Game-Based Learning for Teachers

A Journey Through a World of New Ideas!

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Game On

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Game On

Chapter 1: Why do we play?

Have you ever thought about why so many people of all ages enjoy playing games so much? What do we get out of such a seemingly pointless activity? The obvious answer is that we actually get a lot out of it. Play is both relaxing and energising. Play fulfils our need for challenge, competition and diversion from our everyday lives. It can also let us engage in flights of fancy, bond socially while having fun, and distract us from the hardships of life. When we are actively engaged in a game, our minds are experiencing the pleasure of stepping outside our ordinary lives.

Game-based learning uses the need and desire to play to make learning more attractive. Teachers dealing with poor learning results in their classrooms, or with students who retain little of the material or have minimal engagement can find that adding game-based learning to their classes makes all the difference in the world.

Why play digital games for learning?

Game-based learning can help you bridge the gap between recreation and education, taking advantage of people's natural interest in games. Digital games allow us to create virtual environments for the purpose of learning, letting the players immerse themselves in settings that are relevant to the topic being learned.

Within this digital world, players work towards a goal, choosing actions and experiencing consequences along the way. They become active learners, experiencing environments and making mistakes in a risk-free setting that could not be reproduced in the classroom. For example, earthbound learners can experience aspects of space travel in the safety of their own classrooms, or observe sped up simulations of creature evolution, something humans have a hard time living long enough to see.

Game-based learning means you use a game to support the subject you are teaching in class.

There are different ways to do this. You can set aside a part of class time for games to be played in class while you supervise. You can also have the students use the game at home to deepen their understanding and review the subject at their own pace and have fun doing so. Or a little of both. As the teacher you decide which style works best for you and your students.

SCIENCE: What can digital gaming do for the students?

Serious games and game-based learning have been around for a while, and there is plenty of scientific evidence of how useful it is for learning. Examining 39 studies on serious gaming in an educational context, researchers discovered that serious games are more effective in terms of learning and retention than conventional instruction methods. In addition, the researchers revealed that students learned even more when the game was accompanied by other instructional methods, had multiple training sessions, and players worked in groups.

However they also found that a small number of students were not more motivated by games than by the usual teaching methods. This was because the players were not free to choose the games, nor to choose whether or not to play them, which can undermine their motivation and undo the advantages normally seen in learning games.

In serious games, the level of control is twofold: on one hand the player takes actions and decisions within the game. On the other hand, there is an instructional context of the educational framework, that can tell the student which game to play, which goals to achieve and when to play the game. This book will give you important hints on how to identify good games and how to implement them successfully in your class.

The IMPORTANCE of PLAY

Humans have been playing since prehistory. We have evolved as creatures who play, and this continues into modern times. Children will play all day long if they are given the time and this play is an important part of their development. The games they play change while they are growing up, but the need remains. The games go from the simplest, like clapping or throwing things, to creating with building block, then playing pretend with mates, continuing to become more complex.

Playing is essential for children. Play allows them to stretch and grow both their mental and physical abilities, especially in free play. To really play they need space they can use and modify based on their own choice and fantasy and not structured by adults. Without risks and expectations from the outside they can experiment with different roles and situations. One time they are mighty and another time they are powerless. Once they are good and once they are bad. There is no better boost for children than giving them time and space for real play.

Why do ANIMALS play?

In the animal world it appears to be similar. Play in childhood is an important factor for later survival. One hypothesis in the evolutionary perspective is that play is needed as brain-growth stimulation, especially during a sensitive period of growth. This is based on study results that show that playfulness and brain growth peak and fall off at the same time. Furthermore the cerebellum seems to need the whole-body movements of play to achieve its ultimate configuration.

Play can also be seen as training for the unexpected, as it leads to mental agility and a broader behavioural vocabulary, which in turn helps the animal achieve success in the ways that matter: group dominance, mate selection, avoiding capture and finding food.7 This is also the case for human beings. Children that have been given enough time for play in their childhood are more stable and often more successful than others.

What can PLAY do for your students?

We would like to encourage you to integrate play and games in your daily school life because it can bring a lot of benefits. Play is not only a specific activity but in fact an inner attitude. This inner attitude goes well with today's challenges in terms of flexibility, creativity and the ability to find individual solutions.

To foster these benefits, play should be integrated in a student's daily life. This can mean that students have a certain amount of creative leeway or that game elements like badges and levels are used to help motivate students in class. A higher degree of self-determination can guide students to experience learning as fun and play.

A playful inner attitude leads to divergent thinking, which is essential for creativity. It means that a person is able to have lots of ways to interpret a question, to see lots of possible answers to a question and to think laterally and not linearly.

A study about divergent thinking in children and adults discovered that divergent thinking decreases with the age. The task for the participants was to find as many uses as possible for a paper clip. Most adults created 10-15 ideas. The best in divergent thinking found 200 or more. These thinkers are able to imagine that the paper clip is 10m high and made of foamed plastic. The study discovered that 98% of children of kindergarten age were most creative compared to when they had gotten older and finally minimised once they became adults. Creativity decreases with the age of the participants. There is a need for more creativity, both in school as well as in the world of work, and this can be enhanced by a playful inner attitude and the use of games and gaming elements in school.

What makes a good game in school?

So how can this playful inner attitude can be fostered in school? Consider these six principles for play.

- Play is always voluntary: Constraint and control can kill fun and creativity. In school this can be difficult to avoid, for example, if the game is the only source for learning some information or a particular subject. One option would be to let the students decide whether they want to use the game or not, making sure there are other avenues for learning the topic. The important thing is that the students learn the subject, not necessarily how to get there.
- Play is doing: Try not to spend too much time talking about the game or do too much 'hand holding'. Once the students have understood the basics of how the game works, just let them go and try it.
- Play with others: Playing with others actually increases creativity and can bring a variety of solutions, because everybody brings in a different view and experience. While some games are better to play as single-player to

study a certain content in one's own pace and should be encouraged, try to balance those games out with games where the students interact with each other.

- Playing starts in your mind: It's important to have a sense of freedom in your mind. Place as few limits on the students as you can. Encourage your students to open themselves up new ideas and solutions, and to interact with the game in an open way.
- You need freedom to play: There needs to be a certain amount of time to get into a game, and of course enough time to play the game. If you only schedule a bare minimum for the game without letting the students get into a playful mindset the results may not be as great.
- Playing needs rules: For the purpose of serious learning playing needs a set of rules to form a framework. Keep in mind some games are more rules heavy than others and not every aspect of the play needs to be constrained, just be certain that the game follows your learning goals.

You can start by using gaming elements like quizzes and badges in class (please see the chapter on gamification). Or try asking students to teach others a topic they have shown understanding of with any method they would like. This could range from using a game about mathematics and discussing the results to learning in small groups with the teaching student as a leader.

How learning content is delivered in a game is what separates good games from bad games.

In a bad one, playing and learning are disconnected activities and therefore learning doesn't really benefit from being fun. Think of games where the player has to get a certain score on a basic maths quiz (typical work) then gets to do some video gaming as a reward, which is the only place where it is truly a game.

In a good one, the student learns without noticing it. The game mechanics themselves are part of the learning process and getting better at the subject being learned makes you better at the game. Going back to the maths example, in a good learning game the player has to quickly solve equations in order to power up a rocket ship to escape planetary doom. Getting better at maths actually matters within the game itself instead of simply being something you have to do in order to 'get to the good part'.

With these considerations in mind you should be able to start thinking about what kinds of games could enhance your classroom, while making things more fun.

Chapter 2: We have always played

Crossnumber

Like a crossword puzzle, only using numeric digits instead of words. The clues for the grid are maths equations instead of word hints. They can be designed for a variety of mathematics levels. Traditionally they are printed up and given as hand outs, however nowadays they are available online or as mobile apps

Tangram

A geometry puzzle originally from China where a square is cut into seven pieces geometric shapes which then are reassembled into various shapes using only the seven pieces. No piece may overlap. The tangram is but one type of a dissection puzzle. These kinds of puzzles can make geometry fun as well as give students the ability to see geometry in action.

Mancala

The term refers to a type of game believed to have originated in 6th or 7th century Africa where counters (beans, seeds, beads) are used in a so-called 'count and capture' style board game. The game exercises problem solving skills, basic calculation, patience, analytical thinking, and motor skills. Creating their own mancala board and choosing 'seeds' can be a fun and creative activity for the class and make them more invested in the game.

Tower of Hanoi

A devilish mathematical puzzle invented by French mathematician Édouard Lucas in 1883

The object is to move all the disks from the first rod to the third rod in a stack of descending order. You can only move one disk at a time and can never place a larger disk on top of a smaller disk. Changing the total number of disks increases the complexity of the task. It can teach the concepts of iterative solutions, recursive solutions, and pattern recognition. You can even build your own puzzle with some cardboard cut into various sized disks and three dowels (pencils can stand in for the dowels) which could be a fun and geometry oriented activity for the class!

Learning games are nothing new

You've no doubt picked up this book because the idea of game-based learning intrigues you and you want to add it to your classroom. But think back to your own school days. Like your own students you likely looked forward to the vacation times that started after the last day of school. Maybe your teachers tried to make the last day fun by allowing play, knowing that their students were likely distracted by thoughts of holiday. In English class you might play 'hangman' to review vocabulary, or in maths the teacher might let you play a maths card game; each teacher in turn coming up with something that was both fun and at least a little educational.

And as a teacher, have you ever handed out a home made crossword with the week's vocabulary, or used dice in your maths class? You're already using game based learning! Sure, those are simple examples, but if you have used anything like them, then you're already familiar with the benefits a little bit of fun can add to the curriculum.

Years before there was ever computers or mobile devices that could be used in the classroom, creative teachers have been coming up with clever ways to use traditional games that already exist, and sometimes even designing their own card or board games themselves. Games like solitaire, dominoes, bingo, crosswords, word-search, hangman, as well as various board games have been repurposed for learning purposes. These traditionally haven't been used as digital games, especially by those of us who still aren't all that comfortable with mobile technology, but more and more these games are becoming available as apps or online. Since the games are probably already familiar to most of us, they might serve as a good first step in the direction of digital game-based learning. You can also have a mix of digital games as well as the traditional printed up handouts or physical game tokens like dominoes. Manipulating physical objects can be very satisfying and some learners do better with 'real' things instead of virtual. After all, all classes are unique and you, the teacher, are the only one who can figure out what works best for you and your students. Our hope is that this book can offer you some insights and some inspiration.

Anabela Moura Esteves Frias, maths teacher at the Secondary School of Lagoa in the Azores, talks about the experience at her school.

'Foreign language teachers very often use word search and maths teachers like to use cross numbers. In class, maths teachers in our school started using 'old' or 'ancient games' like Tangram, Hanoi towers or Mancala. The students liked playing, so teachers started using these games in classrooms, especially the ones that have construction elements. Tangram was one of those games. It was easy to create for each pupil and they could play it in class and at home. Playing this game is a learning experience in math. It was based on this kind of games that teachers started to implement games in the classroom at our school. '

Consider the traditional and widespread game of dominoes. Many people can remember playing dominoes or perhaps watching grandparents play it. Just using the game as designed lets you practice such concepts as addition and basic matching skills, but of course the tiles are very versatile and can be used in different ways. For example, have students draw dominoes from a pile, and then add, subtract, or multiply the numbers on each end of the tile.

Some teachers have also created dominoes with fractions, areas, perimeters, decimal numbers, among other themes. They adapted a traditional game into a game for education. Creating these from cardboard as part of the lesson plan could be a good way to get students engaged, especially those who are more tactile and art oriented.

Another potential learning game is the versatile and humble crossword puzzle. These are an easy and readily available resource for helping students improve their language skills. These puzzles come in a variety of skill levels and aren't that hard for teachers to design themselves based on the vocabulary they are currently teaching. Students can even get in on the fun by taking turns designing crossword hints for each other.

They can also be designed to teach other topics, such science, history, current events, among others. Just design the vocabulary and hints based on the science curriculum you are teaching. For example, if the topic is biology, the hint could be '1.Plants use it to convert light into energy' and the answer could be 'photosynthesis'.

Keep in mind that not all students like these kinds of games. Take word searches. While some teachers report that using these,are a great help to their students, for example non-native students learning the national language, others observe that some students find wordsearches to be frustrating, unenjoyable wastes of time. As the leader of your classroom, remember to take the pulse of your class and find out which games and activities work for which students, and for which situations. This is true whether you're using physical games and handouts or mobile games. As in all things, you're the guiding light!

A NEW WAY TO PLAY OLD GAMES

Of course nowadays most of our familiar board, card, and dice games are available electronically. Some are also available as downloadable apps for mobile devices. There are also online tools to help teachers create traditional handouts a little more conveniently as well. Using an online tool to create your crossword or crossnumber puzzles, for example, can save you some time and frustration.

Digital versions of these games can open up a whole new world of possibilities. They allow your students to play them using an interface that they already know and enjoy. The graphics can be much more entertaining. Playing on their phone or tablet can feel less like an assignment and more like simply having fun. And as mentioned before, while some young people prefer the tactile features of a real life game piece, a lot of students these days are more comfortable with computer and phone games. Flexibility is the key to getting the best learning outcomes possible for your students.

You can also use both methods, sometimes having your students use their devices to play the games, and sometimes having them use physical objects, to keep things fresh. You can even get them outside in the fresh air and sunshine sometimes.

Chapter 3: Gamify your class

Gamification in the classroom, a short guide

The evidence keeps mounting on how motivating it is for kids and teens to combine gaming with learning. Teachers around the globe are trying to find ways to use play to enhance their classrooms. Of course you can do this by using actual games in class. There are a lot of learning games out there some digital, and some traditional, as we discussed previously. But sometimes you can't find a game that covers the subject you're teaching or simply doesn't fit into your curriculum very well. Are you locked out of using fun to help your students?

Not so fast! Try gamifying your classroom.

Ok, fine, you say, but what's the difference between **'gamification'** and **'game-based learning'**?

Game-based learning is making a game that uses the topic or subject being taught as part of the game mechanics. A good example is the Tower of Hanoi from the previous chapter. The game itself actually exercises mathematical ability. A digital example would be Letter Quest™, where you form words from a set of tiles to fight ghosts; the longer the words the more damage you do to the ghost.

Gamification, on the other hand, generally refers to applying game mechanics on top of something you're doing that is not a game itself. Gamification tools use game elements and game design techniques in a non-game context, like a class environment. A very simple, common form of this is badging. For example, the community site Reddit uses badges called 'trophies' that users can earn for various sorts of contributions to the community, such as helping with translations or submitting helpful comments. The trophies give the user a certain amount of prestige, so people are motivated to engage in the community in a variety of ways. Even the stickers that teachers in lower grades often give out to their students are a form of this, so we can see that teachers have already instinctively been using this method to help motivate and encourage their students. But don't think of gamification as something you can only use in 1st and 2nd grade, though. Even teens can gain benefits from gamifying

So the content and methods you use to teach generally stay the same, but the process of learning is supported by these gamification tools. Some examples are theme and story, strategy and chance, quests, avatars, rewards, points, badges and levels. We'll be sharing with you some ways to add these concepts to your classroom, as well as introducing you to some teachers that have found success using gamification.

If you already use quizzes in your class to help with testing retention, consider using tools like **Kahoot!** or **Quizziz** to turn those mini-tests into a more social, game-show style experience. These tools allow teachers Have the students split up into teams and compete against each other in a fun, exciting way. If your students enjoy this, quizzes are no longer dreaded, but are looked forward to.

A digital example of this 'gamified but not a game' concept is the popular language app Duolingo. You're not really playing a game when you use it; the app uses repetition, drills, and retrieval practice (see the chapter on memorisation). However, when you complete a section on a particular group of words (such as numbers) you earn an in-game currency called 'lingots'. You use these little gems to buy outfits for your Duolingo owl, or to buy bonus lessons, like 'how to flirt'. You can earn more lingots by accepting a wager that you'll maintain a seven day streak of studying, which helps motivate you to practice every single day. You can also earn achievement badges and there are leaderboards for practicing the most. If you teach language, consider having your students use Duolingo to supplement classroom work. If you don't, you can borrow a few of these ideas for your own classroom.

What are the benefits of gamification?

- Enhances student's motivation and engagement.
- Promotes teamwork, depending on the method used
- Makes 'dry' subjects seem more interesting
- Provides a sense of achievement
- Improves engagement and discipline in class

Check out the boxes in this chapter for some suggestions on tools that can help you digitally gamify your classroom.

ClassDojo

Costs: Free
Plattform: iOS, Android, Web, Kindle Fire
Subject: Varies

36 languages choices

ClassDojo is a classroom management tool to help teachers improve behaviour in their classrooms quickly and easily. It improves specific student behaviours and helps engagement by issuing awards and recording real-time feedback. The main idea is to create a communication app for the classroom that connects teachers, parents, and students who use it to share photos, videos, and messages through the school day. They use ClassDojo to work together as a team, share in the classroom experience, and bring big ideas to life in their classrooms and homes. For positive behaviour it is easy for the teacher to initiate quick feedback to the student, awarding feedback points with a simple click on her mobile device or computer. This instantly reinforces good behaviour and engages other students. Great education gamification techniques is at play here.

Teacher talk

Anabela Moura Esteves Frias from the Secondary School of Lagoa in the Azores on using digital tools to gamify her classroom.

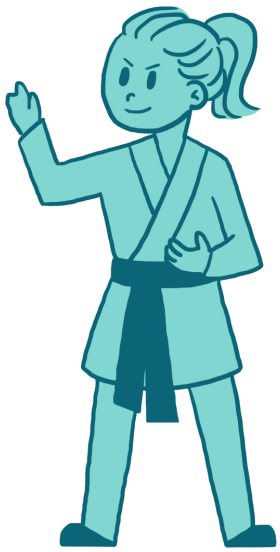
'I started working with ***ClassDojo*** *in a class of students with educational needs. The impact of the gamification app was obvious in their behaviour. At certain times, the simple projection of ClassDojo on*

the wall produced changes in the attitudes of the students, allowing the continuation of the lesson. I thought it was fantastic. What if I used it in my other class (23 students between 13 and 15 years old)? It would be spectacular. I introduced the app and they were all enthusiastic and at that time did not even know how to put their pictures instead of the avatars. I created the class, the students received their access codes and I also granted access to their parents. We defined the points to evaluate.

The first problem that arose was that most parents do not have access to the application reports and as well as some students. I went case by case, solving the problems best way I could. ClassDojo was working, but every time I needed to register something in the classroom, I lost a lot of time with the computer, because it was necessary to switch to the application. I started registering at the end of class, but it was not effective. Everything changed when I switched to an android phone, I installed the application and at any moment I could access it and the students could see the result in their profile. In this way, I could register when the student's skip class, failed to bring their material or forgot their homework; but I was not just pointing out the negatives, I also give importance to positive participation, success in solving activities and good behaviours. I was amazed by the importance these students gave to the application and pride they had when they showed to their parents the points given by the teacher. I could not convince many teachers, but it was worth it.

Now I'm only using it with a class of students with special educational needs, but I point out that the updates have introduced substantial improvements. The class journal allows you to record with photos, for example, special moments of the class. This moment is of great importance for each student. The application allows an exchange of information between all the class council (all of the teachers associated with the class).'

As you can see, Miss Frias did have a few issues implementing ClassDojo at first, but she makes it clear that the effort was worth the reward. You can also see that the app has undergone updates and improvements, so if you use a tool and have some issues with it, make sure you give feedback to the developers. They usually are seeking input from actual educators to help make their tools even better.



Classcraft

Costs: Free
Plattform: iOS, Android, Web, Browser
Subject: Varies

en - nl - fr - de - hu - pt - ru - es - zh tw

Make the class year to a fantastic adventure via World of Classcraft, improving class cohesion and team spirit. Classcraft is an online gamification tool for schools with the basic functions for free but with paid options.

Classcraft connects typical actions in school to the game. These actions can be doing homework, taking extra work, cleaning up the classroom, arriving on time or late to class, disturbing class and many more. The game runs passively in the background and accompanies the class. At the end of every day students get together in a quick round and select the benefits or penalties for their school day. This can also be done by the teacher, but allowing the students to participate in this way seems more effective, because students reflect on their daily actions. Each students can gain or lose points depending on how and what they've done that day. Players can choose from three different 'classes': mage, warrior or healer. Throughout the year they can gain different tools/ weapons/specials abilities and animals for their avatar. As many students are already fans of online multiplayer games of this nature, it can be very fun and motivating for them.

Teacher talk

Amanda Killough, Social Studies teacher at Wetumpka Middle School (*http://wetumpka.eci.schoolinsites.com*)

Which subjects are you teaching? In what kind of school?

I teach middle school Social Studies. My school is in a rural area in Alabama, US and it houses grades 5-8. We have an enrolment of about 1,000 students.

Which kind of gamification e.g. which apps or other tools are you using in your classes at the moment?

Favourite gamification apps to use in my classroom are Kahoot! Quizziz and Quizlet. Additionally, I have used Breakout Edu (www.breakoutedu.com) in my classroom.

In which grades are you using your current gamification tools? How old are the kids you use it with? Do you have a limit in age for certain gamification tools?

I currently use gamification with 7th grade students they are ages 11-13. I do not believe there is an age limit in using gamification with students.

