8 admin interface. Users who have been granted admin rights during the WordPress installation will automatically be granted admin rights to the CLASSM8 admin interface as well, so there will be at least one user with admin rights when the interface is installed. Users can access the interface by entering their email address and password.

After the first login, the settings are not yet complete, so the admin interface will indicate the absence of a game server. This error message will naturally disappear once the setup is complete.

When designing the user interface we wanted to keep it simple. In addition to the games that appear when you've finished setup, there are only three buttons that users with administrator rights can click:

1. CLASSM8 logo: redirects the user to classm8.org
2. gear: pops up the settings panel
3. right arrow: logs the user out of the admin interface

By clicking on the gear icon , users with administrator rights can configure the game server within the settings panel and assign additional users to the interface (see the picture below). Click on the pencil icon to edit the input fields. To save the changes, click on the save icon (disk) to finalise.



The URL of the game server must be given in the following format:
https://server.path.domain.org/
To create a new user, you must enter the user's e-mail address, password and select the level of access (teacher or admin).
In the settings panel, click on the trash bin icon to remove users whose rights you want to revoke.
The number of characters for passwords is limited as indicated in the interface (minimum 8, maximum 15 characters).

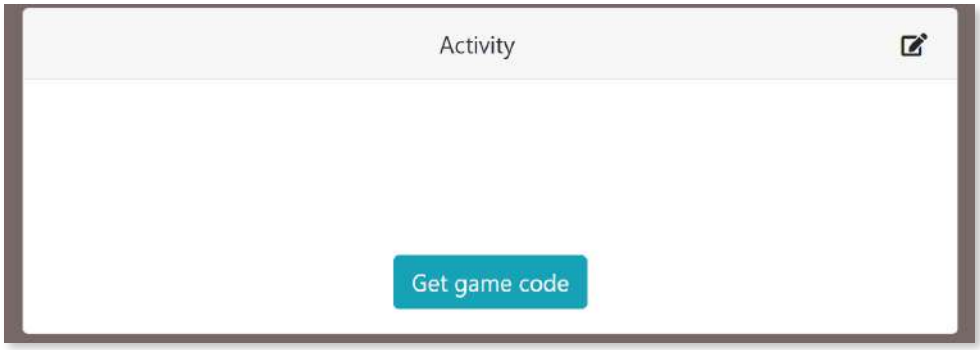
For simplicity reasons, the passwords of the users are also set by the administrator, without even requiring password confirmation. If an incorrect password is entered, the user must be deleted and then re-entered with the correct details.

User passwords are stored by the admin system through the WordPress system. Accordingly, passwords cannot be decrypted, they are only recorded in the database in an encrypted format and are therefore considered secure. However, we recommend users to set unique passwords in the admin interface that are not used elsewhere.

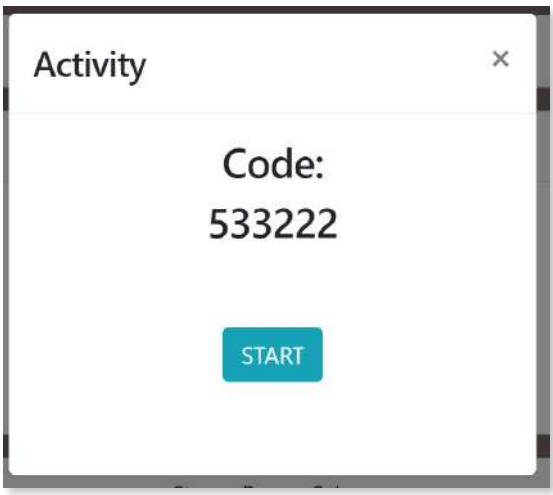
Launching CLASSM8 games

Once the game server is properly configured, the list of available games is displayed in the CLASSM8 admin interface:

The game launcher panel will drop down by clicking on the name of the game.



Users with administrator rights can click on the pencil icon on the interface to add a description or instructions for the game. Changes can be saved by clicking on “save”.
By clicking on the GET GAME CODE button, users can register a new game and the system will generate a game code.



The game code is used to connect the players, the teacher and the projector interface.
The process of the game and the different roles will be described in detail in the next chapter, but it should be noted that there are 3 roles in the CLASSM8 system: teacher, projector, players. The order of entry into the game determines the role a player receives. Accordingly, the person who enters the game first will be assigned the teacher role, the next entrant will be the projector, and after that, whoever enters the game will be assigned the player role.

You can enter the game in any of the following ways:

1. By clicking the START button on the game registration panel (actually only the teacher can do this).
2. You can access the game directly by entering the game code in your web browser, following the game server URL

e.g.: https://server.path.domain.org/533222/

3. By entering the URL of the game server in the web browser and then the game code in the window that appears (see the picture below):

e.g. https://server.path.domain.org/

4. After the projector login, by following the on-screen instructions, e.g. by scanning the QR code.

(This image below is also enlarged)

Further development options

The CLASSM8 admin interface is a simple WordPress theme. Thus, by using a child theme , additional customization options are available (e.g. display your own logo and company name). Further help is available for settings at https://developer.wordpress.org/themes/advanced-topics/child-themes/

CLASSM8 REPORT

Technical Documentation

Prerequisites

This and the next chapter requires intermediate system administrator knowledge and some familiarity with the mentioned tools.