You have used ClassDojo in the past, why did you change to other tools?

I no longer use ClassDojo for a couple of reasons. Firstly, I believe it was no longer age appropriate for my students. They began to view ClassDojo as more elementary and thought there were "too

grown"' up for that. Secondly, my administration discouraged the use of ClassDojo for negative points because it violated student privacy.

How do you integrate the gamification in your class? If possible, please make an example of a typical lesson with your gamification tools. That is always a very interesting part for other teachers, because it is a very concrete approach.

I integrate gamification in a variety of ways. Kahoot and Quizziz are great test review tools to use whole group or individually. Kahoot can be played in teams or on individual devices. When I use Quizziz, I use it as individual review. I post the link on Google Classroom and students take the quiz to review. I can go back and look at their scores and remediate before the test if possible. Additionally, I sometimes administer assessments on Quizziz because it scores it for me and give the student immediate feedback. I typically do Breakout.edu once or twice a year to introduce a big unit as a hook.

How did your students change during the use of gamification? Did they become more motivated and got a better behaviour in class or what happened?

Gamification has been great for my classroom. I have seen classroom test scores raise when we use games to review. Also, Breakout encourages teamwork and teaches critical thinking skills. Students know we can't play games every day, but knowing that that is a regular part of my curriculum motivates kids to do well.

Do you have any hints / Dos and Don'ts for other teachers how to use gamification in general / a special tool?

Integrating gamification can be intimidating at first. Kahoot or Quizziz are great ways to get started. Always check the technology to make sure it is accessible in your classroom. Breakout Edu is so fun and can require lots of materials. Look on Amazon for deals of locks and boxes. Don't get frustrated! Gamification is a really great way to create a student centered classroom.

As you can now imagine, there are endless ways to use gamification in class. But, there are important things to consider when using it in your class.

What should be considered when using gamification in school?

Gamification can be very useful for teaching and learning. However it's always important to think critically about how to make it work best.

Consider these points:

- **Extrinsic motivation:** how do I make sure that students are not just learning for the game and a reward, but are self-motivated and are therefore learning the subject in away that can be sustained?

  You can never be sure of that, but gamification is a good start to get them engaged in class. The more attention you can get from a student, even if all they are looking for are rewards at that moment, the better the

chance they are learning something.

Gamification is a chance to reward even small steps, like reading quietly, of a student in the learning process. From this small beginning, intrinsic motivation can come along in due course.

- **Scope:** how much gamification should I use in class and at what point is it too much and no longer effective?

  It depends on the gamification tool and on the specifics of your class. To give you an example: For a tool like ClassDojo it could make sense to start with a 5 min session in each lesson and end with noting points. At the end of each week you could make a 15 minute session to summarise the results. A suggestion could be not to go over 5% of your time in class with gamification.

  For Classcraft, which is more wholistic, it could be 10 min each day, depending on how many features of the tool you are using. If you use quests and integrate tasks into these or use boss battles as tests, of course it takes up more time.

- What earns the learner rewards or a penalties in the game? And how are they weighted in the whole game context?

  You can take our recommendations as a start and then keep evolving your classroom with input from your students. By examining your experiences with the tool and the class you will learn more about what works, what doesn't, and how you can change things to make a better fit.

- How do I create clear and transparent structures and rules?

  The best way to define the rules and structures is with the help of your students. Let them be a part of designing the kind of gamified classroom that helps everyone achieve their goals. Also, be open to changing the rules and structures as time goes on, and as things change in the classroom. Keep open communication with your students, and check to make sure everyone understands why you're doing this and what's expected of them. Communication is the key to success.

As you can see, there are definitely no universal answers to these questions, but you can use your creativity and the inspired examples of others to make changes to your class. You know your class and student better than anyone, and working hand in hand, you can help them achieve the best educational outcomes while having some fun at the same time.

Here's a short list of our suggested 'Dos and Don'ts'

Do	Don‘t
Start with one tool and give yourself and the students time to get used to it	Don‘t confuse your students
Choose a tool that fits to your class	Don‘t use one tool for all classes, if it doesn‘t fit
Use the tool to motivate your students	Don‘t use it to focus only on negatives
Work bottom-up, give students a continuous chance to participate in the game rules and definitions	Don‘t only pose rules, penalties and rewards on them
Make rules clear and consistent	Don‘t change the rules without explaining the change to your sutdents
Use gamification to support classroom management	Don‘t use gamification to avoid communicating with your students about discipline or other important topics

Teacher talk

Philipp Staubitz is a special education teacher at a special school in the Black Forest in South Germany. He is also an educator and teacher trainer for digital media in school and has implemented Classcraft successfully in his classes. He blogs about his experiences and gives hints for other teachers (*https://ideenwolke.wordpress.com*).

Our interview on Philipp's personal view of gamification in the classroom:

How long and for what reason have you been using gamification in your classes?

I've been using gamification for a year and a half to make my lessons more interesting and motivating to students.

How has your own experience been up to now?

My experiences are almost exclusively positive, even though I had to make changes in certain situations to be sure the focus is not on the system but on the actual topic and school learning.

What kind of changes were these?

Make your lessons interesting: acting close to real life. Keep in mind not to use the system in all contexts: not every action in the class will be provided with a reward directly. The students should learn because of their own motivation not just for points. Finally and very importantly, talk to the students about it and specify the gamification tool in collaboration with them.

Do you think that gamification led to a sustainable improvement in your class?

Above all, I found the joint development and further development of the approach with my students to be very profitable and sustainable. The class also wanted to continue to work with Classcraft after a year and demanded this on their own.

What suggestions do you have for teachers who has never used gamification before? Where should they start?

Think about whether gamification is the right thing for you and if such a system would be a good fit for your students and your own pedagogic setting! Should that be the case, start with the functions and the possibilities of Classcraft. There are blog articles, tutorials, forums and social media (for example, Twitter!). In the beginning, it is important that one begins gradually. Don't expect that you'll know everything immediately and that you can start with a finished, workable system! The most central factor in the development of the system should be the ideas, interests and concerns of the students, because it's all about them!

Below is Philipp's personal account of how he implemented Classcraft, along with some useful tips for teachers wanting to consider this tool for their own classrooms:

I started the Classcraft project as further development of the gamification approaches in our school. The fact that we had gotten iPads for one class allowed us to easily use Classcraft. Students

can also choose to use it on their mobiles. The avatars available are as unique as the students.

It is very important for our school to provide the students with reliable frameworks for teaching and living together. Until now, we use so-called 'amplifier systems', which are available in many different forms (for example traffic lights, token systems, motivational boards and many more). They visually report to the students whether they have achieved their individual educational goals and serve as an aid to assessing their own performance and behaviour.

At this time, there was a smiley amplifier system in the class, which had been well appreciated for two years. In class 8-9 it was became less popular and the students increasingly lost interest in collecting smileys. So for the new school year, something new had to come!

After a long time of research and testing I chose Classcraft as a suitable gamification tool. Let's start with some of my experiences about Classcraft:

Adapting Classcraft to your own setting or your own class is of the utmost importance for success. Students should be actively involved from the beginning and all during the process. It is almost impossible to find the perfect settings right from the start! These can only be correctly found after playing for a while.

Basic game settings

One of the most important game settings is the XP (experience points) needed to get to the next level. You should find a good balance that students do not rise too fast or too slowly. As a rough goal, you can target level 18-20 over the course of a school year.

Based on your own number of lessons in the class and the associated maximum XP number per day (consider holidays), you can calculate how many XP should be used for the next level.

Concrete example

- Maximum XP that a student can achieve per day: 500 (depends on how many XP there are for good behaviour / work performance ...)
- School weeks: approx. 40> 40 * 5 = 200 school days
- possible XP to be achieved in the school year: 200 * 500 = 100.000
- divided by recommended maximum level: 100.000: 20 = 5000
- Incorporate a little goodwill, so that you also get to the next level without reaching maximum XP every day > 4000 XP until the next level
- Level up if you do a good job: about 400 XP per day> about 10 days to get to the next level.

Set weighing correctly.

The evaluation criteria should be worked out together with the pupils. As a basis for this, e.g. individual educational goals or existing class rules are used. The items should be observable on the basis of specific indicators in order to enable an evaluation.

The weighting of the items is a matter of experience and can be changed at any time. It should be noted here that high reward items (such as creating a presentation) are weighted very differently in comparison to lower reward items (such as doing classroom work), so you can't just coast and get the same rewards as those who work hard.

Here is an example of how it can look:

Introduction of classcraft to the class

In my first run I wanted to introduce Classcraft on the principle of 'learning by doing': At first the students were very confused by all the new concepts, for example, the abbreviations (XP, HP, AP, GP), how the abilities can be used, how to use the app and why you cannot run through a world in this game.

An extensive and comprehensible introduction of the game is very important:

- Define rules together, clarify the weighting of the items
- Introduce character classes / avatars in detail: e.g., presentation, exchange of experiences with other classes (cooperative form of

Example for Health Points		Example for Experience Points	
-10 HP	material incomplete	+250 XP	personal goal reached
-15 HP	disrupted lesson	+150 XP	worked quietly and concentrated
-15 HP	forgot homework or incompetent homework	+150 XP	made my work in class
-30 HP	too late for class	200 XP	raised my hand in class and worked actively
-100 HP	missing unexcused	+50 XP	found mistake in tasks
-30 HP	insults and disrespectful behaviour	+350 XP	class service for one week
-100 HP	physical conflict	+500 XP	class exam (good or very good)
		+250 XP	class exam (grade 2-3)

learning)

- Game phase: Possibility to try out the game yourself, to answer emerging questions together
- Handout / Instructions: Overview of rules, avatars, game settings, etc.

Further useful tools and functions in classcraft

- The Riders of Vay: Random Events

  At the beginning of the school day you play a random event together with the class. These are already available in large numbers in the app, but you can also completely customise and extend them. These are little stories that always have a different impact on the players.

- The Makus Valley: noise

  This is an integrated noise monitor. You can use it during group or individual work phases. In addition to the volume level, a timer can also be set. If the class has worked quietly, it directly receives a reward in the form of XP and GP. If it has been too loud, you can optionally also set a penalty (-HP).

- Boss Fights: These are digital learning objectives controls. The students compete individually or in teams against a final boss. If a question is answered correctly, the boss suffers damage. If you have answered enough answers correctly, the boss is defeated and the class receives a reward.

-

- Tasks and Quests:

  Classcraft also gives you the option of posting lesson materials such as worksheets, educational videos, or web-based learning modules. These materials can be placed in so-called quests as on a map, which must then be passed through by the students in order. The difficulty of the tasks can be increased over time. At the conclusion of the unit a boss fight could be inserted.

Placing classcraft in a methodic frame of our school and class

For me, it was important that the students could evolve from consumers to active learners. In my opinion, learning takes place above all when you are motivated and have an active interest in something and do not just learn things by rote.

1.

When introducing a new topic, I first wanted to motivate the students and to help them understand the meaning of the topic. The lesson content for the self-development of the theme was previously inserted in chronological order as quests in the Classcraft app.

2.

Subsequently, the students worked in a modified version of the flipped classroom. Each one watched and studied one learning videos in class. This phase was also the first step of the cooperative learning method (THINK), the students worked out a first

task sheet, first in individual work and with the help of the learning video. When questions arose the learning video could be viewed again at any time and I acted as a learning companion and could answer specific questions.

3.

If the students had completed the first phase on their own and I had the tasks checked again, they sought a partner within the class, who had also reached the same level. The students then worked together on the next work assignment, which took up and deepened the previous learning. This phase was the second step of the cooperative learning (PAIR)

4.

When the entire class had solved the tasks of the last phase, they had a class discussion. In the beginning,I determined the writer and the moderator, then during the school year the students could decide this independently. The class solved the next task together, questions from individual students were taken up in the group and clarified. This phase was the third step of the collaborative learning (SHARE).

5.

When the class came to a conclusion, the students could start working on their individual weekly schedules. There was always the opportunity to access the learning videos and the content provided in the Classcraft app. After a few weeks, the students were able to autonomously divide up the tasks of their weekly schedule (for example, do homework) and work on tasks based on their own prioritisation.

At the end of the thematic unit, we conducted learning target controls in the form of boss battles where the students were able to apply acquired knowledge and gain additional points. These also served as preparation for the subsequent class work.

QUIZLET

Costs: Free
Plattform: iOS, Android
Subject: Language
Required: Internet

zh cn-zh tw-nl-en-fr-de-id-it-ja-ko-pl-pt-ru-es-tr-vi

Quizlet is a memorization tool that offers different study modes. You can use (a) flash cards, (b) the Gravity Game in which definitions in form of asteroids come down the screen and the user has to write the correct term before it crashes, (c) the classical learn mode with definitions and terms, (d) the long-term learning mode with a recommended study set based on the previous answers of the users, and (e) the speller mode where the learner hears a term and has to spell it correctly,. In addition to that, it offers (f) the matching mode, where learners have to find matching terms and definitions within a grid, and (g) the live mode, where a teacher can divide his class into groups and can use the tool as a team game in class. Moreover, it is also possible to create (h) interactive graphs. There are existing quizlets that are available for anyone to use simply by clicking on them.

Quizlet is an open source tool that can be used mobile and is web-based. For the teacher or quiz creator (this can also be learners in class), it offers an application programming interface which is easy to use. The person who wants to create a quiz can easily enter the data here and offers the possibility to upload and download flashcards. It is easy to use and offers a variety of possibilities to memorize facts. This can be vocabulary, subject related terms and definitions, description or process steps with the related information.

KAHOOT!

Costs: Free
Plattform: iOS, Android, Web
Subject: Any

en

A series of short games, or kahoots, are created by the user or the inbuilt options are used. The game is projected so that the whole class can see the results in real-time and each student answers the questions of the game (multiple-choice questions) on their own device. Seeing the answers displayed on a shared screen unites the class, creating ‘campfire moments’. Students can be ‘challenged’ with a fun quiz or learn more serious items in bite-size chunks in a fun way. The teacher can set challenges as homework or revision. Many topics can be covered via these games, from languages to geometry angles to learning about colours to how to code to figurative language to flags of the world to Christmas games… there are millions of games already available or you can create your own based on the topic being studied at school. Kahoot! is already a very popular mobile learning tool among teachers and students because of its fun element and group participation. Children in particular get very excited learning in this way because it is a series of quiz-like questions presented as a short game with friendly whole-class competition.

Chapter 4: Gaming to create interest

Using games to maintain interest in a topic

A big concern in education is motivating students to learn. Educational games seem not to require much additional incentive. Just getting to play a game, especially a computer game for our modern digital generation, is motivation enough. If you can experience flow, that is to say, be fully immersed in the activity, you'll naturally be deeply engaged and will experience enhanced learning, since you're not thinking about the learning, just about playing the game.

There is some research to support this idea. In 2003 a study published in School Psychology Quarterly concluded that high school students were increasingly engaged when there were given tasks that were challenging and well matched to their skills — not too easy, but not too hard. Some older research also shows that games can help students engage in abstract thinking about complex ideas and allow the learner to become immersed in worlds that not only represent scientific phenomena, but can also behave according to the laws of physics. We have known for a long time that the amount of learning and personal development that a student achieves is directly proportional to the quality and quantity of student involvement. It's clear that using games in the classroom improve student engagement and improve learning outcomes.

Despite a wealth of evidence that games support learning some continue to argue against the legitimacy of including this method in school. It's not uncommon to hear arguments along the lines of 'something frivolous like games have no place in serious education 'or 'hard work and study were good enough for previous generations, so it's good enough for the current one'. On the other hand designers of serious games may find resistance from the students who might distrust the 'highjacking' of an enjoyable play experience to serve an educational agenda.

We should ask ourselves a few questions.

Are all types of games going to improve engagement?

The effectiveness of a game for learning depends on the level of activity of the learners. Student engagement is higher with more problem-based activities. Another factor is competition, which can motivate students to participate in otherwise uninteresting or routine educational activities and has been seen to stimulate involvement and interest.

So the games that are best suited to engage students are competitive games based on problem based activities.

Do all students benefit from using games in education?

Of course every student is different, and there will always be outliers who respond differently. However, experience has shown that playing in general is developmentally appropriate for children and when children are actively engaged in play, they are learning. Advances in information technology are reshaping the learning styles of many students

in unavoidable ways. In some cases the use of technology is causing the attention span of young people to become shorter. Using games can help overcome or minimise the problems caused by these shortened attention spans. Furthermore, it has also been reported by multiple studies that students with learning disabilities benefited from the use of games in classroom. You'll also see several real world examples throughout this book of successful use of game by all sorts of classes, particularly special needs classes.

In spite of the positive association between affective and cognitive engagement, there was a negative association between the former two facets and content engagement during gaming1. Researchers concluded that content learning in games is still reflective and conscious in nature, while deviating from the game-based stealth learning approach that argues for learning in gaming without being aware of it. There is also evidence that game-based learning might work differently for pupils with a low level of education or better, pupils from the higher levels of education benefit more from game based learning than pupils from the lower levels. So we could say that game based learning is not an educational panacea.

Interest curve

An interest curve is a graphical representation of a player's interest in a game over time. The interest curve within a game is the flow and sequence of events that occur over time to maintain a player's engagement with the game. The concept is to purposely sequence events within the flow of the entire game to continually grab and hold the player's attention. But in game based learning, grabbing the player's/student's attention means successfully engaging the student to the learning process. So when using games for education one main crucial aspect is the game's storyline. A good storyline can help learners to achieve an ideal interest curve, where interest peaks around the beginning and end of the learning process, and to stay motivated throughout the learning process.

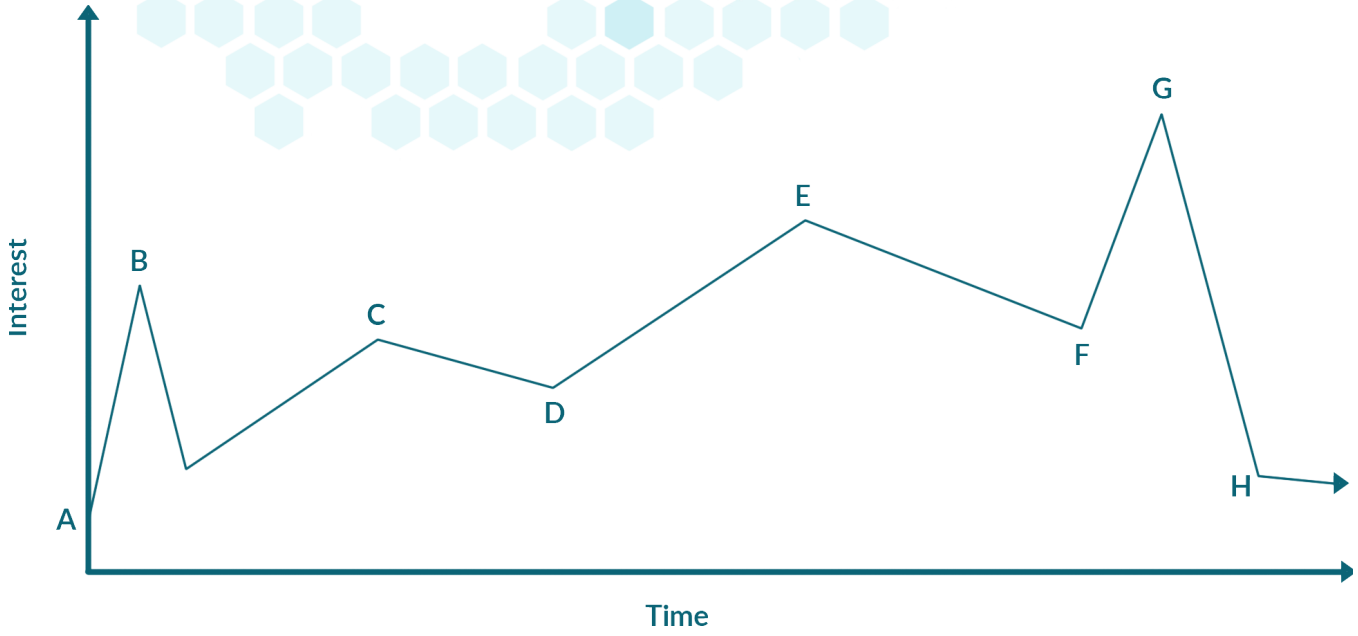


Figure 1: Example of an interest curve for a successful entertainment experience.

Disengagement

On the other hand, games with no smooth interest curve, or lacking real educational potential are simply not enough to establish clear motivational effects. It is also possible that games with technical problems may be partly responsible for the lack of effects on pupil motivation. It has also been reported that engagement in games or game spaces might not necessarily lead to engagement in the learning task. Once the teacher identifies such disengagement, intervention is necessary to get students back on course to engage in the learning tasks. Finally although we might expect to find permanent or long term motivational effects on game based learning, empirical research concluded that no significant differences were found between game based learning and traditional education with respect to motivation on particular subjects.

Sparking an interest in difficult subjects.

Most teachers share the experience of encountering the student who seemingly refuses to learn certain subjects or topics, citing that the topics presented to them on the blackboard will be useless in the 'real world'. This is commonly encountered when teaching difficult topics, particularly when they are abstract or appear to be highly specific. The reality is that these topics are likely not as abstract or narrowly applicable as they seem, however it can be difficult to present these topics in such a way that demonstrates their usefulness beyond the whiteboard and scoring well on tests. Such topics can suffer from, as a result of teaching just the basics first, the "Spherical Cow" effect: where students feel detached from the topic as they are only presented with what they perceive to be useless, simplified problems.

Games and play can be leveraged to help in bridging that gap and engage the reluctant student by 'tricking' them into developing interest. When a relevant application for the topic at hand is presented, and the student buys into the game or activity, it creates a 'hook' a teacher can make use of to develop that interest into a more concrete and formal understanding of the mechanics presented in that game.

Labo for the Nintendo Switch can provide a great example of how to start that interest and develop it into solid understanding. Initially developed as a means to produce cheap, gimmicky games controllers, Nintendo eventually saw the educational value of this platform and changed their focus to providing educational value.

One of the strongest features of the presentation of Labo is that it can spark interest in all types of children (or even adults!). Each toy is built from just simple sheets of cardboard, elastic bands, and stickers. Children who like to build lego sets according to the instructions will enjoy the process of creating these toys. Decorating and modifying the toys will catch the attention of more artistically inclined children.

Labo's cardboard sets are mechanically ingenious

and the builder will see first-hand how much can be achieved despite how limiting the materials seem at first. They will experience first-hand in the process of building the toy how those sheets can become a working miniature piano with real moving keys and functional buttons.

Every mini-game presented within the Labo kit makes use of the existing features of the Switch console in ways that demonstrate the broader applicability of a seemingly narrow feature. For example, the controllers are designed to rumble for the purpose of providing tactile feedback in games. With the Labo RC car, they are repurposed into an 'engine' for the vehicle that can go forwards and even steer by altering the frequency of either motor. The infrared cameras are heavily used by Labo to detect, for example, which direction the RC car should go or which key is being hit on the piano. Nintendo effectively demonstrates what we should be conveying to students, which is that little of what we learn cannot be applied in other, useful contexts.Players are encouraged to play with the toys before reading the manual by directly taking them to the game after they have built it. The expectation is that you will likely not understand what all the buttons, toggles and switches do but instead play with it and develop a likely flawed understanding of it. After the player has made their own attempt to understand the system, they can check the manual and validate what they discovered.

The RC car can provide a great demonstration to students, in particular for teaching physics. While at first it seems to be an extremely simple toy, we can use this to raise questions about many of the mechanics that drive it from fundamental to complex. This is best followed with the Socratic model of teaching and learning by allowing the students to build their understanding of the RC car with perhaps the occasional insightful question.

For example: The car has no wheels. Why does it move? A phone vibrating on a table moves but not in a specific direction, why does this car move forwards when vibrating? The controls talk about 'Hz' and the number changes when you move the slider. What does that mean, and is there a specific number that makes the car move faster than others? Why is that 'optimal' number not the highest number you can choose? What do the different 'Hz' values sound like?

These questions raised can be explained at many levels of depth depending on the academic level of the students which can be linked to formal understandings of physics concepts that are conceptually often quite difficult to grasp, for example the implications of the center of gravity of an object, resonant frequencies, or relating vibration to sound and frequency to pitch. From here we can take the behaviour the students themselves observed within the RC car and use it as the example for the formal, equation-based physics they are required to learn. On the whiteboard you can make direct references to this shared experience and use it as an example they

will be likely to understand and take an interest in. By doing so, we've engaged the students in active participation, and the students who disengage when the teaching approach is overly didactic just might stick with you longer.

The Labo game itself provides explanations of the mechanics of the toys through simulated conversations between an inquisitive child and professors who explain the underlying mechanics that enable the toy to work, inviting the player to expand upon the initial game and try new things. This can be used as a solid example of how to turn natural curiosity into a learning experience.

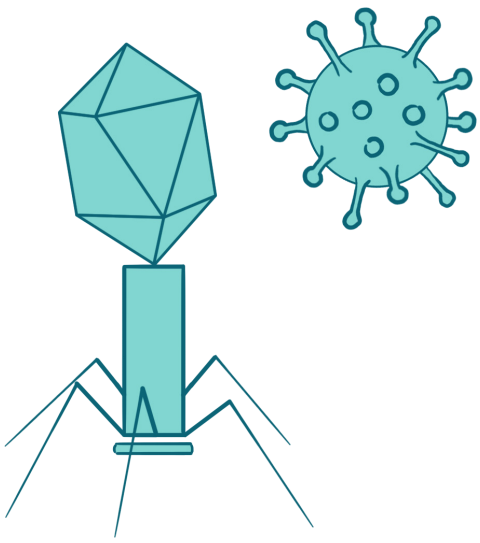
The RC car is by far the simplest toy in the Labo kit, taking around 10 minutes or so to build, and yet with the right approach and attitude we can turn that simple toy into so much more.

Sometimes a teacher has to teach a topic that is quite abstract or technical or is, in some other way traditionally known as being off putting to young people. Games can help here by being a really nice introduction to a topic - or to give a context to see how the topic really matters.

In this kind of situation, the job of the game is to spark the interest of the pupil - and whilst it's important that the game doesn't give pupils the wrong idea, the game doesn't necessarily need to be very curriculum focused or educational in its own right.

A great example is how schools can use Assassin's Creed to get pupils interested in historic periods. AC is generally very inaccurate historically! But it makes the period very interesting and gives the teacher something to refer to (however, you may want to check out the chapter 'Future of Serious Games' to see how the developer of the game is actively trying to help with teaching history and 'Games as Contextual Hubs for a classroom example).

Similarly, playing a game like Plague Inc can get pupils interested in learning more about how diseases mutate and spread, or about how vaccinations and antibiotics work. These games have inaccuracies that mean teachers need to know how they will contextualise the information, but with a good lesson plan and a bit of knowledge about what is in the game, the teacher can really take advantage of the motivational halo that the game creates and use it to their advantage in class.



Chapter 5: Playing with memory

Using games to help memorisation

Most of us know that if you simply read a textbook passively, you'll have a hard time remembering everything once you're finished. As the days pass more of the information seems to melt away. It's likely that some learners will only be able to recall less than half or even a third of what they read, even with re-reading and highlighting. Those activities only make you feel like you're learning, causing the so-called 'illusion of competence', but when it comes time to take a test or demonstrate skill in the real world, the learner isn't up to snuff.

In one survey in 2009, for example, 100% of the history teachers who answered polled said that a big weakness for their students is the ability to memorise and recall important historical facts. (see Nor Azan Mat Zin, Azizah Jaafar, Wong Seng Yue 2009, 324).

Researchers into the science of learning pretty much all agree that you have to actually engage the information in order to memorise it. In other words, use it or lose it. This is where digital games shine.

Serious games or learning with gamification elements can be great tools teachers like you can use to help your students get better at memorisation. When your students learn how to really remember their facts you can be sure that they have the knowledge not only in their working memory, but can transfer it to their long-term memory. In this chapter we'll examine games that focus on aiding memorisation.

Serious games

Games that also are intended for learning. This term is usually used for video or electronic games, but can also be applied to good old fashioned board or card games. If you've ever played a brain-training game or played a realistic simulation game, you've played a serious game! But serious here doesn't mean lacking in fun, since the most effective serious games are as enjoyable as any game people would play in their leisure time.

Memorising facts can be nerve wracking, but remembering is the basis for deeper understanding and the ability to link ideas in your core memory. To do this properly, you need to actively read, learn, and recite key concepts.

Some instances where memorising is of particular importance:

- learning vocabulary lists
- recalling names of important colleagues,
- remembering ears of historical events
- reciting and understanding poems

Of course you need to memorise facts in a variety of different subjects: maths, social sciences like geography, politics, languages, or natural sciences like physics and chemistry. If you don't know the basic facts, you cannot develop an understanding of the deeper ideas.

Despite the fact that a lot of us find it a challenge to remember such facts, memory experts have found some memorisation techniques that really make a difference. A core aspect of all memorising strategies is to find and note intuitive relationships between the new elements to remember and your own experience.

Six tricks for memorisation

Let's start out by reviewing six common tricks of the memorisation trade. Many learning games utilise these techniques in one manner or another, so understanding them can be quite helpful to you in judging if a learning program or app is good enough to help with memorisation.

A lot of the memory tricks are basically just mental imaging, or image naming. It's about creating relationships between the facts you want to remember and things you already have in your brain. It is often easier to recall facts if the learner is not just learning the fact but has additional knowledge about the concept. Game-based-approaches often take the opportunity to connect facts with other background information, situations or settings to make it easier to memorise specific things. Usually, people think that memorising is only about learning facts by heart. Nevertheless, several studies show that it is important to create connections between different concepts and facts in the human brain to get quicker and better access to information or to provide the general idea concerning the information.

Mnemonics

A so-called 'memory device' that assists people in fixing information in their memories, a sort of special code one can use to remember new data. The word derives from the Greek goddess Mnemosyne and many of the mnemonic techniques we use today, such as the method of loci (memory palace), were first discovered by early Greek and Roman thinkers.

Acronyms

Almosteveryone is familiar with this method, and there are a lot of common shared acronyms for a lot of different topics. In this method, you take the first letter of a series of words you need to remember and turn that into a word, usually an invented word.

One such example from the field of biology is the acronym for the stages of cell division:

IPMAT

Interphase, Prophase, Metaphase, Anaphase, Telophase

In the field of physics you can also easily find examples like this famous acronym 'name':

ROY G. BIV

This acronym stands for the colours of the visible spectrum;

Red, Orange, Yellow, Green, Blue, Indigo, Violet

Acrostics

Similar to acronyms, an acrostic uses the first letters of a series of words that you want to remember and turns it into a phrase, often funny or absurd.

In physics, for example, to help memorise the planets in our solar system:

My **Mercury**
Very **Venus**
Excellent **Earth**
Mother **Mars**
Just **Jupiter**
Served **Saturn**
Us **Uranus**
Nothing **Neptune**

Rhymes

Arranging information that you need to remember in a rhyming form has a long history in learning. From remembering dates in history ('in 1492, Columbus sailed the ocean blue'), to remembering how many days are in each month ('30 days hath September, April, June, and November, all the rest have 31, except February my dear son, it has 28 and that is fine, but in Leap Year it has 29'). Rhyming is a very popular form of mnemonics. For example, tiny children learn their ABCs by singing the rhyming song.

Peg system

Another useful way to memorise lists is using rhymes. The technique of rhyme schemes or rhyme-keys is to create associations and images with numbers and key rhyming words. The numbers or images are in specific order and help the learner to get a connection the words that should be remembered. For example you can create a personal key for all numbers from 1 to 10, associating them with images, such as bun = one; shoe = two, tree = three, door = four, and so forth. Then let's say you need to remember different modes of transportation, (a) airways, (b) waterways, (c) roadways and (d) railways. You can picture images of a bun (one) with a plane in it, a shoe (two) which stamps on a ship, a car on a road through a tree (three) and an open door (four) with a train rushing through it. The associated images (bun, shoe, tree, etc) can be used over and over again for different things that need to be remembered, so if you need to remember a grocery list you'd still use those same images, just adapted for your list (a washing machine filled with buns for wash powder, a bottle of soy sauce shaped like a shoe for soy sauce and so forth).

Method of loci

Talk about old school, the method of loci has been used since ancient times. 'Loci' being the latin word for 'places', this is a method that associates the information to be memorised with locations. You may have heard it referred to as a memory walk or memory palace, and has been referenced

in movies and popular television programs. This can be an excellent way to memorise up to twenty items, but can be used for shorter lists as well. You simply select a location that you know very well, such as a childhood home or even a local neighbourhood; any place that you spend a lot of time in for preference.

The idea is to create a story and place the words and pictures to be remembered at specific elements in the location. For example you can use the path from your door at home to your school or your place of work. Let's say you're studying chemistry and you want to remember the six non-metallic halogen elements: fluorine (F), chlorine (Cl), bromine (Br), iodine (I), astatine (At), and tennessine (Ts).

So start at the beginning of your memory palace. When you open your front door a big red F is written on it and you are afraid and run to your garage. Then on the number plate of your car you see a big CL while gas is coming out of your exhaust. You enter the car and at the first traffic light you have to stop because a man with a bromine brown jacket is crossing the street shouting "BRown, BRown, BRown!" and so on.

So it is about creating a strange story based on your well known places, where you place the facts to be remembered.

Chaining

Chaining allows you to remember things by linking each fact or word in a series, like a chain. Let's say you need to remember 5 of India's major exports: Petroleum, jewellry, automobiles, cereal grains, and textiles. You could link the petrol to the jewellry by picturing a fancy gold necklace dripping with petroleum. Then you could picture a car festooned with gold chains. Then you'd picture the car stuffed with so many grains of rice they are spilling from the open windows. Then you could wrap the rice in bolts of cloth. You can also create a story with the items ('I went out to trade my barrel of petrol for a nice necklace for my mother. But when I got to the store all they had were cars where the jewellry was supposed to be, so I bought rice instead, then traded that for some linen cloth') The stranger and funnier the linking or story the better.

Applying to games

To bring it together we can focus on the following rules which should be integrated in the game:

- Learners have to make **creative associations** within the game context
- Learners should focus not only on a single fact or item but the game should help to get focus on an item and fact **within a context** because combinations of facts and meaning help them to remember facts for a longer time.
- Learners should go through the story several times and **demonstrate** what they need to know within the game-based-learning approach because learning information off by heart for an exam is not enough for the brain to remember in the long term. So-called

'retrieval practice', that is a sort of self quiz, engages the memory right away, solidifying it.

- Learners should have the opportunity to create metaphors or analogies within the game.

If your students want to remember something more easily, they have to actually build that memory. In addition to that they should store duplicates of the concepts and information in multiple locations of their mind. It is about creating their own brain storage system. A game which focuses on memorising should focus on (a) learning, (b) reviewing, and (c) practicing new information. Here the use of multiple senses can be helpful since different people prefer different approaches. Furthermore, linking knowledge using multiple senses is a powerful way to embed information in long-term memory. The core idea is to provide an enjoyable way to cope with the usually boring problem of getting in contact with the facts.

As an example of tools which focus on memorisation think of the apps which offer practice exams to help passing tests, such as for getting your driving licence, your fishing licence or your hunting licence.

Also language learning apps, such as Duolingo or Babbel, often spend a lot of time on memorising vocabulary and spelling, plus the ever important retrieval practice.

Babbel

Costs: High
Plattform: iOS, Android, Web
Subject: Language
Required: Sign-Up, Internet

en-de-fr-es-pt-it-sv

Babbel is a language learning app combined with an e-learning platform. Babbel comes with a user-friendly interface and is currently available in at least fourteen languages. Babbel versions can be found in: Dutch, Danish, English, French, German, Indonesian, Italian, Norwegian, Polish, Brazilian Portuguese, Russian, Swedish, Spanish and Turkish.

Babble includes tasks for language learning which combine vocabulary training like

word selections, or translations findings with pictures and audios as well as sentence training. It can be done on increasing difficulty levels from beginners to advanced users.

It also offers digital language proficiency assessment exams. The app provides written lessons and audio related ones. It offers bite-sized lessons that get the learner talking. Moreover, the app includes elements to practice speaking as well as listening and offers different tasks for beginners and more advanced. It offers both vocabulary and grammar as well as understanding and writing. In Babbel new vocabulary is often taught with images, and grammar. The app encourages the learner and strengthens the current skills. One core aim of Babbel is to ensure a structured learning process.

Flashcard apps like Memrise, Tiny Cards, or Quizlet take the traditional paper flashcard and make it digital. Flashcard help make learning content visual, and using visual memory to learn facts helps your brain to process unfamiliar content, like the words and sounds of the new language. These digital versions not only make creating new flashcards quick and easy, they also include some gamification elements like badges, points, humour, or just smileys and sounds to liven up the memorising process. The apps can be both customised, or the user can get flashcard groups that others have created.

There are also Serious Games which focus on learning and memorising facts but which offer this in a complete game which is so much fun that the learner is not consciously thinking about learning, so called 'stealth learning'.

In such serious games the learners deal with several aspects of memorising: (a) remembering content elements, (b) recalling previous actions. When looking for learning games for your students, you should check which concepts and techniques of memorisation are used in the game.

Many games are just present knowledge without context or a strategy for retaining it. But that's not usually helpful for the user. The game should also provide a systematic approach to using the information and the facts.

The serious game 'Enchanted Crystals' is one good example of this approach. The aim of the app is

en-de-es-pl-pt-vi-zh tw-zh cn-ja

Memrise

Costs: Free / High
Plattform: iOS, Android, Web
Subject: Primarily languages, but also Arts & Literature, Maths and Science, the Natural World, History & Geography, Professional and Careers, Entertainment, Trivia
Required: Sign-Up

Memrise aids long-term memorisation of facts and discrete items via vivid sensory experiences – 'mems' – which are short audiovisuals, static images, soundbites or 3D cartoons. Testing is embedded throughout and students 'grow' their garden; every time they correctly click on an answer part of their garden flourishes and flowers bud and bloom, and they 'water' these plants to ensure that what is in their short-term memory stays in their long-term memory. The University College London-backed team of Memrise researchers call this Elaborate Encoding (where memories are formed and kept in the human brain via conscious connections and elaborate associations with sensory experiences), Choreographed Testing (adaptively calibrating tasks set) and Scheduled Reminders (long-term testing over time to ensure that the long-term memory stays long: for example, making sure that students are able to recall an item learned over 6 months ago by periodically testing it). There is also a large Memrise learning and teaching community.

BrainYoo

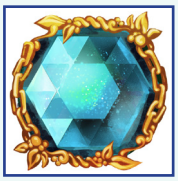
Costs: Free
Plattform: PC, Mac iOS, Android
Subject: Language
Required: Internet

zh-nl-en-fr-de-it-ja-ko-ru-es

BrainYoo is an app for learning with flashcards. It is a memorizing tool, which the learner can use in classes at school and at home. BrainYoo can be used online and offline. The tool is an instrument to be used to train vocabulary and enables location independent learning. It adapts to the learning speed of the user. Every user is able to integrate content easily or they can use content that already exists. This means teachers or learners can create flashcards and questions on their own. Furthermore, publishers offer existing content. The teacher can divide the content in sessions that also partitioning of smaller or larger learning units.

They can offer multiple choice questions or terms and definitions in combination with illustrations and graphics. It is useful for exam preparation aims to provide a faster and more efficient way of learning. Therefore, it also provides success statistics to the learner and visualizes the learning process.

to foster basic maths competencies in students. In a jump-and-run format the players take on the role of wizardry students who learn spells and use them to save their friends at a school of wizardry which has been taken over by evil. To successfully cast the spells the player must quick perform addition, subtraction, multiplication and division. Memorising basic maths facts such as multiplication tables will make you quicker and more accurate at casting the spells. The game also repeats mathematical problems over and over to help set them in the memory. This is also a version of retrieval practice. Due to the repetition effect, results can also be called up quickly without having



Enchanted Crystals

Costs: Free
Plattform: iOS, Android
Subject: Mathematics

en-de-el-pt

Enchanted Crystals is an innovative game for training mathematical skills. In the game players take on the role of two wizard apprentices who need to find out what is going on at their academy and learn new spells in order to master the challenges thrown at them. Spells are cast by combining magic crystals in different ways and then writing the result as a number on the screen. Most challenges in the different levels require players to cast the spells quickly, thus making them practice basic mathematical operations, such as addition, subtraction, multiplication, and division in order to get through the levels. The game does not teach mathematics, it rather focuses on giving players a fun environment to practice in.

Encourage students to play Enchanted Crystals on their own in order to increase their skills when it comes to mathematical operations. The game needs no explanation and can be played by those who just learned mathematical operations as well as those who want to improve their speed of calculating.

to go through the whole mathematical process every time and this goes hand in hand with an increasing memory capacity.

Serious Games can be seen as a framework for providing a meaningful context (see Holm Sørensen / Meyer 2007, 561). They don't only test for correct answers and memorisation but rather allow the exercise and performance of skills.

A good memorising game engages multiple sensory inputs of the information. You as a teacher can check if engages reading, seeing, hearing, visualising, moving, touching, and so forth in the game. For example to memorise historical facts perhaps those facts can be put in a game story and can be used as an active part of the game which has to be used by the players to get the game solved.

The main aspect of such a game is that the learners have to practice recalling and not simply parroting. Here the teacher can check the game on accuracy and the level of repetitions.

If a game really wants to strengthen memorising it is usually more than simply learning exactly by heart. But if you as a teacher want the learners really to learn something by heart, for example passages from the Bible (religious education) or spelling in language learning, the level of repetition has to be much higher.

Memorising is the first step toward creation of deeper conceptual understandings and for problem-solving abilities. So even if game based approaches or serious games have a broader focus teacher should see if memorising aspects are also included.

CHAPTER 6: LEARNING BEYOND THE CLASSROOM

Carol Rainbow, retired ICT teacher and ICT adviser

'I believe that Bring Your Own Device (BYOD) is going to be a huge part of the future of education.'

The personal mobile phone and the personal tablet are often right at hand and the user knows how to handle it. This makes a big difference. The learner doesn't have to struggle with the peculiarities of an unfamiliar device, but can directly focus on the learning activities in a familiar setting. And this opens educational possibilities not only at school but also outside school. Learning happens anytime, anywhere.