The backend systems needs a continuously powered Linux server with the following minimum hardware specification:

- minimum 10Gb storage
- minimum 1Gb database storage
- minimum 4Gb memory

and environmental specicifaction:

- WordPress 4.9.8+
- PHP 7.2+
- MySQL server 5.6+, alternatively MariaDB 10.0+
- HTTPS support
- Node.js v12+

Other requirements:

- WordPress memory limit 64Mb+
- disabled PHP safe mode
- PHP max execution time 30sec+
- PHP memory limit 256M+
- enabled Curl extension
- Curl timeout 300sec+

Expected performance with the the following constraints:

- Concurrent users <100
- Max number of users in a single group: 20

page load time <10secs.

Expected weekly usage pattern:

- Weekdays: 9-19
- Weekends: 9-17

The application is built on the top of widely available, free, open-source technologies.

The application does not have any special requirements regarding the end-user's devices.

It runs on all up-to-date browsers on all popular mobile devices.

Passwords have been stored with one-way encryption mechanisms.

The system is accessible only through secure HTTPS communication. The plain-text HTTP is automatically redirected to HTTPS.

All login attempts, both successful and failed get logged.

Installation of the game and other utility scripts

First step is to verify the prequisites.

Thorugh the development the application has been tested with:

- Debian(11) and Ubuntu(16) Linux
- Node.js v10 and v12
- mysql 5.7 and 8.0

We recommend to use the latest security updates for all components.

The application uses npm for package management and most of the service functions have been implemented as npm scripts too.

After registering on's email it can be downloaded from the website classm8.org.

Installation of the dependencies:

$ npm install

You need to provide a mysql/mariadb database with a preconfigured user which has full access to a predefined database. Then you need to provide an ormconfig.json based on the ormconfig.json.dist template with the database's host, database name, user name and password.

Example settings of the ormconfig.json where the red background highlights the fields to be configured:

```
{
  "type": "mysql",
  "host": "localhost",
  "port": 3306,
  "username": "test",
  "password": "test",
  "database": "classm8",
  "entityPrefix": "classm8_",
  "synchronize": false,
 ...
```

Then this step initializes the database:
$ npm run reset_db

Behind the scenes the application uses an express node server.
You can start it in the development mode on localhost:3000
$ npm run dev
It can be stopped with CTRL-C
The nuxt.js framework shows the progress of the applications boot/compile process.
When it is ready the application will be available on any browser on the same computer after typing http://localhost:3000 to the browser's url bar.

The host and the port can be configured via environment variables:
$ HOST=0.0.0.0 PORT=3001 npm run dev

We provide a periodic_run.sh script which restarts the application every day automatically to avoid problems caused by any kind of memory or other leaks:
$ HOST=0.0.0.0 PORT=3001 ./periodic_run.sh

Apart from the above dev modes, the application supports an optimized execution as well where hot reload is disabled:
This steps builds the optimized application:
$ npm run build
And this one executes it:
$ npm start

For testing we implemented a service script to artifically insert a game session record into the database:
$ npm run start_session N

It returns with the new game session's slug:

export SLUG=539105

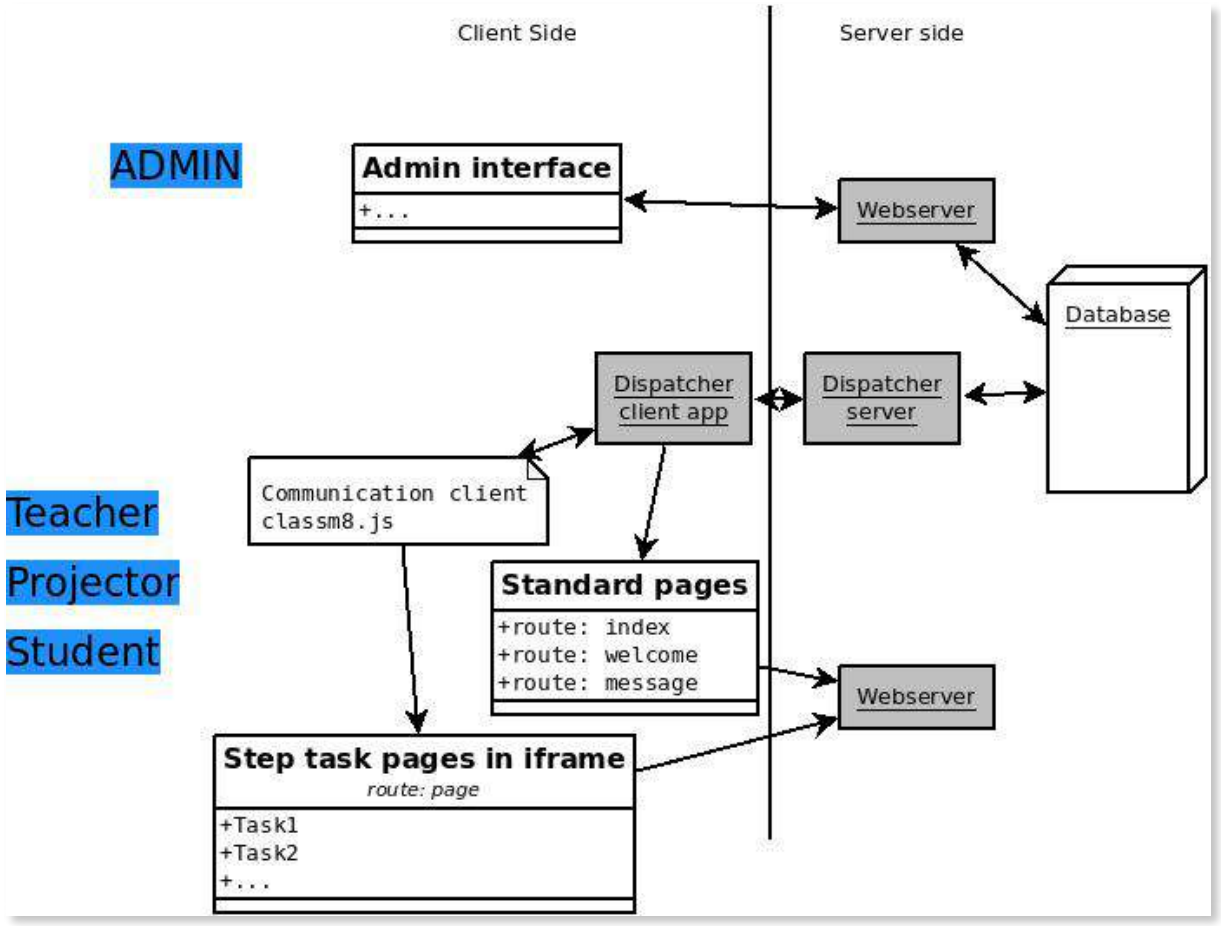
The database can be reset to its original state with its install step:

$ npm run reset_db

This command cleans all game sessions and events!

General architecture

The current and the following chapters assume more in-depth programming knowledge. They focus on internal structure and behaviour of the application.



Main user types of the system:

- Administrators: They can manage and set up the games
- Teachers: They can start games and manage a game session
- Projector: This is only a virtual user. Its only responsible to broadcast a shared view of the game's state
- Student: Participants of the game sessions

The administrators manage the system through the Wordpress interface or directly through the database.

The teachers start a game session from the Wordpress admin interface.

The game sessions have been managed by the dispatcher application.

The dispatcher and the Wordpress application share a common database and the Wordpress application uses some API endpoints of the dispatcher application to start the game sessions.

The dispatcher application has the following main components:

- Database: Its responsibility to store the game sessions' details and the game's configuration details
- A nuxt.js application with the following parts:
  - A Vue.js based isomorphic web application
  - A server side socket.io server and its client counterpart which connects the multiple parties and the database. (socketManager)
  - API end points
  - Some games have been implemented as nuxt.js subapplications too.