When we picture learning, the most common image that comes to mind is a formal setting, like a school room. Most people think of a teacher or trainer of some kind, standing before an audience and dictating the learning process. But consider how rapidly the world is changing these days. People have quicker and greater access to information than ever before. How we engage in leisure and work is evolving, changing in ways our grandparents might not even recognise. Technology is also driving a huge change in social norms and behaviors. The amount of information people are being exposed to is both amazing and daunting. So confining learning to the school room may not be enough to prepare students for the complex world which they will be entering. We need to encourage people to supplement their learning on their own, outside of formal settings. But how?

We've mentioned before how the desire to play and engage in games seems to be built in to the human psyche. Playing is something we do voluntarily, and not usually because someone has forced us to do it. It's simply fun, and we like fun!

So the most obvious way that games can get young people learning outside of school is by tapping into their desire to have fun. If you use a game that is actually enjoyable on its own as a game, one that people would choose to play regardless of the learning content, they will play and learn during their free time. Their attitudes towards learning are likely to change as well.

So why digital games on mobile devices? You've likely noticed that people have taken to using mobile devices seemingly everywhere. People can be seen hunched over smartphones and tablets on the bus, walking down the street, in the restaurants, during social gatherings, and more. We even seem to use them in situations where it is not very polite to focus on a device instead of talking to the people who are directly next to us. This behavior has even created a little controversy about mobile devices.

Clearly these devices command our attention in a way other things just do not. While people often debate the issue of the etiquette involved and the effect it's having on society, the use of electronic devices is here and not likely to change. So we have to ask ourselves the question: can that focus be used to help us increase our learning potential? And what role do games play?

There are a couple of motivational factors at play:

- It's not difficult to get people to pay attention to quick, brief amounts of information. When the phone beeps or a notification pops up, most people pay attention to that.
- People are attracted to playing games in a lot of different situations. Sometimes we call this intrinsic motivation to play.

We can utilize those factors in learning contexts. If we make our games into serious games with a learning purpose, we can use our 'bad habits' for a positive learning outcome.

Probably the biggest benefit of using games and mobile devices for learning is the so-called 'stealth learning' factor. If a learning game combines both fun and learning in a skilful way, and the learning doesn't even take place in a school setting, then learners are likely to play the game and get the benefit of the learning without consciously thinking about the fact that they are learning. Sneaky!

But how do you make sure that learners using digital games don't get distracted by the other things their devices offer, like social media?

One answer to that is to keep the learning units small so that students can take them in bite-sized chunks. If they can complete a learning unit in just a few minutes, the natural distractions are less likely to disrupt a learning session. Tiny learning units can also benefit special needs learners with attention issues.

But the great thing about adding the gaming dimension to this is that games naturally command our attention. Have you ever played a game and lost track of time? Many people have experienced this. So if we are talking about games we are actually able to use longer units. When the game is engaging the learner is able to focus for longer.

In either case, using digital games on mobile devices allow people to study in unusual places, such as waiting on queue or while using public transport.

And the fact is, whether we like it or not, young people these days are used to spending a lot of time on their devices. Encouraging them to play fun learning games can be a big motivator for them to actually enjoy the learning process. Motivation is the key.

Games also give learners immediate feedback, wherever they are using them. Students don't need to wait until the end of a term to get their grades, or even a few days to get the results of a test, before they find out that they are weak on a topic. Playing the game shows them immediately how they are doing, either through points, or by not being able to progress to the next 'boss fight'.

There can be a lot less anxiety involved as well since the results of the game are not a part of their grades, it's simply for their personal enrichment. We've all met the students who obsess too much over their grades to the point that they have trouble actually achieving. Using games on their own time lets them self test in a manner of speaking, and lets

them relax a little while learning.

Learning games played outside of school can also be helpful to special needs students who often have negative associations with the classroom and learning in general. Young people can suffer from this for a variety of causes, whether the issue is economic, social, or a disability. When they are playing a game, however, they aren't thinking about the learning process and are more free to learn without pressure. This is particularly true if they can play the game on their own time.

Practical tip: Communication elements on your mobile phone

Neil Kokemuller, active business, finance and education writer

"While old-fashioned face-to-face communication may be preferred, the fast-paced nature of some businesses makes the use of other communication channels necessary or beneficial. [...] Each channel has strength and weaknesses that you must understand to optimize organizational communication." (Kokemuller 2018)

Communication elements on your mobile phone which you can use outside school can be specific educational apps but also classical telephone communication via voice, video conferencing, or Skype, discussion forums on your internet browser, e-mail communication via your email tool and social media approaches like educational podcasts and blogs, but also social media apps like twitter, facebook etc.

As in all things, we have to prepare the students for the real world of work that they will be entering.

Don't forget the pedagogy

Of course we can't forget that the learning content has to be solid and actually contribute to real learning. In order for our fun and games to actually be useful, we can't only think about the cool technology.

So, we need a combination of

(a) the common use of technology together with our behaviors in interacting with our devices and

(b) a pedagogical structured approach which supports actual learning and not only the possibilities offered by technology.

Practical tip: Search for pedagogical didactic approaches

Helga Walter, Vocational teacher Germany

Translation by the authors:

'Learning with new media and mobile phones should not just be technology. You need a pedagogical didactic approach behind the apps. This can be a game-based approach or even systematic learning.' (Walter 2018)

Original German:

"Lernen mit neuen Medien und Smartphones darf nicht nur Technik sein. Man braucht einen pädagogisch-didaktischen Ansatz hinter den Apps. Das kann ein spiel-basierter Ansatz sein oder aber auch ein systematisches Lernen." (Walter 2018)

We also have to consider some crucial aspects of learning games

- There has to be a story in the game which captures learners' attention, immersing them in the game world.
- There have to be didactic and pedagogical based gamification elements like competition, rankings, goals, and badges. Didactical and pedagogical based means that they are not only integrated in the game but integrated in a way that supports the learning process and adds additional value.
- Feedback is important and should be related to the tasks in the game and not just an additional feature. The feedback has to be individual and immediate to ensure that the learner feels addressed and gets responses to his or her individual decisions and actions in the game.
- Serious games should offer situated learning, that is to say the game should draw the users into an immersive experience where the learning happens in a context that makes sense. The situations in the game can and should be similar to real life situations and may offer an authentic character. This offers the opportunity for model learning according to Bandura (cf. Bandura 1976 and 1979).

One interesting example of a game that gets people learning outside of school can be found in the app Charity City. The goal of this game is for the players to learn the benefits of working towards the good of society. By playing the game, learners are able to reflect on social responsibility and to discover how easy it can be to act in ways which are helpful for other people in their community. The makers of this app also wanted to create a next generation that is socially responsible and to strengthen charity in the local comm unity. For the info box about Charity City, see our chapter on Games for Attitude Change.

Platform game

Platformers, platform game, jump and run are all terms for a particular style of computer game that's been around and popular for a long time. These games involve the character on the screen jumping, running, and climbing around different 'platforms' on the screen to accomplish various objectives. They are considered a type of action game. If you remember the old Donkey Kong game from the 80s, then you've seen or maybe even played a platform game!

The app uses a typical platformer or 'jump and run' game format to showcase different opportunities to engage in charity in the game world community. The goal for the player is to solve as many of the problems in the community as possible so that the people get to know the character of the player and will vote for him or her as a new town mayor / king. The only way to influence the vote is through community service. This mobile game combines action and fun with social and political engagement.

But how does Charity City get people to learn outside school?

- First of all the game doesn't stress that players are supposed to learn something, it simply offers a fun, free game to play on the mobile.
- Experiences are provided in authentic situations which mirror real life, for example taking care of pets or properly disposing of the rubbish found on the streets.
- The game uses the desire to play platformers to let players be exposed to the ideas of charity work and offers information about charity institutions in the real living environment during the game.
- The game puts people into situations where they can see how easy it would be to do some kind of volunteer service, so that they can transfer that idea to their real life in an easier way.
- The app also harnesses the passion players have for competition, challenges , and fun as the player has to win against other opponents who also want to become the new leader of the town.
- In addition to that, the app offers rankings and leaderboards to share the final results but also on progress during the game. This means the app gives immediate feedback on success or failure and offers different chances to get better.
- It is also offers a comic style fun experience which reminds the player of other nice games and generally puts the player in a light hearted mood.
- The app creates a feeling of flow, which means that it balances the skills of the user and the challenges to be solved. The player becomes engrossed in the game.
- The player discovers during the game that there are specific benefits for a person who does charity work,

The Charity City app was created by the project "I believe in Good" and provides extracurricular education methods. But these methods can also be used to promote the teaching of charity in schools where this mobile educational game is used in combination with classical lessons.

Many of the elements discussed here can also be found in different apps, of course. The use of gamification elements, showing topic related benefits for the learner, authenticity, flow-feeling, game motivation and stealth learning, learning without being consciously aware that you are learning, or only partially so, are the best ways to get people attracted to learn outside school.

Chapter 7: Practical games for the real world

Using games for practical skills (procedural learning)

A lot of what we learn isn't just facts and information, but how to do something. Some of us need to know how to type, how to cook a soufflé, how to drive, or install an electrical outlet. But is looking at a blackboard or listening to a lecture the best way to learn to do those things? Sure, you can learn some of the things you need to know from an instructor talking to you about it, but these are the kinds of things people need practical experience doing.

- Skills, unlike didactical knowledge, require carrying out a series of steps and seeing the consequences of those steps.

  For example, following a recipe for baking a cake requires steps ranging from turning the oven to the correct temperature to preheat before baking to measuring out the ingredients in the proper proportions, and even mixing wet vs dry ingredients correctly before combining them.

- Skills require practicing in order to really cement the memories.

  This is particularly true in skills which require a specific, repeated order of actions to be done correctly. An example would be replacing a sound card on a computer. Doing things in order, including turning off the power to properly discharging static electricity before touching the delicate computer components will ensure you don't destroy anything valuable.

- Skills require practicing in differing contexts.

  If you are repairing automobile engines, you are unlikely to be repairing the exact same engine in the exact same place all the time. By practicing in different contexts you would be able to take your general knowledge of engines and apply that to different settings as needed.

In fact, research has shown that when people try to remember something, environmental cues play a major part in how easy it is to remember. Learning any procedure from a blackboard, even relatively simple ones, is not nearly as powerful as learning it by doing it. This is why we carry out fire drills!

Procedural learning is an ideal place to use games since games can help translate learning 'off the blackboard' and turn it into knowledge that is very practical, concrete and automatic.

- Create an enjoyable wrapper around the skill process. Practicing can easily become boring, particularly before we are any good at the skill. By making it into a game we can remove some of the drudgery around the necessary 'evil' of having to do something over and over to gain mastery over it.
- The skill must be very accurately represented but the wrapper does not! To go back to our example of engine repair, the process for doing that has to be correct in any game

relating to it, but it could take place on a space station or the moon. Games to teach medical students how to place an IV could happen with fantasy creatures or humanised animals instead of humans.

The benefits of using games for procedural learning is very like the benefits of doing practical exercises or experiments in a class. Of course, using a game allows you to practice things and 'live through' scenarios that would be impossible, or dangerous in the real world. If you use a digital game to practice repairing an airplane engine, there is no crash if you make a mistake.

This is a situation where you really do want to find a game that is designed for the purpose of training the practical steps you care about. It's just so important that the steps are reinforced deeply and accurately - so whilst a game like Overcooked

(*http://store.steampowered.com/app/448510/Overcooked/*) might have some parallels to cooking in the real world, the steps involved can be .... unconventional.

Good examples of games that help train procedural skills include:

- Mavis Beacon Teaches Typing

  This typing program has been around since 1987, and is a great example of actual practical experience to learn something new. The only way to learn to type is to actually type, after all. The program has different games that get the learner used to typing without looking at the keyboard and gives feedback on accuracy and words per minute typed. Users can even earn certificates they can print up when they pass tests. This is procedural skills learning at its most basic.

- GaBa_LEARN: Medical procedures in nurse care

  The game GaBa_LEARN is currently being developed by Ingenious Knowledge and partners to simulate the daily routines of a nurse in a nursing home. The game's target group are nurses in education. They can practice the daily actions of their future job within the game. To find information on the game please visit: eduproject.eu/gabalearn

- Games about training wait staff at McDonald's

  Corporations like McDonald's are starting to use games to help their newly hired employees learn the processes they need to know, for example, how to run the till, in a fun and engaging way. This is another instance where using a game to train allows the employee to make mistakes in a safe environment, in this case, without annoying real world customers. The employees can become used to their tasks in a relatively stress free environment and get to have some fun while doing it.

The Virtual Bacterial ID Lab

Costs: Free
Plattform: iOS, Pad
Subject: Science

en

This app for iPad is intended for high school level biology students, but could be applied to a variety of research settings. While not a game in the strictest sense, this app does give an idea on how a simple simulation can be used to show the needed steps to do lab work. Going from sample prep all the way to sequence analysis, users work in a virtual lab with on screen guidance, as well as tabs on the right with in depth explanations. Usually DNA sequencing is quite expensive and requires a lot of time in the lab, so this app could be useful for classes that don't have access to the correct equipment, or perhaps as pre-lab time practice.

Toothbrush Trainer

Costs: Free
Plattform: iOS, Android
Subject: Health
Required: Sign-Up, Internet

en

This game uses a silly tooth character called Budd, your official 'Toothbrush Trainer' to help young children develop better tooth brushing techniques, as well as encourage daily brushing. Children earn prizes and awards for developing a daily brushing habit, as well as being guided with cute animations and catchy music to perform this habit effectively. The program is based on research by the US National Institute of Health, with support by child psychologists and dental hygiene scientists. The game also uses aspects of Augmented Reality (AR) by using a so-called 'Magic Mirror' to place children right in the game with Budd.

Taking game skills to the real world

As we have mentioned before, video games play an ever present part in the lives of many young people. Although the vast majority of research by psychologists on the effects of gaming has been trying to prove its negative impact, we should not only focus on the possible negative effects but also ponder the benefits of playing these games (Granic, Lobel, & Engels, 2014). After all, as we discuss in the chapter Why We Play, playfulness has always been an important part of childhood development and learning in general. This is particularly important considering the wealth of research showing benefits to serious or learning games, as you'll see discussed in the chapter on Serious Games Theory.

The benefits of playing video games focus on four main areas:

- cognitive (e.g., attention)
- motivational (e.g., resilience in the face of failure)
- emotional (e.g., mood management)
- social (e.g., prosocial behavior)

Cognitive gains

Contrary to the conventional belief that playing video games is intellectually lazy and sedating, it turns out that playing these games promotes a wide range of cognitive skills. Players practicing First-person shooter (FPS or action) games show faster and more accurate attention allocation, higher spatial resolution in visual processing, and enhanced mental rotation abilities (Green & Bavelier, 2012). Other benefits of action games are the improvement of low level vision, perception, memory, selective attention and cognitive flexibility. Improving such skills has real – world application, just like the normal play that children engage in.

One meta-analysis (Uttal et al., 2013) concluded that the spatial skills improvements derived from playing commercially available FPS video games are comparable to the effects of formal courses aimed at enhancing these same skills. Further, this meta-analysis showed that spatial skills can be trained with video games in a relatively brief period, that these training benefits last over an extended period of time, and crucially, that these skills transfer to other spatial tasks outside the video game context.

Another study convincingly shows that if a game is tailored to a specific mental impairment, in this case multitasking in older people, it can indeed be effective (Anguera , et al., 2013).

Motivational benefits

By setting specific tasks and allowing young people to work through obstacles to achieve those tasks, video games can help boost self-esteem and help children learn the value of persistence (Vitelli, 2014). Also researchers have noted that players can display a correlating motivation in their real-world career goals. Children develop beliefs about their intelligence and abilities, beliefs that underlie specific motivational styles and directly affect

achievement (Dweck & Molden, 2004).

Immediate feedback allows the players to solve problems on their own while working towards specific goals. This motivational 'sweet spot' balances optimal levels of challenge and frustration with sufficient experiences of success and accomplishment. Importantly, in the best games available on the market, this 'sweet spot' is so effective because it adjusts itself dynamically. The difficulty level is continuously being calibrated to players' abilities through increasingly more difficult puzzles demanding more dexterity, quicker reaction times, and more clever and complex solutions (Wyeth & Sweetser, 2005).

Moreover, individual differences in players' personalities and preferences for game genres may also have a differential impact on motivational outcomes. New studies that are designed to take these complexities into consideration are necessary to move the field forward significantly (Granic, Lobel, & Engels, 2014).

Emotional benefits

Many studies have shown a causal relation between playing preferred, that is self chosen, video games and improved mood or increases in positive emotion, (Russoniello, O'Brien, & Parks, 2009) and (Ryan, Przybylski, & Rigby, 2006). More than that, many gamers report intense emotions of pride and achievement by immersing themselves in games that allow a high sense of control that 'takes them out of themselves'. Games do not elicit only positive emotions; video games also trigger a range of negative ones, including frustration, anger, anxiety, and sadness.

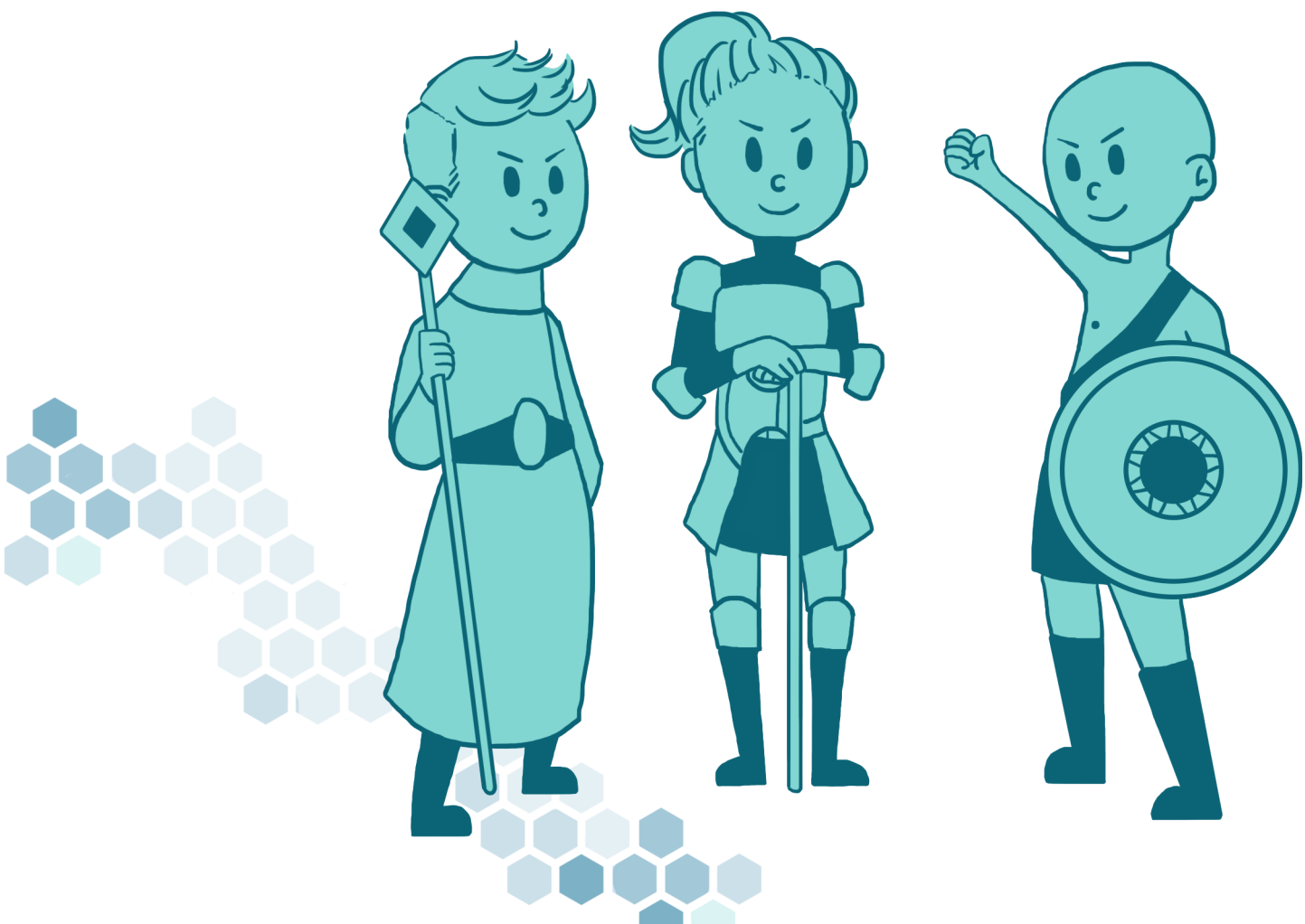
Games continuously provide novel challenges, demanding players to shift already established appraisals to new ones in order to most efficiently reach goals. The extent to which adaptive emotion-regulation skills are learned through gaming remains speculative at this point, but testing these ideas seems like an exciting new area for future programs of research. Importantly, the type of contexts that most often pull for effective emotion regulation strategies—such as reappraisal—are social in nature (Granic, Lobel, & Engels, 2014).

Social benefits

Perhaps more than ever before, video games have become an intensely social activity. Instead of the stereotypical gaming nerd who uses video games to shun social contact, over 70 percent of gamers play with friends, whether as part of a team or in direct competition. Social and prosocial activities are an intrinsic part of the gaming experience with gamers rapidly learning social skills that could generalise to social relationships in the real world (Vitelli, 2014). Players seem to acquire important prosocial skills when they play games that are specifically designed to reward effective cooperation, support, and helping behaviors (Ewoldsen, et al., 2012).

Though many games have violent content, they still provide players with an opportunity to learn social skills by focusing on cooperation with team

members. Research has shown that playing violent video games in groups reduces feelings of hostility better than playing such games alone (Vitelli, 2014).



Chapter 8: Firming up soft skills

What soft skills problems can games help to solve?

The popular image of games as solitary anti-social pursuits taking place in dark bedrooms is out of date! Games aren't just self-contained worlds living inside computers. They are played in the real world, often with friends. Many video consoles have so-called 'party games' that require several players, all in the same room, interacting with the game, sometimes cooperative, sometimes competitive. Multiplayer games are more popular than single player games, and even single-player games can be social. Just look at the popularity of video game streaming on YouTube and Twitch.

Twitch

Twitch.tv is an online streaming service similar to Youtube. Twitch, however, is pretty much exclusively for gaming. The platform is used for everything gaming related from individuals streaming themselves playing video games to the broadcasting of 'eSports' or video game tournaments. With a Twitch account you can either stream your content, or watch other content streams and participate in live chat while watching the stream with other viewers. If you have any video gamers in your life, there is a good chance they watch or participate in Twitch streams.

Because of how social games are, they offer the perfect opportunity to give students a chance to practice their communication and soft skills.

These skills can be hard to teach in many areas because they need groups of people for interacting in realistic ways. And often, when a 'communication skills' lesson is taught, the setting is so artificial that everyone knows how they are 'supposed' to behave. The hard thing about communication and other soft skills isn't answering a question in a lesson - it's putting the skills into practice!

As a teacher, you can use games that are about training soft skills to support your pupils improvement but equally you can use many games that **aren't even 'about'** communication if you are creative in your lesson planning.

What is the role of the game in soft skills education?

The key thing in a soft skill game experience is that the players are given a realistic scenario where the 'artificiality' of a constructed lesson fades away and the players can simply use their soft skills.

The game you choose needs to present a variety of situations and scenarios that require communication, teamwork, and compromise. The game doesn't need to be focused on 'learning' to make this happen.

If there is a specific aspect of soft skills that you want your pupils to learn, the tricky thing is finding a game that emphasises this specific skill.

Examples of good Soft Skills education games

A great example of a game that emphasises teamwork and clear communication is the game Keep Talking and Nobody Explodes. Keep Talking and Nobody Explodes can be played on tablets, computers and even in virtual reality.

Player 1 (and ONLY player 1!) is shown a bomb. The bomb has a countdown timer and if that timer reaches zero the bomb explodes. The other players have the manual and player 1 cannot see this manual. The other players have to help player 1 defuse the bomb. You see, player 1 has no idea how to defuse the bomb and the other players have no idea which bomb Player 1 can see. So player 1 has to describe the features of the bomb very specifically so that the other players can look up the bomb disposal process and describe which action to take, which wire to snip. What makes this game so much fun is that many of the bombs are similar and it the game provides a nice amount of pressure (without ever feeling too risky). So players often make a mistake and blow themselves up. After a few rounds of play, you will see players learning how to communicate very effectively.

Keep talking and nobody explodes

Costs: Medium
Plattform: Windows/Mac/Linux (all on Steam), Playstation VR, Oculus, Google Play, Switch, Xbox
Subject: Communication and cooperation

en

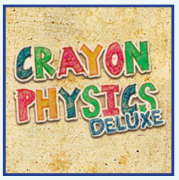
Keep Talking and Nobody Explodes is a cooperative game where players must work together and communicate effectively to keep a virtual bomb from exploding. The puzzles have a variety of challenge levels, and the puzzles are different every time. It can be played with only one copy of the game, with the manual readers using paper versions of the manual and the bomb diffuser using the computer. There are also virtual reality versions of the game. The game also allows for community created modules and missions in Steam.

Real world case

The following class experience was made in partnership by João Freitas (Citizenship teacher) and Marco Medeiros (special needs teacher) at Escola Secundária de Lagoa with special needs students. Started in 2010, the project is still being used with special needs learners to develop soft skills. The Crayon Physic experience was implemented in Special Needs by João Freitas in 2009.

The Kinect (motion sensing input for Xbox and Windows) arrived a lot earlier than Mr. Freitas and Mr. Medeiros expected. In December 2010, after having exhausted the most obvious alternatives, they asked the help of the Lagoa Entrepreneurs' Center (NELAG). The two teachers asked for funds for the acquisition of a XBOX 360 console accompanied by an innovative technology, the Kinect. On February 4, 2011, thanks to their benefactors, the console arrived at Escola Secundária de Lagoa.

Two months after it was released, there was already a Kinect in school. It suggested great potential. Such an interface could be an astonishing facilitator. Having already experimented with other video games, both teachers were acquainted with traditional interfaces and knew their limitations and barriers. Kinect was much closer to some video games that Mr. Freitas used on the digital board (smart board), such as the Crayon Physics Deluxe. The teacher had the idea that more natural movements would facilitate the relationship with video games.



Crayon physics deluxe

Costs: Medium
Plattform: Windows, MacOS, Linux
Subject: Physics, problem solving

en

Crayon Physics Deluxe is a nifty little physics simulator for the computer. The goal of the game is to guide a ball from its starting point and have it touch the stars. The drawings made inside the game magically come to life in a two dimensional world. Players use their creativity to solve puzzles and learn about physics.

While this puzzle game is only intended as a single player game, it can also be played on a smart board where the student can draw and try for a solution, where students can collaborate. Its has a very easy and accessible gameplay and allow for user made maps where the teacher can address the difficulty. The game can be used in short sessions to address basic problem solving skills.

For more information please see www.crayonphysics.com

The game was used in a special needs classroom to train problem solving skills and communication. This game was a very good hint about the power of the interface because we used it with smart board.

First their focus was on assembling the equipment and adapting it to the classroom space. They connected the console to a projector in front of which they fixed the Kinect, obtaining a projection of a considerable size and a satisfactory movement

area . They did some testing and were ready to start.

The Xbox 360 and Kinect came with Kinect Adventures, a game that the teachers thought would be good to familiarise the students with the equipment. However, it became the video game of choice. It soon proved to be encourage integration of students in peer activities, even those who did not normally participate in such activities.

The idea of using Kinect came about because sometimes normal interfaces can be a barrier to the use of software with young people in special educational needs, even when using video games. Video games were used in special education regularly since 2009. Mr. Freitas used Age of Empires (1997) in an activity that allowed the development of skills in interaction, cooperation, communication and resolution of problems; in a similar approach, Mr. Freitas used Crayon Physics Deluxe in collaborative problem-solving activities on the digital board (smart board).

Thus, the introduction of a video game console came naturally in an environment where the school already recognised the usefulness of some video games in the classroom. Even if the interface was one of the reasons Mr. Freitas and Mr. Medeiros chose the XBOX with Kinect, that video game's interface and the video game Kinect Adventures created an ideal combination in special education.

Kinect adventures box

Kinect Adventures has several mini games, some of them of a competitive nature and others that were collaborative. The teachers followed a collaborative approach, in light of previous experience that Mr. Freitas had with Age of Empires and Crayon Physics Deluxe. Those games showed him the richness of the collaborative process between students when using video games. Given the simplicity of Kinect Adventures mini games, one could expect that they would have little educational interest. However, the Kinect interface allowed the teachers to create an external dynamics of the game that favoured the development of several skills that normally are not associated with video games. Movement, coordination and communication were now promoted by video games. The actions that were taking place outside the game were used as to help evaluate the students' behaviors. This was different from common interfaces, in which everything happens on the screen. Thus, it was not necessary to use 'external transfer models' as in the case of Age of Empires (CP 14), the actions of the students were visible enough as consequence of the interface.

Similar to previous experiences, in which video game rules were modified in some way, it became advantageous extend the game's dynamics beyond the game itself. Creating outside game rules that promoted learning situations that video game, by itself, did not provide. The nature of the interface helped in the integration of this new rules in the

video game. Kinect does not present a lot of the skill and adaptability obstacles of most other controls. The student thus has a 'cleaner' experience and the teacher less interference in the teaching-learning process. Only accelerometer and touch devices such as smart boards and touchscreens have shown some similarity in terms of ease of use, but these require the student to carry a control device and/or are reduced to two spatial dimensions and don't show the level of immersion or the kind of video games that Kinect allowed, nor activities identical to those developed in special needs. These characteristics promoted the level of motivation necessary to carry out the learning activity.

Some students who showed a strong resistance to anything that involved interacting with their peers were easily engaged with Kinect Adventures. The teachers could approach problems such as difficulties in working together and on verbal and non-verbal communication skills. The video game stimulated verbal interactions, made the students better at reading body language and sharing space, because these skills were essential to achieve the goal of the game. Other video games also have that need for cooperation but do not benefit from an interface of that nature, nor are they so readily accessible. The Kinect helped to enhance the motor functions of the students. It's the opinion of the teachers that this type of video game interface can be a good way to develop activities with video games, which would happen while sitting down, while remaining in a relatively small and controlled space that allows for observation.

Some students who were less adept in Physical Education were readily able to play with a partner in Kinect Adventures, perhaps because a virtual ball is not as threatening as a real one. It's possible that students who are uncomfortable participating in physical activities can become used to it in a 'safe' setting where they can lose their fears and gain skills in the video game, which might allow them to be more at ease with the non-virtual physical activities.

Another potential feature is that the video game puts the focus of the student into the game instead of their social phobias, since the game is engrossing. This state of mind allows them to be more at ease with communicating and cooperating with their fellow students than if they were facing a crowd doing the same thing. The teachers believe this may have played a role in aiding the development of skills such as communication, which they would shy away from otherwise.

Kinect Adventure allowed the creation of activities to develop soft skills because collaboration required the players to interact and understand each other. Conflicts and misunderstandings were opportunities to discover some of the limitations the students had in communication and social interaction. Gradually, clashes, disconnected movements and initial conflicts have turned into moments of healthy mutual help and cooperation. Pupils who did not previously communicate or did it timidly started to have an active role in the engaging with other students; while others who

had great difficulties with cooperation, began to give guidance to their partner. A climate of understanding and interaction was created. Results began to emerge after a couple of months.

Kinect Adventures has a competitive and a cooperative component, the latter being the one that proved to have greater learning potential towards how students engaged in cooperation. The teachers could see whether the students actually collaborated or whether they simply acted independently of their partner. It provided clues about their ability to perceive their left and right sides and if they could communicate this information to their partner. These precious pieces of evidence were revealed in a very immediate way which caused some astonishment, for in prior personal experience of Mr. Medeiros, a Special Needs Teacher, it typically takes a longer time to obtain discover these things.

Classroom strategy

The activity consisted of a situation of cooperation in which a pupil, "the captain," gave verbal instructions to his partner in a Sub-game of Kinect Adventures called River Rush, in which two player controlled a boat in a river. That sub-game required that they both move in a synchronous manner to manoeuvre the boat effectively.

They needed to jump over obstacles in a coordinated way, which implied that the captain gave the command "jump", in addition to having to give the commands "right" and "left". The process proved to be complex, as the students confused the right with the left, did not give the commands or did it to late. The decision was made to simplify the activity in some cases, at least in the initial phase. When starting, only the "jump" command, was required, training the students to anticipate the movements of their partner.

While the partners did the activity, a third student, 'the boss', checked to see if the partners stayed in the playing area, giving directions to do so. This new member of the team also checked if the captain was giving the instructions, reminding him to give the 'voice of command' when he forgot to do it. This strategy increased the complexity of the collaborative situation and enriched the level of communication between the students.

The position of boss only emerged at a later stage of the project when Mr. Freitas began to prepare the class for an activity in which students had to organise independently to welcome another class from the school for a Kinect demonstration session. This created the need for someone to coordinate the operations. This too added to the educational value as the 'boss' helped to develop the activity, promoting the acquisition of competences in himself and in his peers.

For a personal perspective and analysis of the project by Mr. Marco Medeiros, please see the appendix 'The Kinect Classroom Adventure'.

Chapter 9: Games for attitude change

Use of games to change student's attitudes towards a social topic

Have you ever wondered, if you could change your student's attitude towards a social topic or even towards school and learning? Well, there is an approach in game-based learning that could help you. Some groups in serious gaming have started to develop games with a social theme that can have an effect on the player. These are called social impact games or games for change, after the organisation Games for Charge (gamesforchage.org) that yearly honors the best of those games.

Social impact games can best be used to present an opinion. They don't need to be didactic or 'factual' but rather show some perspective or raise some ideas that can be discussed in class.

A good way to use social impact games is to play the game as a lead into a group discussion in class or to ask pupils to write or present a response to their experience with a game for change.

Teacher talk

Mrs. Aina Motivāne from the Laidze Technical School in the Talsi region of Latvia used teaching material and the game Charity City (see the chapter 'Playing with Memory for more details on this app) for a lesson on food waste in Europe. She had chosen this topic because at the time her students weren't so keen on engaging in service to the local community:

'I have chosen the game Charity City and corresponding teaching material for my lessons about food waste. The game is a Jump'n'Run game, which can be played for free on the mobile phone. It addresses the topic of young volunteers with a fun approach. The goal of the game is to become king or queen of Charity City by getting people to vote for oneself. The sympathy of people can be gained by helping them directly or helping in organisations that do charity work in town. The target group is teenagers of 12-16 years.

The levels handle different volunteering topics: Helping an old man buying groceries in the supermarket, feeding birds, serving in a charity restaurant, planting trees, cleaning up a park, taking a shelter dog for a walk and feeding cats in a shelter. Attached to each level, there is a connection to the real world by listing possibilities to do the volunteering. For instant, examples of international organisations for animal care that have special volunteer programs for youth.

I have used the material "Housekeeping - waste cooking or second chance for food" from the game website (http://eduproject.eu/believe/im-a-teacher/?lang=en) for a lesson for 15 years old pupils. I took the basic structure that was proposed and adapted it to my class, by changing the tasks a bit.

In the beginning, I introduced the topic and presented some statistics. This was followed by a short presentation about food law in France and examples from Denmark and Austria. Next, I used

pictures of "mountains" of wasted food, which really made youngsters think. Examples from the handbook about food banks where excluded, because most of the youngsters in the class are from poor families and get help from food banks, so this was a sensitive topic.

Then the students did some individual work on the topic and discussed all together how everyone can decrease food waste in the world and in Latvia. In the end of the lesson youngsters created recipes.

The game is not directly integrated in the lesson, youngsters play it individually at home. In the next lesson we review and discuss it.

As I noticed, youngsters really enjoyed the lesson, because it's not a formal way of education. In the beginning it's a bit hard for them to open up and to think, but after presentations and examples they are really creative and it seems that they are eager to find out more things. And they start to think about charity and their personal contribution to it. That's where the game slips in. After the lesson they were interested in the game and started playing it at home. They got even more ideas about volunteering for society and spread the game to some friends.

For now, after one lesson, they didn't change their attitude to volunteering yet, but I think it's a question of time - after more lessons, examples of volunteering, the game and the informative links that they get in the game, I think we'll really manage to create a more socially responsible generation of next donors.

Making it work

To make students start to think about volunteering and their personal contribution to the society, a clear teaching concept is needed. A social impact game can contribute as a part of that lesson structure and should be accompanied by other methods like presentations, group work and discussions, as seen in the example with Mrs. Motivāne. The game could be played at home by students to get another approach on the topic of the lesson. That way students can choose their own pace and way to play. Back in class, the game should be reviewed and discussed or used for further work on the topic.

At the moment, there are not very many good social impact games available. Part of the issue is that several games approach these topics as themes to dole out through dialogue and cutscenes, but not through action within the game. That way, they don't really take advantage of the medium's strengths, which is the game design itself.

Other games with a social background don't succeed because the game and the subject are not well interwoven with each other. Or because the content doesn't fit with the game.

The simple game "iBeg" for instant, deals with the topic of homelessness in Vancouver, Canada. The player is homeless and needs to obtain or increase points in hygiene, health and spirit. He or she does so, by begging, taking a shower and so on. In our opinion, it was a nice try, but ultimately falls down.

To play something in such a light hearted way regarding what is a harsh reality to real homeless people doesn't actually help anyone to understand their situation.

Sometimes, the content is too thin: it's fun to play, but the impact and subject of the game is very light. Games that are too heavy and filled with too much content are the other extreme. In that case the game is the afterthought and players have only little or no intrinsic motivation to play.

We would like to show you some good social impact games and suggest how you can use them in your classes. If you would like to be updated regarding new social impact games you could make it a point to regularly check this website: http://www.gamesforchange.org/. This organisation holds a festival each year on the topic "Games for Change" and highlightsn good and new games that reach out to change people's attitudes. This can give you an idea of what's new and if it could fit to your school themes.

CHARITY CITY

Cost: for free
Platform: Android, iOS
Subject: Charity work in society

en-de-lv

The Jump'n'Run game, which can be played for free on the mobile phone gives students an idea of how volunteering in the society can look. It addresses the topic of young volunteers with a fun approach. The goal of the game is to become king or queen of Charity City by getting people to vote for oneself. The sympathy of people can be gained by helping them directly or helping in organisations that do charity work in town. The target group is teenagers of 12-16 years.

The levels handle different volunteering topics: Helping an old man buying groceries in the supermarket, feeding birds, serving in a charity restaurant, planting trees, cleaning up a park, taking a shelter dog for a walk and feeding cats in a shelter. Attached to each level, there is a connection to the real world by listing ideas on how you can volunteer in real life. For instance, examples of international organisations for animal care that have special volunteer programs for youth.

Website:

http://eduproject.eu/believe/?lang=en

Download in Google Play Store:

https://play.google.com/store/apps/details?id=com.ingeniousknowledge.charitycity

Download in Apple App Store:

https://itunes.apple.com/de/app/charity-city/id1236750485?l=en&mt=8

Bury me, my love

Cost: Low
Platform:iPad, iPhone, Android Phone, Android Tablet
Subject: Refugees

fr-en-it-es

Bury me, my Love is a text-message-based game designed for handheld devices. It tells the story of Nour, a young Syrian woman who is leaving Syria to find refuge in Europe. Majd, her husband, stayed back in the homeland; through a messaging app, he is going to do his best to give her some directions so she can reach her destination safely.

The game lets you to walk in Majd's shoes. How will you help Nour overcome the difficulties she encounters? The only tools at your disposal are text messages, emojis and selfies. You will be able to track her progress as she moves from one city to the next, and together you will have to make choices that could have direct consequences. Give your students an idea on what a refugee lives through during her journey to Europe.

Website: http://burymemylove.arte.tv

Life is strange

Cost: Medium
Platform: Windows, Playstation, Xbox, Android, iOS, Linux, Mac OS
Subject: Choices

en-de-fr-it-ja-pt-zh cn-es

This is a story based choice and consequence game. The protagonist must tackle the challenges of growing up in the game, which are often relevant to the target group of 14-19 year olds. The player is Max, who saves her old friend Chloe by discovering she can rewind time. The pair soon find themselves exposed to the darker side of Arcadia Bay as they uncover the disturbing truth behind the sudden disappearance of a fellow student. Max also must quickly learn that changing the past can sometimes lead to a devastating future.

The game is quite long, so it was watched as a video rather than playing it in the group using 'Let's Play' videos on Youtube. The youths watched how others play the game and decide. This allowed them the chance to discuss and reflect on the reasons people made choices. The experience was that age differences have a strong impact. It was noted that the older ones were very quiet and thoughtful. A reason for this could be the different maturity and life experience. In that sense, it may make sense to work with more homogeneous groups.

For more information in German visit

https://digitale-spielewelten.de/projekte/alltagshelden/116

Website:

https://www.lifeisstrange.com/en-us

Chapter 10: Games for health

Candy for breakfast?

It's the morning and the school bell is ringing.

You'll often see the same scene in school across Europe: Many children come to school without breakfast or buy their breakfast at a school kiosk. This kiosk offers sandwiches, fruits and of course many sweets. It is obvious that most of the children prefer sweets.

The children who have breakfast with them are getting more and more sugary spreads, drinks or snacks. A common side effect of this is that children are often overweight, which in addition to the health issues, can lead to exclusion and bullying. Most importantly though, obesity in childhood is also the cornerstone of secondary diseases such as diabetes, dental caries or bone, muscle and heart diseases.

Ultimately, consuming so many of these nutritionally empty foods has a negative impact on the performance of pupils. The children who are so filled with sugar can suddenly crash, losing energy, show a lack of concentration and are quickly hungry again. Starting the day with a healthy meal is so important, and those who don't suffer many disadvantages. After all, as a teacher, it is difficult to talk directly with parents about the fact that children have an unhealthy lack of good nutrition.

On top of this, the children are more attached to their mobile phones than ever. They 'zone out', lacking awareness of their surroundings and become lazy. Instead of playing games in the schoolyard, they seem glued to their mobile phones as they sit nearly motionless. We know that poor nutrition and lack of exercise have serious consequences for brains, bodies, and on social life.