Communication model

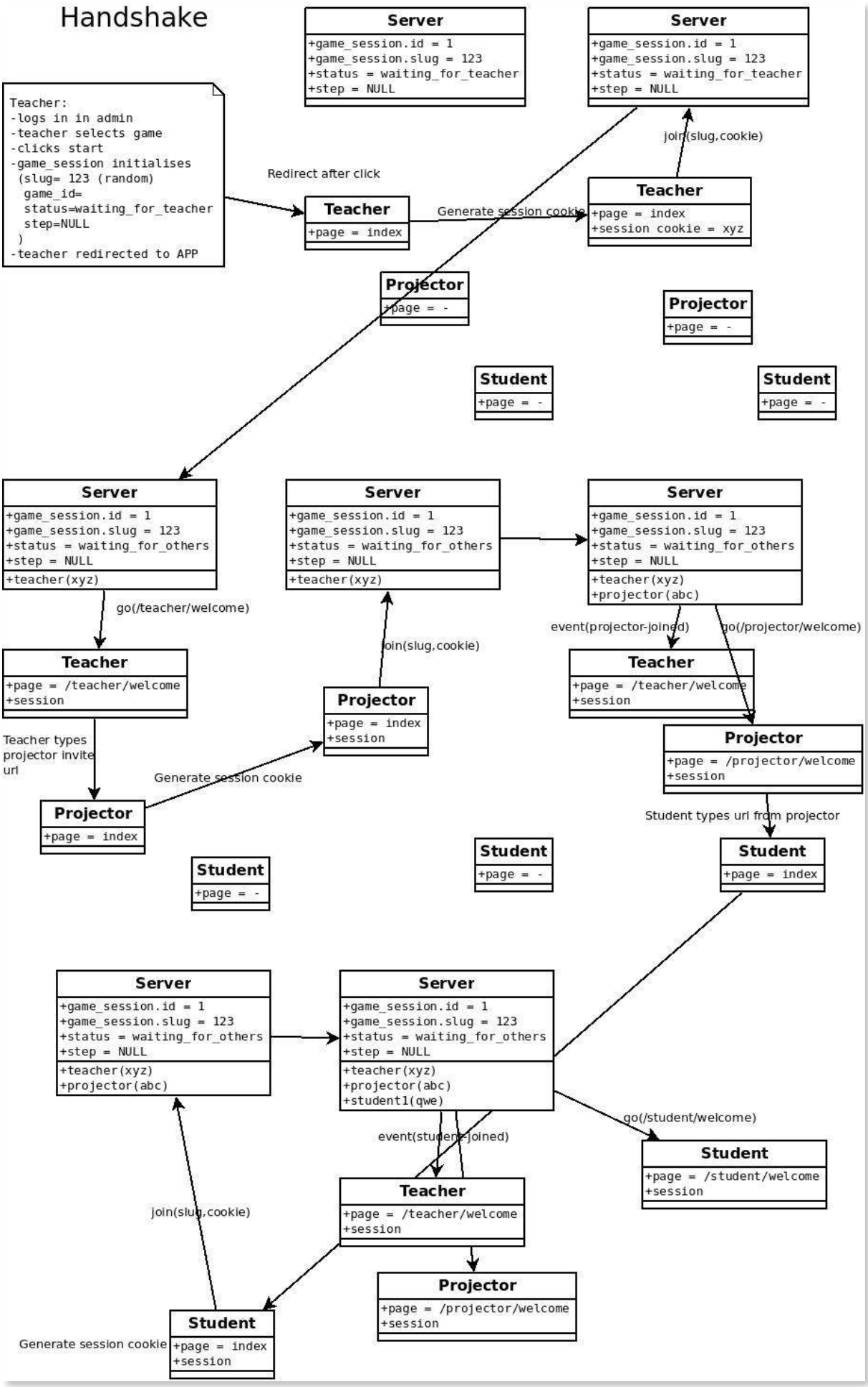
The application uses socket.io to establish a two-way quasy synchronous event based communcation channel between the connected clients and the server side.

Fundamentally the games all actions have been triggered by the different parties or in a few cases by their browsers (like timer events/etc).

When any parties submits an action, their browsers generate a socket.io event which gets captured on server side where the socketManager application updates the game session's state in the database after it verified if the incoming event is valid. Then it broadcasts the new game state to all connected parties.

The game flow has the following main steps:

- Handshake process: Where all the parties connect to a new game session
- When the teacher triggers a step change in the current game's flow
- Any parties send an information blob to the server. (answers to questions, temporary data.)
- Reconnection to re-establish an interrupted session.


Handshake
Server
+game_session.id = 1
+game_session.slug = 123
+status = waiting_for_teacher
+step = NULL
Server
+game_session.id = 1
+game_session.slug = 123
+status = waiting_for_teacher
+step = NULL
Teacher:
-logs in in admin
-teacher selects game
-clicks start
-game_session initialises
(slug= 123 (random)
game_id=
status=waiting_for_teacher
step=NULL
)
-teacher redirected to APP
Redirect after click
Teacher
+page = index
Generate session cookie
Teacher
+page = index
+session cookie = xyz
join(slug,cookie)
Projector
+page = -
Projector
+page = -
Student
+page = -
Student
+page = -
Server
+game_session.id = 1
+game_session.slug = 123
+status = waiting_for_others
+step = NULL
+teacher(xyz)
Server
+game_session.id = 1
+game_session.slug = 123
+status = waiting_for_others
+step = NULL
+teacher(xyz)
Server
+game_session.id = 1
+game_session.slug = 123
+status = waiting_for_others
+step = NULL
+teacher(xyz)
+projector(abc)
go(/teacher/welcome)
join(slug,cookie)
event(projector-joined)
go(/projector/welcome)
Teacher
+page = /teacher/welcome
+session
Teacher
+page = /teacher/welcome
+session
Projector
+page = index
+session
Projector
+page = /projector/welcome
+session
Teacher types projector invite url
Generate session cookie
Projector
+page = index
Student types url from projector
Student
+page = -
Student
+page = index
Student
+page = -
Server
+game_session.id = 1
+game_session.slug = 123
+status = waiting_for_others
+step = NULL
+teacher(xyz)
+projector(abc)
Server
+game_session.id = 1
+game_session.slug = 123
+status = waiting_for_others
+step = NULL
+teacher(xyz)
+projector(abc)
+student1(qwe)
go(/student/welcome)
event(student-joined)
Student
+page = /student/welcome
+session
Teacher
+page = /teacher/welcome
+session
join(slug,cookie)
Projector
+page = /projector/welcome
+session
Generate session cookie
Student
+page = index
+session

The handshake stage's events:

1. teacher joins

message:

- from: teacher
- to: server
- type: join
- arguments: slug, clientId

prerequisites:

- game_session.status=waiting_for_teacher where slug matches

reaction:

success:

- DB: insert into session_user
  game_role_id= teacher,
  game_session_id=(select id from game_session where slug matches),
  client_id=clientId from message
- DB: update game_session set status = waiting_for_others
- DB: log event
- Server instance: Connect socket id with session_user.id
- Message:
  from: server
  to: teacher
  type: go
  arguments:
  routeName=teacher-welcome
  Context

game_session does not exist:

- Message:
  from: server
  to: sender
  type: go
  arguments:
  routeName=message

routeArguments={message: "Game does not exist!"}

2. projector joins:

message:

- from: projector
- to: server
- type: join
- arguments: slug, clientId

prerequisites:

- game_session.status=waiting_for_others where slug matches

reaction:

success:

- DB: insert into session_user
  game_role_id= projector,
  game_session_id=(select id from game_session where slug matches),
  client_id=clientId from message
- Server instance: Connect socket id with session_user.id
- DB: log event
- Message:
  from: server
  to: teacher
  type: event
  arguments:
  eventType=projector-joined
  Context
- Message:
  from: server
  to: projector
  type: go
  arguments:
  routeName=projector-welcome
  Context

game_session does not exist:

- Same as teacher's equivalent

3. student joins:

message:

- from: student
- to: server
- type: join
- arguments: slug, clientId

prerequisites:

- game_session.status=waiting_for_others where slug matches

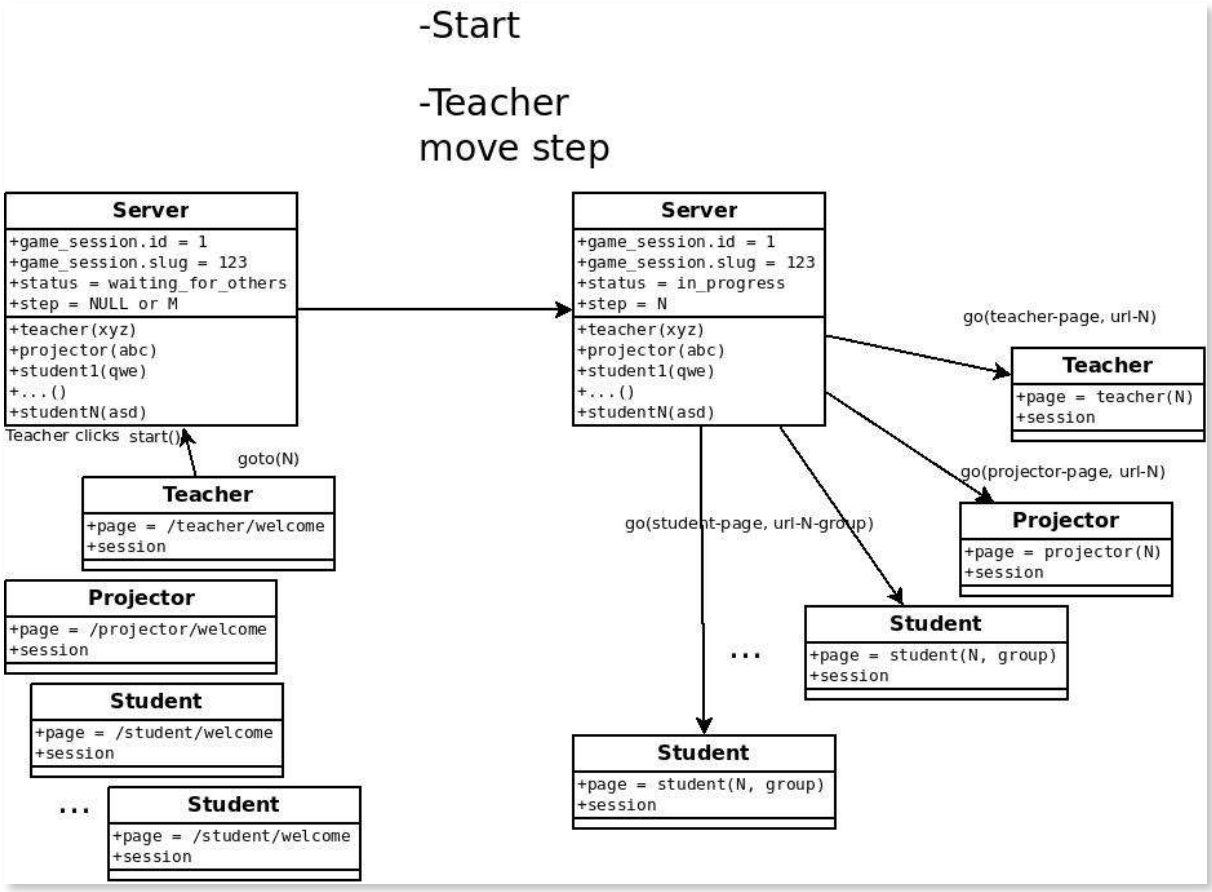
reaction:

success:

- DB: insert into session_user
  game_role_id= student,
  game_session_id=(select id from game_session where slug matches),
  client_id=clientId from message
- Server instance: Connect socket id with session_user.id
- DB: log event
- Message:
  from: server
  to: teacher, projector
  type: event
  arguments:
  eventType=student-joined
  Context
- Message:
  from: server
  to: sender
  type: go
  arguments:
  page=student-welcome
  Context

game_session does not exist:

- Same as teacher's equivalent



The start and next step teacher event:

- teacher starts/moves:

  message:

    - from: teacher

    - to: server

    - type: goto

    - arguments: N or default is the smallest position's id for the specific game

  prerequisites:

    - game_session.status=waiting_for_others/in_progress where slug matches

  reaction:

    success:

      - DB: update game_session

status=in_progress

current_step_id = N,

- DB: log event
- Message:

from: server

to: projector, student, teacher

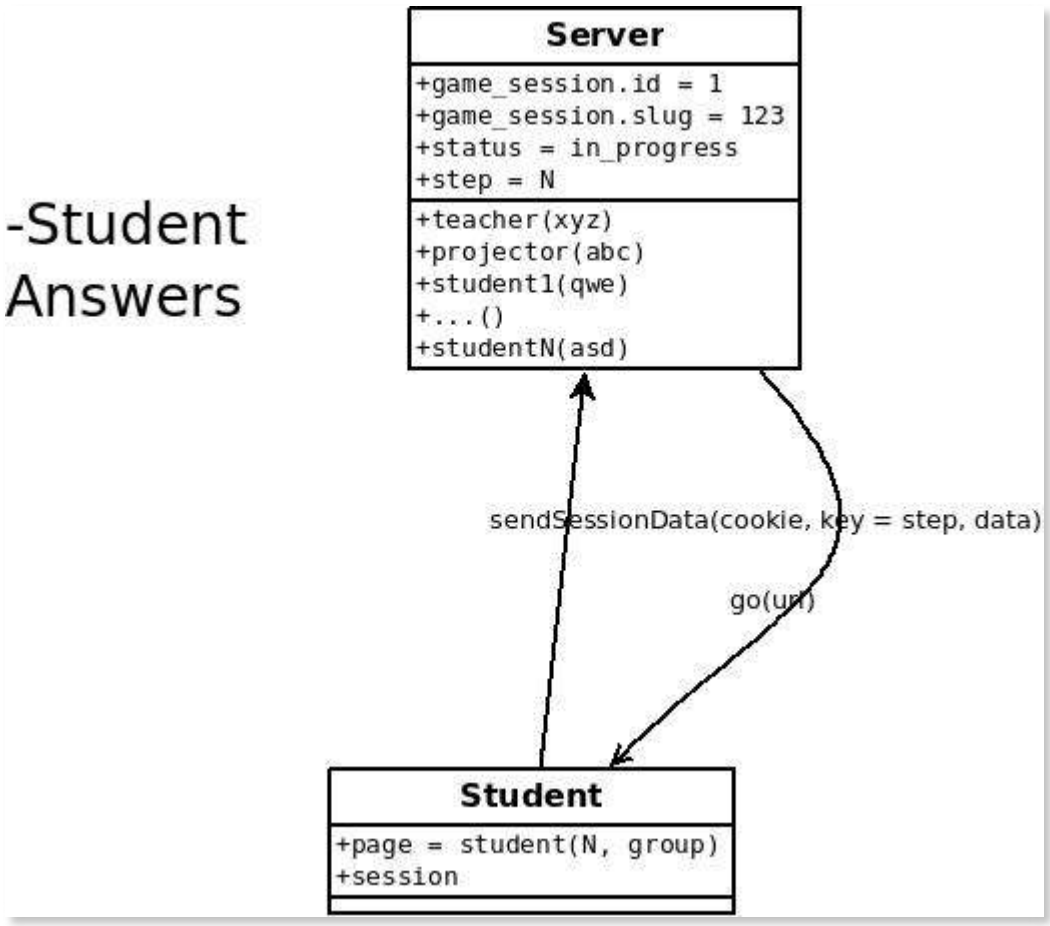
type: go

arguments:

routeName=(select url from game_step_task where game_step_id, game_role_id, group matches)

routeArguments={pageComponent={pageUrl: url}}

Context



The different answer event:

- student answers, sets username, somebody sets group or just general sessionData:

  message:

  - from: student
  - to: server
  - type: sendSessionData
  - arguments:

    key: $currentStepId, group, username, etc

    clientId: clientId

    data: json

  prerequisites:

  - game_session.status=in_progress where slug matches

  reaction:

success:

- DB: insert into/update game_session_data

game_session_user_id = (select id from session_user where client_id = clientId from message)

game_session_id = from message

key = from message

answer = from message

- DB: log event

- Message:

from: server

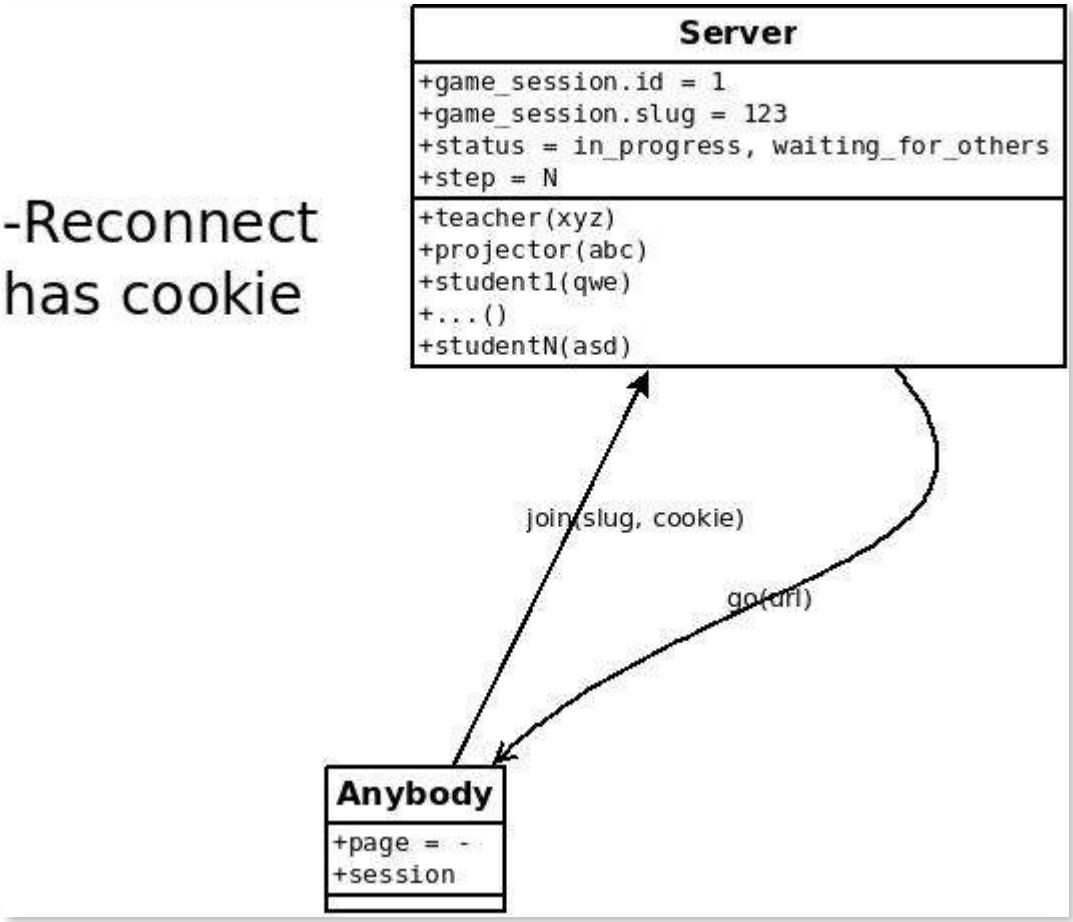
to: projector, student, teacher

type: event

arguments:

eventType=newSessionData

Context



The reconnect event:

- anybody reconnects:

  message:

  - from: anybody
  - to: server
  - type: join
  - arguments: slug, clientId

  prerequisites:

  - have already cookie generated
  - game_session.status=waiting_for_others/in_progress where slug matches
  - session_user where client_id, game_session_id matches

  reaction:

success:

- Server instance: Connect socket id with session_user.id
- DB: log event
- Message:
  from: server
  to: teacher, projector
  type: event
  arguments:
    eventType=join
    Context
- Message:
  from: server
  to: sender
  type: go
  arguments:
    routeName=(select url from game_step_task where game_step_id, game_role_id, group matches)
    routeArguments={pageComponent={pageUrl: url}}
    Context

game_session does not exist:

- Message:
  from: server
  to: sender
  type: go
  arguments:
    routeName=message
    routeArguments={message: "Game does not exist!"}

The Context which has been sent with most of the replies:

```
{
  game: {...},
  gameSession: {...},
```

```
  gameSessionData: {...},
  gameSteps: {...},
  stepId: N,
  users: {
    clientId1: {...},
    clientId2: {...},
    ...
  }
}
```

Database

The application uses a mysql database. The nuxt.js application uses the typeorm object relationship mapping library to provide the higher level objects persistence and mapping to the database. Its configuration lives in the entity folder.
The application itself is communcating via events between the different parties, but the incoming events manipulate only the database and the broadcasts/updates use only the data coming from the database. This way the application does not rely on its in-memory state.