So what can we do about this without involving the parents directly, and in a playful, engaging way? Why not integrate video games and apps that encourage healthier living into school? You'd be surprised how the use of digital games can have a positive impact on: 1) Physical and Mental Fitness, 2) As a tool for Prevention and 3) Nutrition.

In 2014, DeSmet et al. conducted a meta-study of 54 studies with 51 games and demonstrated that the use of G4H actually has an impact on the health of players. The study results were independent of age and gender.

The games were played on average 4 hours per week for 3 months and had an impact on health. Above all, the study showed that players led a more adapted and healthier lifestyle due to the use of the games.

DeSmet et al, 2014. A Meta-Analysis of Serious Digital Games for Healthy Lifestyle. Promotionhttps://www.ncbi.nlm.nih.gov/pmc/articles/PMC4403732/

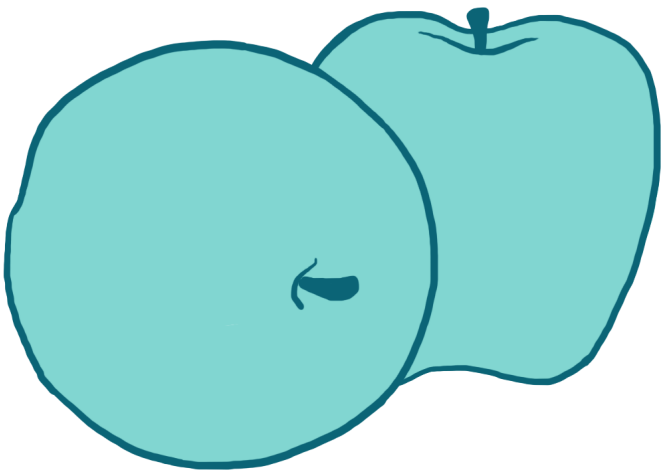
Of course not all children lack a healthy lifestyle, but for some these games might just be the first step towards a new awareness and appreciation for fitness and nutrition. Nobody is more playful, imaginative and positive than children. Children also tend to trust their caregivers and this trust

should be cultivated responsibly. Teachers can help guide the students to live healthier, better lives.

Inside this chapter you'll see some info boxes about some games that you could consider introducing to your students so they can start thinking about healthier living.

Often, a healthy lifestyle is associated with engaging in sport activities. However, games for health can also be about games that combine nutrition with other school subjects such as Biology and Math. These games are PC-based and available online.

For example, you can find a range of games on the topic of nutrition at Fruit & Veggie Color Champions (*https://foodchamps.org/*).



Fruit & Veggie Color Champions

Cost: Free
Platform: Browser based
Subject: Nutrition

fr-en-it-es

This website offers a wide variety of games. The learners between 2-8 can play different games, including a game that uses maths.

In the game 'Farm to Fork' players learn where fruits and vegetables come from and how they get to market. The player has to choose, whether he or she wants to care for a field or orchard. They have to 'add rain and sun' on the vegetables/fruits. Than they are responsible for the harvest and the logistic getting the food to the shop.

In the another game 'Fruit & Vegetables Math' players proves their mathematical skills with fruits and vegetables. In various mathematical tasks, the player adds, subtracts, divides and multiplies fruits and vegetables.

There is a lot children can learn, such as:

Naming fruits and vegetables, Categorising food by food groups, Combining knowledge about nutrition with different school subjects, Cooking with vegetables and fruits.

Home page: *https://foodchamps.org/*

The introduction of video games in lessons or school sports, can encourage children to develop a new understanding of fitness. Don't believe it? Sure, older gaming platforms required that players be seated with a control in their hands, barely moving more than their thumbs, but modern consoles, including the common smartphone, have methods for noticing, and therefore encouraging movement. A pretty famous phone example would be Pokemon Go, which encourages players to walk around to try to find various Pokemon on their phone. There are others as well, such as The Walk, where you have to carry a package the equivalent of across the length of the UK to save the world, or Zombies, Run! in which you have to run away from packs of zombies and collect items to build up a base. Games such as these act as a sort of pedometer plus, making walking or jogging a bit more fun and less mundane.

There is also a treasure trove of activity inducing gaming to be had in console games. Platforms such as the Xbox, Nintendo Wii, Nintendo Switch, and others, have allowed the development of games that not only encourage movement to play, they require them. One famous example would be Dance Dance Revolution, or DDR. This dancing and rhythm game was originally found only in arcades, but now can be played on everything from computers to mobile devices, to older models of Playstation and Xbox. This game is already used in some school and university settings to supplement physical education and some people claim to have lost weight playing the game. Use of the game usually requires a special pad to dance on so the game can register your moves.

Keep in mind that in some cases the software and hardware required to play the physically active games have been discontinued. Xbox's Kinect system, for example is no longer supported, and the Wii is no longer produced. However this might benefit the school or teacher, since it could be cheaper to get older systems than newer ones. On the other hand, mobile phones continue to have gyroscopes and accelerometers and the Nintendo Switch has built in motion sensors in their controllers as well. Furthermore some of the virtual reality games can register your movements and could be used to encourage exercise. These systems can be used with computers or Playstation.

Playful school in the Azores.

Each year on 16 October the Secondary School of Lagoa organised a 'Day of Food' with their students. This goes along with the 'International Nutrition Day' to teach students about the need for healthy eating combined with physical activities.

One of the teachers had the idea to build a station for playing sport games. This station is placed in the inner playground, equipped with space for the players, an XBOX, a projector and speakers. There is always a teacher or an older student there to help the players use the game and assist with technical equipment.

The students get the opportunity to use 'Play Sports' stations either during their free time, in

between classes or before/after school. Teachers can reserve the station for their class for a particular time period if they wish, sessions lasting about 45 minutes. The school has found it to be a fun and effective way to encourage better living among their students since their students seemed to find the activities fun and engaging.

In addition, fun apps can also be integrated into physical education lessons, which should motivate the students to move outside of school. We've mentioned Pokemon Go and Zombies, Run! and The Walk which act as pedometers as well as gamifying walking/running. Another very cute one is Wenji Zhu's fitness app Wokamon. By encouraging the use of unusual and fun apps, we can turn couch potatoes into children who genuinely enjoy moving.

Wokamon

Cost: Free
Platform: Android, iOS
Subject: Fitness

en-de-da-fr-ja-pt-es-zh cn-zh tw

Wokamon is a pedometer that lets you raise virtual pets (remember tamagotchi?) for mobile phones. As soon as the application is running, the player's steps are counted. Within the app the user has several virtual pets and the more the player moves or runs, the more these pets, called wokamon, grow. So the more steps the higher level the wokamon become. The more the animals grow, the more crystals the user receives which can use to buy clothes and toys for the wokamon. The app is a real eye-catcher for children because of its funny and lovable wokamon. The use of a favourite wokamon should encourage children be more active since they want to level up their wokamon which is a built in motivation.

Playful school in Germany

A school in North Rhine-Westphalia, Germany saw a great demand for digital games in physical education and decided to launch the project "Wir treiben Sport" (We do sports). Here a test run with 16 students was made.

The aim was to motivate the pupils to have more fun with the sport through games console.

Within the 3 project days, the units "Sport with the Wii-Fit" (focus: muscle exercises and yoga training) were developed. The experience of the teachers was that children who had previously been uninterested in sports, our so-called 'couch potatoes', could be motivated to do sports when using the game console. Some of the students were even interested in attending a yoga course. The students become encouraged to engage in sports activities with lots of fun and intensive physical exertion.

The school came to the conclusion that there is no reason why modern game consoles should not be used in sports lessons as an accompaniment to regular physical education to help inject motivation and fun in movement. As always, of course, it's still important to make sure the game console doesn't replace physical education, or the teacher, but is

an additional tool for increasing enjoyment of movement and giving more students the idea that they too can be 'athletic'.

An ounce of prevention

There are also several games for prevention in the games for health sector. Preventative behaviors can be important in several health areas, such as in sex (avoiding diseases and unwanted pregnancy), drug abuse, transmission of viruses and bacteria as well as promoting positive behaviours such as regular teeth brushing.

How often have you witnessed a single child with the sniffles turn into an entire class of sick children in your own classrooms? With so many people crowded in the same room, touching the same markers and desks and doorknobs it seems inevitable that everyone will catch whatever is going around. Enter the e-Bug site, where you can find games which are designed to help children learn simple hygiene to help halt the spread of disease. All activities and plans have been designed to complement the national curriculum. The student pages complement the teacher's resources by offering online games, revision pages and more to continue the learning experience at home.

Prevention also includes educating children and adolescents about safer sex and drug abuse. Nowadays the market offers a number of opportunities to playfully communicate about these sensitive topics in the classroom. One game created by Middlesex-London Health Unit of London is 'Adventures in Sex City'. In a cheeky and uncomplicated way, the game informs the player about sexual diseases and how to protect oneself from them.

E-Bug

Cost: Free
Platform: Browser
Subject: Health

en-cy-fr-vls-bg-el-tr-cs-da-de-hu-ga-it-lv-lt-nl-pl-pt-rw-ar-es

e-Bug helps children learn about ways they can help prevent the spread of disease and how infection works. It can be used in both the classroom and at home and has fun games that children of all ages can benefit from. This game is developed for two target groups. For junior school children (9-12 years old) and senior school children (13-15 years old). The website has resources for both students and teachers.

In one game, 'Stop the Spread', players can see who is infected by the green aura around them. They must drag a tissue in front of the infected person's nose before that person sneezes, or else the infection will spread to others. Players also have to dispose of the dirty tissue in the bin and make sure not to touch any other characters with it as this would also lead to a transfer.

Main link: *http://e-bug.eu*

Adventures in Sex City

Cost: Free
Platform: Browser
Subject: Sexual health

en

The game "Adventures in Sex City" is an educational video game about handling such a sensitive topic as safer sex. In the game, the city is attacked by the villain Sperminator. Players can choose between the characters Captain Condom, Power Pap, Willy the Kid and Wonder Vag and protect the city from being overwhelmed by their sperm. The opponent and the player engage in a duel in a quiz about safe sex. With every correct answer, the player protects the city from attacks. For every incorrect answer, the game will explain why the answer was wrong. The game teaches about safer sex, facts about sexually transmitted infections, and the notion of assuming responsibility for one's own health.

Main link: *https://www.healthunit.com/adventures-in-sex-city*

Data security

Some teachers are worried about the use of apps with their students' tablets or smartphones in relation to the data security. Rightly so.

Of course, this is no less an issue in the games for health sector, perhaps more so. Depending on which provider the games are purchased from, critical and private data can be passed on such as health status or physical activity. Many app vendors offer their apps free of charge and then finance themselves through sale of the personal data of consumers and their usage behavior. As a result, various permissions by the user are only released before the start of the installation.

You can try researching 'top ten' lists and review the ratings and comments for an app to get some idea on how data is handled, as well as if there are any costs. Everyone should also make it a habit to read the terms and conditions. In most cases, they provide information about the apps specific business model and whether or in which cases costs are incurred. In the Privacy Policy every provider must list what data it collects and what it does with it.

More detailed information and explanations on the subject of data security can be found in chapter on Data, Ethics, and Safety.

Chapter 11: Data, ethics & safety

Protecting your pupils' data when using games.

On Friday 25th of May 2018, the EU General Data Protection Regulation (GDPR) came into law. This law aims to protect the rights of EU citizens to control who can store their data and what they can do with it.

Most of the time when you're using a game with a class, there won't be much cause for concern but you should think about what kind of data any game might be collecting, and how this data could be used by the companies who make the games.

Any game that collects data on its players will have to inform you of what they intend to do with the data if they are going to comply with the GDPR. This means being more accountable to players of any game or service, making it clear to players where their data is being stored, and allowing players to correct or delete personal information stored by any game.

They will have to:

- Inform players that the game is collecting information
- Give players the right to access their data
- Allow player to ask that their data not be used in certain ways
- Correct any information they have wrong about a player
- Allow players the choice to delete the data held on them.

You should pay particular attention to the privacy information the game shares with you when it is first installed, or when you look in the menus for it. (Hint - it might be under a "help" menu or an "about us" menu or a "your settings" menu).

What data might be collected?

Much of the time, when you use a game with pupils there isn't really anything to worry about. An online web-based game that doesn't use logins won't know anything sensitive or important about its players. A console game that is used on a machine with no internet access can only save the player's data to a local hard disk. But online games or games that use internet connected games or apps on phones or tablets could be transmitting all sorts of information (if the creators of those apps wanted them to!).

You should make your pupils aware that when they use any game, the information they share will be living on a computer somewhere else and that if this information was hacked, that it could end up being shared in a way they wouldn't want. This is particularly important where a game saves personal information like real names, sexual orientation, private messages, photographs and videos, or GPS locations.

Talking with your pupils about the apps and games they already use can be a good way to make them aware of the possible risks of sharing data online. They may already be aware that apps such as Snapchat and games like Harry Potter: Wizards

Unite track their location and can allow friends to find them. Asking questions like "Who else can see the locations you share using these apps?" can help them realise that there are people at the companies who could see their data, that friends of friends might be able to see their data, and that even strangers who know how to manipulate the rules might be able to see their data.

There is a good set of "Safe Internet Behaviours" available at *http://www.safetynetkids.org.uk/personal-safety/staying-safe-online/* and these apply in games as much as they do in any other online interaction. They cover good practice for how to stay safe online and when using mobile phones and include good advice on not sharing personal information, not trusting people are who they say they are and remembering that once you have posted a video or a photograph, you can't control what happens to it.

How can you check a game is safe?

To be sure that a particular game is safe, you need to think of different types of safety.

Virus Safety

You need to make sure that the actual copy of the game you are using is legit and that it won't introduce a virus to the computer, phone or tablet that you're using it on. The best way to be sure that the game is legit is to get it from an official source. If you are using a purchased console game on disk or if you're using an app from an official store like Google Play or Apple's App Store then you can have confidence that the game is not going to infect your machine with anything nasty.

Age Group Safety

For many games you will find a PEGI (Pan European Game Information) or ESRB (Entertainment Software Rating Board) rating. These are industry groups who rate games according to strict criteria and give them an age rating. Additionally they tell you what kinds of content are contained in games that could be inappropriate for some children. This extra information comes in the form of "Content Descriptor" (from the PEGI system as explained here: *https://en.wikipedia.org/wiki/Pan_European_Game_Information*).

You can also find groups who run websites to help families and schools understand which games are suitable such as *http://www.askaboutgames.com* or who maintain lists of good games for using with young children such as *https://www.familyeducation.com/entertainment-activities/activities-kids*

Content Safety

Sometimes you will want to use a game that is not PEGI / ESRB rated for your age group - or which is rated for an advanced age group, but which you think may be suitable in a controlled context for your pupils.

A good example could be Assassin's Creed Origins. This 18+ PEGI rated game is very violent but could have possible uses in teaching history - providing the teacher facilitates it well.

AC:O illustrates that crucial middle point of history where Egypt was being culturally influenced and wrestled over between the Ptolemaic monarchy, the Greeks, and the Romans,demonstrating the influence and confluence of their cultural and architectural styles throughout the regions you can explore. You'll find very ancient tombs and Egyptian religion (Ra, Anubis etc.), Colosseums, crucifixions and Caesar, and the Great Library of Alexandria and their Roman pantheons and statues. While the exact details are not adhered to so as to allow the story to flow in an entertaining way, it does a great job of displaying that particular scene within its regions. You can see the inside of a tomb (which is now not really possible in the real world), the great sphinx at scale (smaller than you think!), an imagining of the great library (which doesn't currently exist), and the disconnect between the peasant population and the learned city folk.

If you were to use this game, as a teacher you should ensure you activate "Discovery Mode" that turns off all violent features and lets players explore ancient Egypt with added educational features.

In this situation, the easiest way to be confident that there will not be any inappropriate content is to play the game yourself and, if possible, create a saved game file so that your pupils can load your game and start playing from the place you have personally checked is OK.

Chapter 12: Use of simulations

Is this the real life?

If you've ever had your hair cut or styled professionally, you've benefited from simulation based training. Before they are allowed to touch a human, most hair stylists practice their techniques on a plastic head with hair that they can cut, color, and style without fear of ruining a real person's hair. It's not very fancy or high tech, but it is a type of simulation. You yourself probably engaged in some form of mock or practice teaching scenes during your schooling and training. We can use technology to enhance this practical form of learning.

The goal of simulation based learning approaches is to create a (usually simplified) copy of a world, situation or setting where one can practically demonstrate the knowledge one has gained or observe something difficult. One of the reasons that simulations are popular in learning is because they let you have a glimpse of processes that are impossible to observe directly. Evolution for example takes a long time, you can't observe a prehistoric ecosystem, volcanoes are dangerous, and you can't travel to space and land on Mars (yet). Edward Norton Lorenz, award winning mathematician and meteorologist, made a substantial breakthrough with the chaos theory when 'playing' with a weather simulation in computer. Such simulations give us an understanding of real phenomena and that experimentation with them allow for construction of science.

Simulation can allow experiments to be conducted within a fictitious situation to show the potential real behaviours and outcomes. It's also the case that using gaming simulations can produce somewhat more positive attitudes toward the subject matter being studied compared to other teaching methods. Simulations have a number of advantages in the teaching of science. They are great for which activities cannot be performed in the school laboratory because of the danger involved or for the ethical considerations of animal testing. They can help in reducing the cost and time of some laboratory experiments. They free up teacher time so that they can interact with students instead of dealing with the management of the experimental setup/apparatus. More importantly simulations offer an easy way of controlling experimental variables, opening up the possibility of exploration and hypothesising.

The video game SimLife: The Genetic Playground allowed users to create an ecosystem in the classroom to watch 'evolution' unfold. The students could explore and debate the phenomena in an interactive experience, one that was more akin to the dynamic process of evolution. Interactive simulations or games report higher cognitive gains and better attitudes towards learning compared to those using traditional teaching methods. This game was designed in 1992 and is no longer able to be run on modern computers though it might be possible to run on so-called 'emulator software'. This would require the help of someone knowledgeable about computers, for example if the school has an IT department.

Teachers tend to use other valid pedagogical approaches when addressing evolution. However, when a teacher shows a picture of a chimpanzee in a class and say 'this has a shared ancestor with us' the teacher is trying to create a 'virtual world' inside the class where the students must imagine (which is difficult) that a great number of generations ago they had common ancestors with that ape. An image or a movie is harder for the teacher to explain and for the student to understand. A picture of a chimpanzee is just a chimpanzee, even a sequence of reconstructions of possible intermediate forms, approximations of what our ancestors may have looked like based on the archeological findings, does not explain evolution by itself. A video game that simulates evolution could use the known evolutionary principles and that's what SimLife does to some degree. The students wouldn't be watching real evolution but manipulating a dynamic process embedded in the simulation would help them understand the dynamic process of evolution. Teachers use the best strategies that they know and can prepare them to use inside the classroom to be time effective but, today, many opportunities are emerging in the form of simulations in video games.

The key point is to interact with a dynamic process and a simulation embedded in a video game could work better since games are interactive and engaging. Many kids like to play simulations or at least games that contain simulated aspects, like Football Manager (http://www.footballmanager.com/).

Kerbal space program/ kerbalEdu

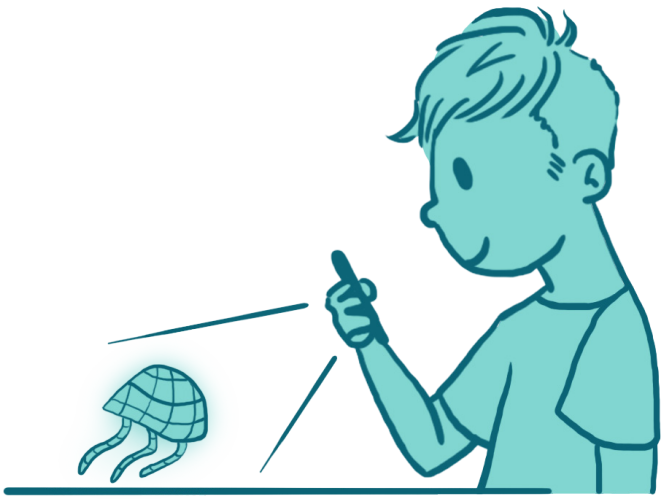
Cost: Medium/High
Platform: Windows, Mac, Linux
Subject: STEM
en-de-fr-ru-ja-es-zh cn

Kerbal Space Program is a physics based space flight simulator that you can play on your computer. Build your ship, launch it into space, don't crash! The physics of Kerbal are nearly realistic, or in their own words; 'While the Kerbal-physics are good, they are not perfect. Take the learning opportunity and explore how they differ'. Astronaut Scott Kelly has even said that 'NASA could probably use this to teach future astronauts orbital mechanics'. Though it started life as simply an entertaining flight sim, the developers have created KerbalEdu to help teachers bring the game into their classrooms, and have even integrated learning analytics into the game, accessible through teachergaming.com

Video games like **Kerbal Space Program** are very popular. Kerbal tries to simulate the process of space exploration from the rocket development phase to the planet landing. It's by no means a perfect simulation, but does bring some real aspects into play. However, **The Orbiter Space Flight Simulator** (http://orbit.medphys.ucl.ac.uk/) would give you a gaming approach that also would help understand what happens in the real situation. Nevertheless, not a simulator that you want to use blindly in the classroom because you will have a hard time understanding it and even a

harder time explaining it to the students. Kerbal would be more suitable for use in the classroom. Plus there already exists an education version of this game called KerbalEdu, so its a video game transformed to better suit the classroom, and hopefully this trend will continue in the future. At the moment, many commercial games can have a serious approach in the classroom. Nevertheless, good things are on the horizon.

Currently the uses of simulations can be drastically improved upon with the help of augmented reality and virtual reality (VR). VR parks in Japan are showing the potential of virtual reality. It's the jump from the screen into the game itself. These technologies can revolutionise teaching. The holodeck from Star Trek is soon upon us. One day, you can bring students on trips inside volcanoes or to the moons of Jupiter. Your school may not be able invest in expensive VR technology, however, you can make your own Google VR. On the other front, we can find the augmented reality. You can look to reality in different ways. Looking through your mobile device will allow you to translate texts written in other languages. You can turn your phone to the night sky and see the names of the stars. There are many types of augmented reality and many types of approaches to it, but Microsoft Hololens is a good example of what the future of this technology can bring. Today, Microsoft Hololens are being used in fields like space exploration, medicine and architecture. Soon they will reach the schools. All of those technologies can improve educational video game simulations, making them more real and immersive. You can look more into this topic in chapter 24, the Futures of Games in Education.



Chapter 13: Games for problem solving

Using games for problem solving

Commonly when teaching a subject, the teacher has to help the pupil move from a base 'abstract' form of factual learning to a deeper more practical form of learning. It is one thing to be able to perform calculus or answer some historical fact when directly challenged, but being able to access the correct piece of knowledge and being able to use it with the correct procedure at the right time is a challenge for many learners. Doing so requires being able to detect the patterns that map onto our knowledge even when those patterns aren't highlighted for the pupil.

What problems can problem solving games help with?

- If a pupil is able to answer any didactic or procedural knowledge question when directly asked - but struggles to do the same or becomes frustrated when the problem is presented in an unclear way.
- If the kind of pattern that occurs in the real world is rare or if it is hard to find safe ways to create a practical scenario within which to use knowledge.

What is the role of the game?

A good problem solving game must be appropriately realistic and accurate to support learning. The actual skills and learning outcomes that are important for the class must be able to be used in the game itself. That doesn't mean the game has to be 100% realistic though. A bridge simulator game may be suitable if the focus of a lesson is on transferring forces through support beams and so on, whereas if the class was about specific material strengths and the game did not accurately model this, then there would be a problem.

In addition to the game being appropriately accurate it is important that it doesn't flag the type of problem it contains. If the scenario presented to players is obviously about a particular exercise then some of the benefit of moving away from traditional methods to a game are lost.

The game should allow the player to take part in scenarios that draw from a range of the knowledge and skills being taught and should present the kinds of real world problems that such knowledge and skills apply to naturally. The player's job should be to draw upon the classroom learned knowledge to progress in the game.

Examples of good problem solving games

Strategy games are often good candidates for problem solving since they are often open ended and support a lot of player choice in how to approach a problem. A good example would be the game Fate of the World. This game which is available for PCs puts the player in charge of setting policies for various countries as a powerful NGO. The player has to meet certain climate goals whilst maintaining popularity in the countries over which they govern.

In a geography context, Fate of the World can be interesting because it requires that the player not

only pay attention to different pieces of information about climate science and energy policy (e.g., the amount of solar energy available in a location) but must also pay attention to the social and political factors affecting their country. There are no simple decisions in Fate of the World - the player must bring a wide range of skills and knowledge about modern affairs and environmental science to do well in the game.

Other games like Kerbal Space Program, which we discuss in the chapter 'Use of Simulations', also serve as a good example. In Kerbal Space Program the player must help their humanoid alien 'Kerbals' to get off their home planet and reach the 'Mun'. Although it is clear to the player that hey have to use physics and maths in their pursuit of space travel, the player isn't presented with formulae and instead can try a wide range of arrangements of components in building their spacecraft. However, by applying what they have learned about aerodynamics, payload weight, heat shields, gravitational orbit boosting and so forth, a player can really see how the relatively abstract concepts they learn in class apply to a 'real world' scenario. The game may be fantastical and fictional but the physics of the game are close to true to life and offer a lot of potential for use in class.

Real case

We return to Escola Secundária de Lagoa where Mr. Freitas and Mr. Silva have heavily tested the use of games with various kinds of classes.

Problem-solving skills are important. Video games can give different contexts to problem solving placing students in different situations, where they can transfer and apply problem-solving skills. The use of Human Resource Machine and SpaceChem aimed to do exactly this kind of problem-solving approach. These video games contain coding concepts that can be potentially transferred to coding languages in general. These game were used in Hour of Code and Code Week in activities that were done in an open classroom situation at Escola Secundária de Lagoa. The ICT teachers would bring their students to a prepared space in the hall of the school where the games were available. Some teachers had some previous preparation and others were helped by one of the organisers of the activity (Mr. Freitas). There was a video projection on the wall where the fundamental mechanics of the games were highlighted. Also, some materials on paper and videos that contain the solutions to the initial levels of the games were given to the students, so they could rapidly understand the games.

Human resource machine

Cost: Medium
Platform: Windows, Mac, Linux
Subject: Programming

en-es-de-nl-pt-it

Human Resource Machine is a puzzle game about transporting objects from one point of origin to the destination using command lines. The player must give the right commands so the character can choose the right objects in the right order, skipping the undesired ones. The game take this simple mechanic to complex situations forcing the player to give a sequence of commands that work. The game tries to imitate the coding principles used in programming languages and has some correlation to real coding. The student can learn some basic ideas about programming in an interesting environment.

The game is presented in a very simple way, but requires some time for the player to learn its mechanics, but favours and facilitates experimentation.The game is solo, but works well in groups of students working together to reach solutions, communicating with each other and sharing possibilities and discoveries.

SpaceChem

Platform:Windows, Android
Subject: Chemistry/Programming/ Engineering

en-de-fr-ru-ja-es-it-pt-ja

SpaceChem is a single player puzzle game where you control pathways that lead to the production of molecules with atoms and other molecules. The game uses logic and science to accomplish its goals and stimulates creativity because it allows some degree of alternative solutions.

The game can be used to teach some computer science ideas, even if the game is not about coding and can get players interested in chemistry and engineering; the game is difficult to understand at first, but has good tutorials. It requires time in preparation and for the student learn its mechanics, but it can payoff with older kids. The menus and interface are simple enough end easy to navigate. It's a one player game, but it work well as a group problem, where the students can share and discuss solution. The game is in many languages.

Teachers that had previous knowledge of the video game jumped right in and controlled the open class with no help from the organisers of the event. The ones who were in contact with the video game for the first time needed early guidance but had no difficulty taking the matter into hand after a short introduction. In the class intermissions, the gaming space was open to any student who wanted to try the games. It worked like a sit and play kind of situation in which groups of students tried to approach and solve the problems, helping each other and trading ideas, while other students just watched the others play. One teacher was always supervising and giving advice and help to the students. Human Resource Machine was an easy game to approach but SpaceChem is a more abstract game and only some students could handle it by themselves in the 15 min time of the intermission.

We can't overlook the fact the teacher managing the event had previous experience with video games and was interested in using them and showing to the school their potential. Human Resource Machine was a video game that had its particular coding language and the idea was to interest students about coding in a game environment. Mr. Freitas wanted to address the problem of how to make students interested in coding. He also wanted to give the more advanced ICT students situations to transfer already acquired coding skills. SpaceChem doesn't have a coding language per se but the resolution of its problems was considered to have an affinity with coding concepts and problem solving in general. Both games allowed for different solutions and that was seen as an opportunity to recreate a coding community where students could compare ideas and search for optimal solutions. Bringing the computers to the school's hall was a choice that made possible to create a situation where the idea of playing the game could spread to others.

Each class spent approximately an hour using these video games that addressed problem-solving concepts with the possibility of the different paths and optimal ones. As was previously pointed, helpful materials were available and in some situations extra instructions were given about the interface and game mechanics. The students were in front of their computers and the teacher supervised the experience, noticing initial difficulties and giving advice, especially in the first levels where problems with the interface were more frequent. After a while, many students were trying to solve the problems on their own and some of them were trading ideas about how to solve the situations presented by the game. Two of the teacher tried the game before and that experience directed them to the more relevant educational concepts. The teachers circulated around the students making observations, asking questions and pointing out flaws so the students could improve their solutions by asking them to think about what they were doing as they would in a normal class.

Jose silva testimony, and ICT teacher experience

Mr. Jose Silva's story is about what he thinks the students learned, with an interesting correlation between the knowledge of programming and success in these videos games .

Mr. Silva says that the students had an evolutionary learning of the concepts in the same way as the programming classes, for example:

- global and local variables;
- language syntax;
- the semantics of language;
- basic control structures;
- complex control structures;
- structures within structures;

The teacher thinks this development of the knowledge allows the students to acquire competencies that they can use in other learning situations. Regarding the experience with the game, in an hour and a half and asking students to do their best in programming, the first lesson the teacher drew from the game relative to the development of the students was that the ones who showed better results in the practical programming disciplines did better and surpassed game levels more easily. In an hour and a half of the activity, these students had gone further in the game. In this way, he thinks that the acquisition of knowledge in the level of classroom programming may have a direct correlation with the ease of learning the concepts, mechanics, and structure of the game.

The reverse process could not be directly observed because the game was not used to learn to program at the command line level, but the expressions and comments of the students helped to understand that the game could be a fun way to learn to understand the basic ideas of programming.

Human resource machine

With Human Resource Machine Mr. Silva registered some comments and analysis made by students, and these examples highlight the transfer process from real programming to the game mechanics:

'The game's JUMP command is the same as the GoTo command in our programming!';

'Inbox is the Basic InputBox and Outbox is the MsgBox'.

The teacher considered this to be very interesting due to the fact that without any encouragement from him, collaboration and cooperation emerged among peers to overcome the levels and interpret the situations that were proposed by the game. He thinks that this kind of situation does not happen so often in the classroom. The use of the game created motivation for collaboration. One of the comments made by the student highlight this idea:

'I'd rather help you than get as far as possible in the game …'

All of these factors stand out because of the way they came about. It was not the teacher who

encouraged collaboration and reaching as far \as possible in the game, but rather the game itself which motivates and implicitly provokes this reaction in the students.

Another interesting development was the students' search for the best possible results. It made them practice the level more and try to achieve 'perfection'. In a classroom situation this factor only stands out in individual work and even then there is not a demand on the part of the students to improve the task accomplished. Again, because it was a digital game, it encouraged the students to seek the best score and the best performance, practicing and trying to understand all the mechanics for such success.

SpaceChem

SpaceChem was introduced to students as a game of logic and understanding of control structures, mainly cycles. The students' interpretation of the game was more complex than expected because SpaceChem does not present itself with common learning techniques. Students who usually have a logical reasoning for a good level of programming found it very easy to overcome the first obstacle (first level without tutorial).

There were many questions about the use of the input and output variables - alpha, beta, psi, and omega, because the way they are presented does not allow the learning of variables in the game as it does in class. For example, the small process of acquiring a molecule in the ALPHA space and delivering that molecule into the PSI space causes the student to enter into the complexity of not being able to identify in the process what is and is not variable.

What Mr.Silva meant when he says that the game 'does not allow the learning of variables in the game as it does in class' is that the context of the video game is different from a coding class but could be an opportunity to create a skill transfer scenario. He thinks that this may be a possibility because of the correlation that he witnessed between performance in code skills and performance in game that require skills akin to code. He also added that he would like to see if this game could be used for enhancing or even learning coding skills with students that did not know anything about code, and that was the initial hypothesis of Mr.Freitas when he decided to bring this game to the school. Probably the game won't teach coding per se, but it may create interest in doing that and some understanding of how coding works.

Chapter 14: Serious game theory

Back it up with science

Over recent years digital games and also serious games have increased in complexity (see Rooney 2012, 43). Therefore, it is important to support Serious Games and Game based-learning with sound theoretical frameworks.

If you have a closer look at Serious Games many people talk about increasing motivation. You can easily find sentences and statements like:

'It is widely acknowledged that such games can provide an engaging, motivating and "fun" experience for students'. (Rooney 2012, 41) or

'Integrating in the game characteristics may add motivational impetus and engaging elements that could assist in facilitating learning' (Charsky 2010, 180 referring to Aldrich 2004 / 2005; Alessi & Trollip 1991 / 2001; Gredler, 2003; B. Herz / Merz, 1998).

But, there are also meta studies focusing on motivational aspects of game-based approaches and serious games. In such a meta study of Wouters / Oostendorp and Spek from 2013 the researchers found that serious games 'were found to be more effective in terms of learning […] and retention […], but they were not more motivating […] than conventional instruction methods'. (Wouters / Nimwegen / Oostendorp / Spek 2013, 1) The reason for that would be that students often can not choose the game and the timing of when and how long they have to play. In total though, the meta study shows more pros to serious games than to conventional learning methods.

The educational value of serious games is addressed by many writers and researchers. Most of them address the potential of serious games and game-based learning to facilitate situated learning (cf. Prensky 2001; Kirriemuir / McFarlane 2004; Van Eck 2006).

Therefore, the special add-on which is provided with game based approaches is the easy way to transfer the learners in a situation in which they can learn and which can be used as a prototype for situations where they use there competencies and skills.

Another theoretical basis for game approaches and serious games is the so-called model of flow. A very popular approach in this field is the flow idea of Chen from 2007 (cf. Chen 2007). In this approach it is important that a player of a game gets in contact with both challenges and skill improvement. The more skills the learner has, the more challenges and problems can be addressed and solved. If the player has more skills than he needs in the challenges of the game, he will be bored. Otherwise if there are high challenging situations in the serious game, which are not fitting to his skills, there will be anxiety. For example, if you need to solve mathematical riddles in a game for learners in high school and all the riddles only address additions and subtractions on elementary school level, the game will be boring after a while, because the riddles and challenges will be too easy to solve for the higher skilled learners. And if the same game addresses primary school learners but

provides riddles where the learners need analysis skills to solve them, the young learners may become afraid and will avoid playing the game, because their skills are not enough to solve the riddles. The flow theory is looking for a balance between the level of challenge in the game and required skills of the player.

The idea of a flow area means that a teacher who uses the game in education has to make sure that the game's fit of challenges and skills is within a range which keeps the students attracted to the game and lets them follow the learning path. The following figure presents the core ideas of this approach:

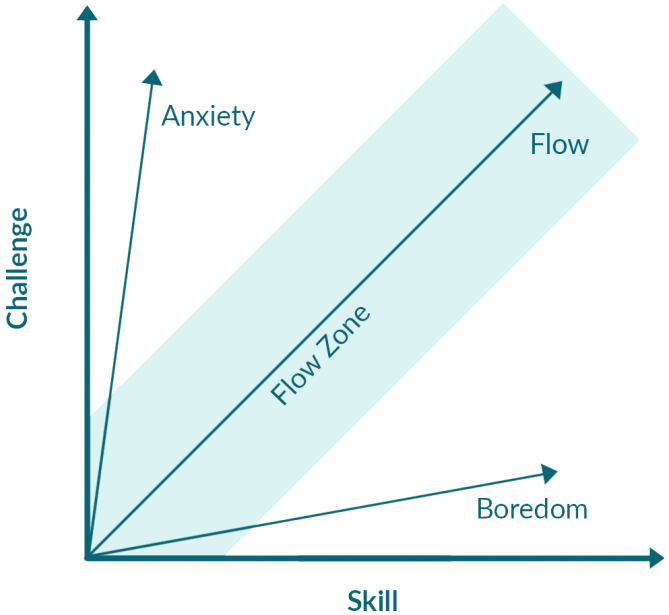


Figure 1: Skill-challenge relationship (adopted from Chen 2007)

The learning potential of computer games is high. Paul Gee had a closer look at different games and came up with a list of characteristic features of games with regard to their learning perspective (cf. Gee 2017). The first element he mentioned was interactivity. This is about the interaction between players and the interface as well as between different players. He also mentioned customisation, which is in his view promotes different ways of learning within the game. Moreover, the third aspect are strong identities, which means that the learner focusses often on a specific virtual character. There is an identification with this character and its challenges and problems will be the player's own. The same identification is provided with functions, skills and goals or aim in the game. In addition to that, Gee stated that well-ordered problems are characteristic, too. Usually, this is a part of the level design.

Interestingly, the idea that games are pleasantly frustrating is one of the characteristics found by Gee (cf. Gee 2017). He recognised that games for educational purposes may adjust challenges according the skill-level of the player. Such games provide feedback concerning the progress the learners or players are making. Games also offer cycles of expertise. By offering options for extended practice and mastery of challenges of tests the player get immediate feedback about his or her current status of expertise. Gee also addressed that games in educational contexts have to be deep and fair. Deep means that a game and its elements must be simple as well as easy to

learn and to play before complexity comes in and the game starts to challenges the player in a more demanding, ambitious and sophisticated way. Fairness of a game means that there must always be a way which leads to success (cf. Gee 2017).

In addition, many experts point out the benefits and advantages of serious games as being the ability to implement situational learning or better to facilitate situated learning (Prensky 2001; Kirriemuir & McFarlane 2004; Van Eck 2006). With regard to serious games, this goes hand in hand with the need for problem based learning approaches, which can easily combined with situational learning. Approaches of problem based learning and well structured problems according to Gee (cf. Gee 2017) support most design strategies of games. The learner has to solve missions or address specific goals which include game related problems and learning related problem and which have to be accomplished (Kiili 2005, 2007).

All these requirements and gaming elements of educational games or serious games are embedded in a setting that provides a feeling of immersion. Brown & Cairns state that immersion is an important factor in facilitating flow. It can be described as a powerful experience of game play combined with engagement (Brown & Cairns 2004). They define immersion as the user's degree of involvement. On their lowest level, the engagement level the user wants to keep playing. On the medium level, the engrossment level, the emotions of the player are affected by the game. And on the highest level, a player feels cut off from reality and is only focussing the game. This also means that the player loses the connection to his or her real life and puts the game over all other needs and interests.

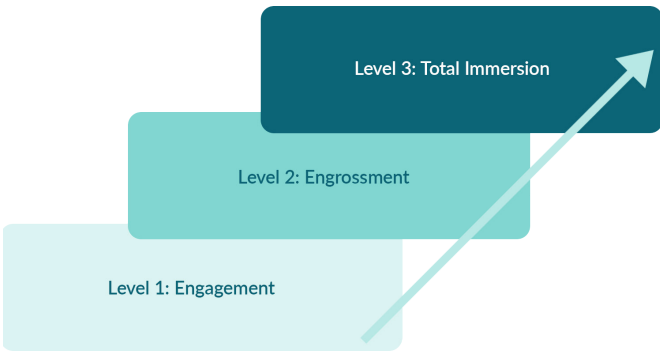


Figure 2: Levels of immersion with regard to the approach of Brown & Cairns 2004

These aspects and elements leads to the focus on motivation. There are also many researchers like Rosas et al., de Freitas or Dickey, who were able to identify and document the potential and ability of digital games to powerfully engage and intrinsically motivate players (cf. Rosas et al. 2003; Dickey 2005, de Freitas, 2007).

A more general approach which provides an overview on the different aspects of learning with digital games provide Garris / Ahlers and Driskell who distinguish between input, process and output and put the playing cycle in the center of the development:

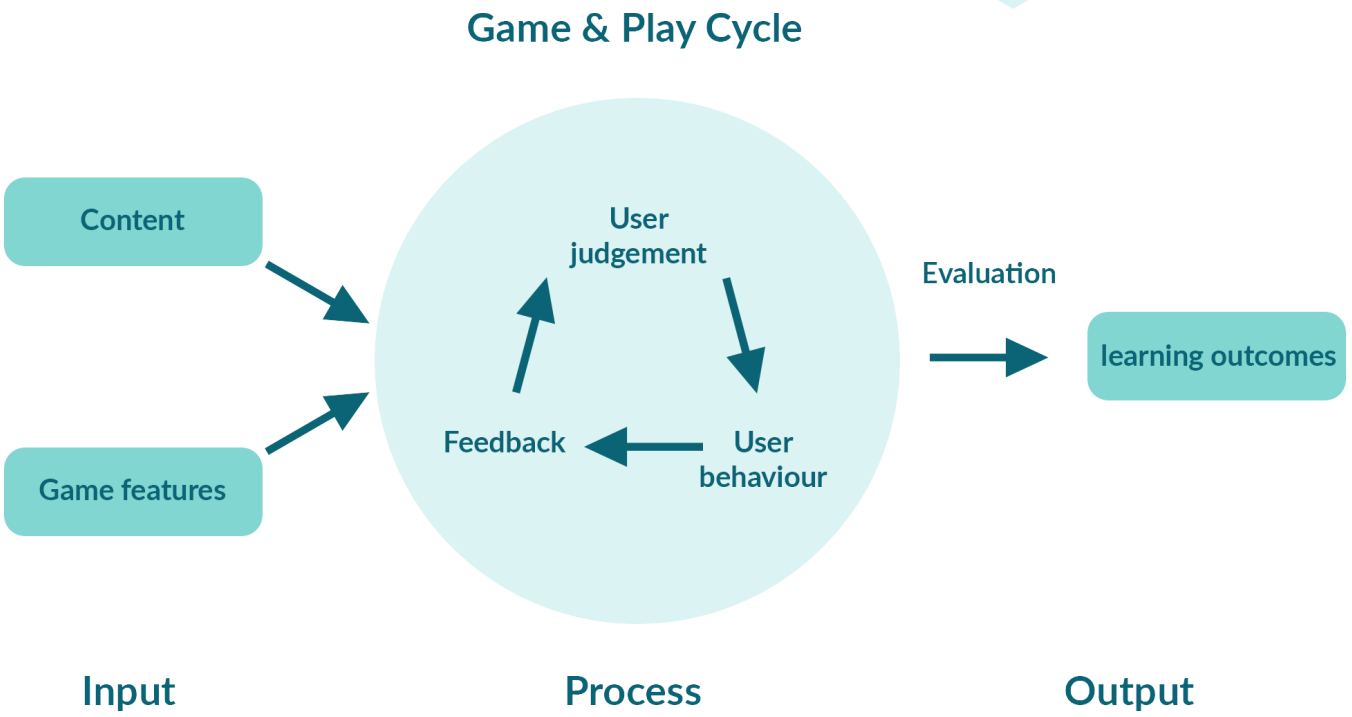


Figure 3: Model of learning with digital games according to Garris, Ahlers and Driskell 2002

Chapter 15: Games as contextual hubs

Using games as a contextual hub

Most of the time, when a game is used in classrooms, the hope is that the game has content that is about the same topic that we are teaching. But, the 'elephant in the room' of educational gaming is that in the past many of games that have been developed for education weren't actually very good! As a general rule they have either been built by educationalists and therefore lack the graphics and immersion of commercial games. Or they have been built by smaller commercial providers, but then lack the education rigour that is required for gaming in the schools (Microsoft, 2012).