The games, game sessions have the following building blocks:

- The game configuration data itself. Essentially a root entity which has the game's name and id
- The steps of the games which give the stages/pages of the games.
- The tasks of the steps which configure what should be displayed at a specific step for s specific role. (Roles can be teacher, projector or student)
- Sessions of games which contains the general information about a specific session. Which game it is related to, different session ids, the game's state (defined in the handshake process in the communication model.) the game's slug (the short identifier which is used in the url to identify the game and which is also needed at connection time.)
- Users of a specific session and their roles.
- Different data blobs sent by users for specific steps of a game session
- Event log

These have been implemented with the following SQL table structure:

```
create table game(
  id        integer auto_increment primary key,
  title     varchar(256) not null,
  status    integer default 1 not null comment "0 deleted, 1 active",
  created   datetime default now() not null,
```

```
    modified    datetime
);

create table game_step(
    id          integer auto_increment primary key,
    game_id     integer references game(id) not null,
    status      integer default 1 not null comment "0 deleted, 1 active",
    position    integer not null comment "Position of the step in the game",
    description varchar(256),
    created     datetime default now() not null,
    modified    datetime
);

create table game_step_task(
    id          integer auto_increment primary key,
    game_step_id integer references game_step(id) not null,
    game_role_id integer not null comment "1 teacher, 2 projector, 3 students",
    `group`     varchar(64) comment "Student group (specific to this game) optional",
    url         varchar(256) not null comment "Url of the task",
    status      integer default 1 not null comment "0 deleted, 1 active",
    created     datetime default now() not null,
    modified    datetime
);
create table game_session(
    id          integer auto_increment primary key,
    game_id     integer references game(id) not null,
    slug        varchar(6) not null,
    game_step_id integer references game_step(id),
      status          integer not null comment "1 waiting_for_teacher, 2 waiting_for_projector, 3
waiting_for_students, 4 in_progress, 10 finished",
```

```
    created     datetime default now() not null,
    modified    datetime
);

create table game_session_user(
    id          integer auto_increment primary key,
    game_session_id integer references game_session(id) not null,
    game_role_id integer not null comment "1 teacher, 2 projector, 3 students",
    client_id   varchar(64) not null comment "Client cookie to stick sessions",
    socket_id   varchar(64) not null comment "Temporary socket id",
    created     datetime default now() not null,
    modified    datetime
);

create table game_session_data(
    id          integer auto_increment primary key,
    game_session_id integer references game_session(id) not null,
    `key`       varchar(64) not null comment "group, username, any step id or any other kind of
key",
    game_session_user_id integer references game_session_user(id) not null,
    data        json comment "value assigned to the (user, key)",
    created     datetime default now() not null,
    modified    datetime
);
create table event(
    id          integer auto_increment primary key,
    event_type  varchar(64) not null,
    event_args  json,
    created     datetime default now() not null,
    game_session_id integer references game_session(id),
```

```
    game_step_id   integer references game_step(id),
    game_session_user_id integer references game_session_user(id)
)
```

Url structure

- /index/

  Input from user:

  - game_session.slug

  Behavior:

  - It asks the slug of the game the user wants to join. (If it is already in the url check /slug/* step)

  - Generates identifier cookie and connects to server.

  - It lets the user connect.

  - The first user joining after the teacher will be the projector.

- /slug/*

  Input from url:

  - game_session.slug

  Behavior:

  - Generates identifier cookie and connects to server. (If it has not existed already.)

  - It connects the user automatically.

  - The first user joining after the teacher will be the projector.

- /slug/teacher/welcome:

  Input from server:

  - Context

  Behavior:

  - It displays a welcome screen for the teacher with the game's title.

  - It displays the welcome url what can be used to join the projector and the students

  - It shows the other joined roles. (students, projector)

  - Teacher can start the game.

- /slug/projector/welcome:

  Input from server:

  - Context

  Behavior:

  - It displays a welcome screen for the class with the game's title.

- It displays the welcome url what can be used to join the students.
- It shows the number of connected students.

- /slug/student/welcome:

  Input from server:

  - Context

  Behavior:

  - It displays a welcome screen for students with the game's title.
  - It displays the welcome url what can be used to join the other students.
  - It shows the number of connected students.

- /slug/teacher/page header:

  Behavior:

  - It displays the current situation:
    - game.title
    - game_session.slug
    - game_session.current_step
    - current game_step.position/max(game_step.position)
  - Teacher can move forward/backward the game.

API

The dispatcher application offers the following REST api end points:

- /api/status: It returns „Status OK.” with HTTP status code 200 when the system is working.
- /api/game_list: It returns the list of available games in an array with HTTP status code 200
- /api/game_start: It expects an ’id’ GET query parameter which corresponds to an entry from the database’s game table.

  If the parameter has not been provided it returns HTTP status code 400 with an error message.

  If the referenced game is not available in the database, it returns HTTP status code 404 with an error message.

  Otherwise it creates a game session with WaitingForTeacher state and returns its slug to the client. (This is the first step of the handshake process.)

Automated testing

The application uses the ava testing framework.

The automated tests focus mainly around the handshake process since its relatively high complexity.

The automated tests can be started with this command:

$ npm test

A summary shows if all tests have been executed successfully.