But there is another way to use games that harnesses the motivational pull of games and that doesn't rely on the game designers to teach the curriculum.

Instead of the game providing the actual teaching content, the game can provide a contextual hub around which the teacher can create a suite of lessons. The learning process doesn't rely on the game itself but instead, the game becomes the context for learning. In that way even a game that has no educational value, in the hands of the right teachers, suddenly becomes an educational tool.

In short, using games as 'Contextual Hubs' means creating a set of cross curricular lessons that are centred around the experiences of a video game.

Contextual hub learning activities normally involve recurring game play throughout the unit of work and the learners often adopt roles as the characters of the game to create a more immersive and contextual experience. As stated, people playing video games are indeed learning 'content', albeit usually not the passive content of school based facts (Gee, 2003).

The secret of contextual hub projects is that there should be no specific pathway through learning activities. There is no single solution. Each lesson should be created according to the needs of the students and the subject. Although, obviously, there should be some kind of structure that leads to progressive knowledge. Teachers in collaboration with their students can decide on the content of the scheme of work by picking from lists of possible activities and adding their own ideas to create a rich learning experience that is unique and appropriate for their individual needs, class and school (Microsoft, 2012).

What problem can contextual hubs solve?

There are many possible benefits of using a game in this way.

- The separation in how we teach academic subjects isn't true to most real world contexts. In the modern world, people need to access a range of diverse skills as and when they need them. By using a game context as a hub, teachers can set problems that require pupils to access knowledge and skills from across the curriculum.

- Many skills we teach pupils lack a context that makes them meaningful for pupils. Taking advantage of the rich world building context of a video game means pupils have a way of understanding how the knowledge and skills they are developing are real.
- Teachers and pupils share the domains of school and learning - but teachers have all the expertise. By using a game, the pupils get to be experts. They have semiotic domain expertise in gaming and by situating learning in their world, the experience can be much more meaningful. It also allows pupils who may not normally excel to experience success by leaning on gaming skills they may have.

What is the role of the game in a contextual hub?

If you are interested in using games in this way, you needn't look for an 'educational game'. In fact, many of the best Contextual Hub games are simply fun, off-the-shelf commercial games that pupils love. Look for games that your students already enjoy and try to imagine how the context of the game could support a range of different types of lessons.

They key thing to remember is that the game isn't supposed to do much teaching. In this way of using games you, the teacher, creates lessons - but the game provides a context for your pupils to understand your lessons, and supports your class by helping to make the learning journey enjoyable, motivational, and richly engaging. One of the key benefits of using games as Contextual Hubs is that it empowers the teacher to make lessons that suit whatever their classroom needs are.

Examples of contextual hubs being used

Consider the Guitar Hero series of games. Whilst on the surface they clearly offer some value in terms of music and performance, some teachers have managed to find ways to teach all over the curriculum using the Guitar Hero game as a hub activity that provides a context for lessons. Living out (via the game!) the fantasy of being in a rock band who are becoming famous can excite and engage pupils and by exploring how different curricular areas interact with that fantasy, lessons can tap into that engagement.

In 2007, Derek Robertson and Meldrum Primary in Scotland explored using Guitar Hero as a context for different kinds of lessons. Other teachers in Scotland like Gillian Penny, Kim Aplin and Ollie Bray got involved and in 2009, The Consolarium (an initiative of Learning Teaching Scotland) worked with local councils to create a project they called 'Thinking outside the Xbox'. This project saw 55 primary and secondary schools across the region using the Guitar Hero game as a context for a lessons ranging from literacy and numeracy, to art, physical exercise, science and lots of other areas.

In schools that have used Guitar Hero as a contextual hub, pupils 'formed bands', planned their band's tours, designed their Album Art, band t shirts, and

brand identity. They looked at the most populous cities in the country and chose venues for gigs that would be the most profitable. They could calculate the cost of hiring a van, a venue, and the fuel cost of travelling between cities and then figure out how many tickets would need to be sold to result in a profit. And between these lessons, pupils can have turns at practicing performing as a band. In practicing as a band, the pupils cement the fantasy of being in a band; they can contextualise the lessons and understand the connections between different subjects and understand how those subjects relate to the real world.

This kind of learning is very meaningful for pupils. They might not be lucky enough to be in a touring rock band, but by using the game as a hub for activities, they get many of the learning benefits of role playing through those scenarios whilst benefiting from the engagement and motivation that video games can offer.

Guitar Hero isn't the only game that teachers have used as a Contextual Hub.

Learning Teaching Scotland also used the game Nintendogs as a Contextual Hub to help students understand concepts of routine, looking after pets, basic money interactions, as well as to support art and language lessons.

Rhythm Game

Guitar Hero is an example of a type of game referred to as 'rhythm games'. These are a class of music themed action games, probably the most famous of which is the popular arcade game 'Dance Dance Revolution' or DDR for short, which involves dancing rather than playing an instrument. Others of the genre include Rock Band for music, and Just Dance for dancing. Unless the game console has a way of sensing movement built in, such as the motion sensing of the Switch JoyCons, another device has to be connected to the computer or console for these game to work, but even computers can get in on the fun with USB dance pads and music instrument controllers.

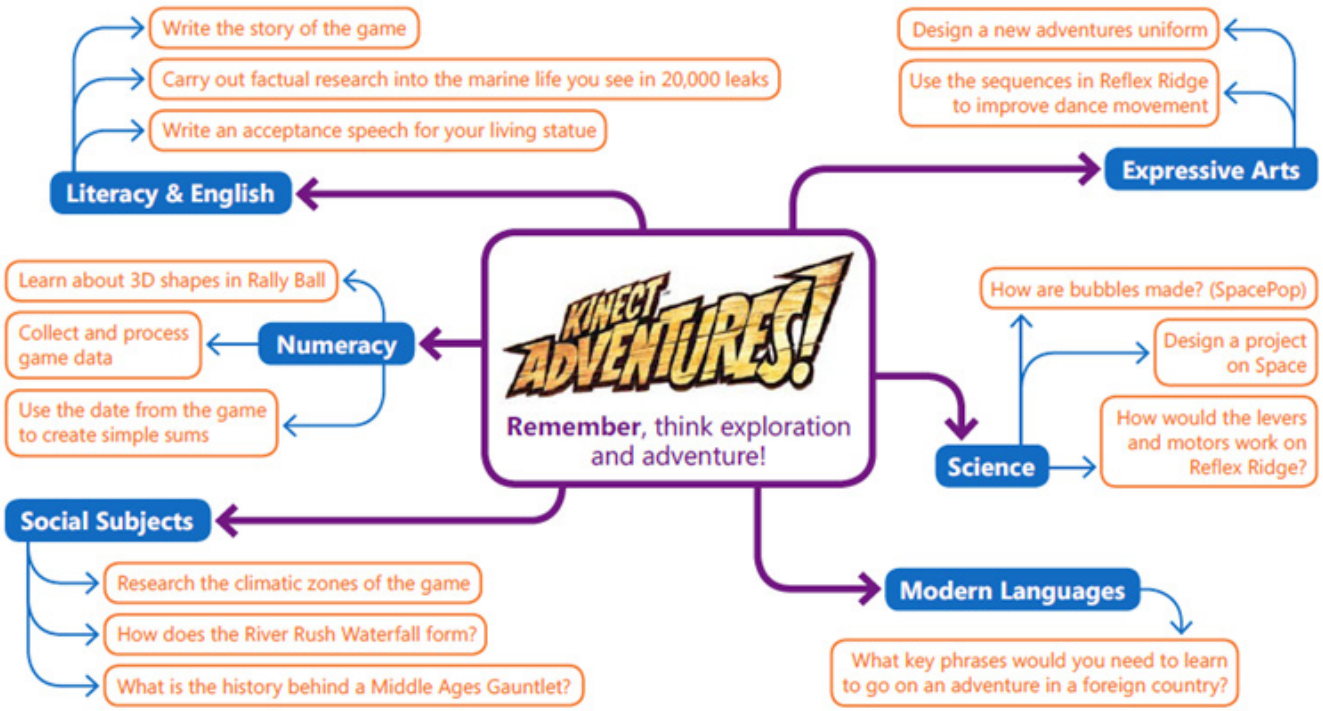
Kinect™ Adventures!

You've seen us discuss the use of Kinect in the chapter 'Firming Up Soft Skill'. Kinect Adventures is a sports video game that was released by Microsoft Game Studios for Xbox 360® that can be used as a contextual hub. The key here is thinking about what the game is about, rather than what the game does. The game is about adventure, exploration, teamwork and discovery.

Your class project/unit of work will therefore be about adventure, exploration, teamwork and discovery. Remember, when using games in this context, the game is the 'hook' and provides the stimulus for the learning. How could you link your standardised curriculum to these four words?

The diagram below shows some of the possible ways

that Kinect Adventures (adventure, exploration, teamwork and discovery) could be linked to some curriculum activities (Godfrey, 2012).



(Please keep in mind that Kinect is no longer supported by Microsoft nor their current Xboxes. Using this tool would require getting old equipment and software.)

Assassin's Creed in the classroom

Last year in Greece in the 10th Primary school of Ioannina a gifted school teacher, and gamer, named Nikos Mertzianidis, had the idea to use Assassin's Creed in the classroom to teach history. He used Assassin's Creed game packages and a PS4 console. The topics he choose to teach were the Pirates, the French Revolution and, the Industrial Revolution.

The courses started at November 2016. Although his purpose was to teach history, in the end the approach was multidisciplinary (history, music, physics, art, foreign languages and geography). In that way he used the game as a contextual hub inside the classroom. The courses ended on June 2017. The teacher also conducted a small research on his game-based learning approach. After the end of the courses the teacher prepared a one day seminar for students and parents in order to present the findings of his work.

This game is also touched upon in 'Data, Ethics, and Safety', 'Future of Gaming'.

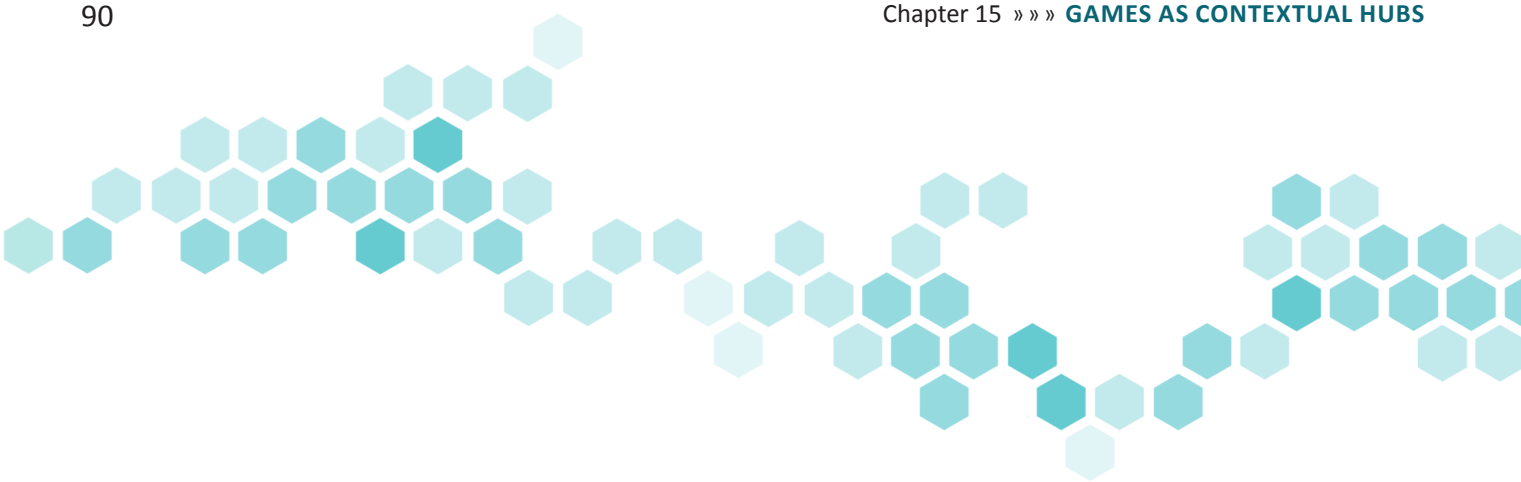
Assassin's Creed

Cost: low to medium
Platform: Microsoft Windows, PlayStation 3, Xbox 360
Subject: Action Adventure with historic background

en-fr-it-de-es

Assassin's Creed is an action-adventure video game published by Ubisoft as the first instalment in the Assassin's Creed series. The plot is set in a fictional history of real-world events and follows the centuries-old struggle between the Assassins and the Templars. "Venue is the year 1191 AD. The third crusade devastates the holy land.The player is Altair, who tries to stop the enemies by putting pressure on both sides. The player is a killer and warrior who is hidden and feared for his mercilessness. His actions can plunge the immediate environment into chaos and its existence has an impact on events during this pivotal time in history."

(*https://store.ubi.com/de/assassin-s-creed/56c4947f88a7e300458b468e.html#start=9*)



NINTENDOGS IN CLASSROOM

Cost: medium to high
Platform: Nintendo DS, Nintendo DS Lite, Nintendo DSi
Subject: Cat and Dog care

en

Nintendogs is a realtime pet simulation video game developed and published by Nintendo for the Nintendo DS handheld video game console. It was first released in Japan, and was later released in North America, Australia, Europe, and other regions (Wikipedia: Nintendogs, 2018).

It was a teacher, Anna Rossvoll, funded by Derek Robertson's Consolarium (Scottish Centre for Games and Learning), who saw the potential of Nintendogs to serve as a contextual hub - the centre of a thematic study - in an early year's class. In that particular case, there was evidence of increased motivation to write plus enhanced social skills. In addition to seeing the potential in the game, and incorporating it into learning activities, there is one more aspect. From a self-esteem perspective, teachers need to help children - some more than others perhaps - to appreciate any improvements which are evident (Miller & Moran, 2012). After that, Derek Robertson setup a number of scalable projects using other games – from Guitar Hero to Endless Ocean. Derek's notion of a 'contextual hub' is that you don't just push the games (and their associated devices) into the classroom. He spends a lot of time working up how the games can be used, and building extensive activities around them (Kind, 2008).

CHAPTER 16: CHALLENGES IN USING GAMES IN SCHOOLS

BEFORE THE GAME SESSION

Pros and Cons of different hardware

The hardware can establish boundaries in what you will be using. This will be based on

- hardware and related systems in place
- available Know How and
- the school's and country's general policies

Using different hardware can make a difference, if the teacher uses mobile devices or PCs, for example. For example there are many kinds mobile devices, such as smartphones and tablets. The iPad is a tablet famous for its smooth experience. In the case of a windows PC the experience varies, but, normally, the user would need some computer skills. The kind of PC that is available is also important, because it will determine the games it can run.

The iPad forces the use of a very closed game store system in a non configurable machine, similar to consoles. That will limit how it is used but also make it somewhat easier since you can only use what is in the Apple Store and you can know the app is configured for the device. The Windows PC is a very different scenario. It could grant you access to more options, but that will come at the expense of the need for more IT knowledge. PCs range from very simple systems to powerful ones, which will influence what kind of games they can run. We focus on Windows because it's the more common Operating System (OS). Apple computers and Linux computers exist and there are games for them, but the choices are more limited.

Today this can be made easy by using sites like Can You Run It (https://www.systemrequirementslab.com/cyri) or try searching online for the minimum system necessary to run the game. You should be a little above the minimum, in most cases, to have a reasonable experience. Be aware, more closed systems like tablets and consoles can facilitate the use of video games but a Windows PC can be more flexible.

The mobile apps stores can sometimes be overwhelming. You will need to do some research and trial and error to make a choice. Consoles have generally more curated stores. The main stores on the PC vary in organisation but will have a bigger and more varied selection than consoles and mobile devices. The type of control schemes in these platforms can be very different. In addition, the PC is the only one which offers the possibility for modifications (mods), which sometimes can be useful to adapt a video game.

In general, closed platforms (mobile and console) will make installation and running of video games easier and PCs will give flexibility but are more complex and require more know how.

WHAT DO YOU HAVE TO CHECK TO START?

You must check the level of permission on the PC you are using, that is to say, whether or not you are even able to install software. If the computer is not your own, are you allowed to install software in that system? Is the firewall of the school somehow

blocking access to online resources needed for the installation and running of the video game? Also, can you use mobile devices in your school?

These are tricky situations, which are very dependent on school policies and you must rely on the school administration to solve this. In some cases this can be a government policy. You may need to access to the school network just to locally connect computers or you may want access to the internet. Schools have normally strict defensive system that sometimes go beyond their needs. If you don't have the necessary access to the internet you may be missing some benefits. The fact is that most platforms have online stores and if they are blocked you will be missing on that.

Fortunately, physical game copies can be found, but some may require a connection to be activated and installed, and used in some cases. In this kind of no access scenario, the teacher may have to use video games that are not played online and can be bought as a physical copy for a total offline installation.

In terms of multiplayer fees, most consoles need a payable subscription. In some cases mobile platforms and PCs don't have these extra costs, except where the game itself requires a subscription. This aspect will depend on the need for the multiplayer feature in your classroom activity. Therefore, its availability at your school is something that you must take into account and where you should start.

For the stated reasons, we must admit that not all the games will be available for use in each school. But that's no reason for despair.

If we know what kind of game we want, we can start looking for alternatives. Here is you an example from Mr. Freitas: 'I was using Minecraft in the classroom. At some point I used Manic Digger (a clone of Minecraft) because the free browser version of Minecraft did not allow me to save what the student's were building. I did use Manic Digger until I had the possibility of acquiring an educational version of Minecraft. Manic Digger did not have as many features as Minecraft, but as a free product it was great for teaching. In some situations, the teacher may confront the difficulty of getting the exact game that he wants, but there is always the possibility to look for similar alternatives'.

A QUESTION OF BEING AGE APPROPRIATE

One situation that teachers can face is the age of player for which the game is intended and if the topic is somewhat problematic to use in the school. The age is something that is easy to find on the game box, store or site of the developers and, also, on rating sites like PEGI (Pan European Game Information) for Europe and ESRB (Entertainment Software Rating Board) for the United States. The IARC (International Age Rating Coalition) provides collaboration among various rating authorities. Many other rating systems and authorities exist in the different countries, and you can find additional information at many sites that discuss this

topic. Nevertheless, it's important that teachers understand their reality and when in doubt they can always play safe and ask the school board and parent associations.

However, plenty of games don't pose any kind of problem for use in teaching situations so where possible it's better to choose these ones first. It's important to emphasise the educational perspective to the school community. Make clear how the games are being used: it's not about entertaining the students, it's about using this kind of media in a teaching activity. It's similar to how we already use movies, books and other forms of media in the school.

Let's get to the core: knowing how the game will improve your teaching

Now, it's all about preparing the classroom activity and the characteristic that a game should have. In other chapters we discuss how to select and approach video games, how to turn a commercial game into an educational one, as well as using evaluation and diagnostics. All these topics can constitute challenges, and by reading those chapters, the reader can get a deeper understanding for them. In this chapter, we will talk more lightly on those topics focussing on how they relate and where they can appear. Nonetheless, the further chapters will give you a deeper insight in some of the matters written here.

The first question you can ask yourself before using a video game in the classroom could be

Why use it?

- Is it to motivate the students?
- Is it because the video game can really add something
- that other strategies won't do in the same manner?
- Is it because it fits well in the curriculum?

The reason must be clear to you in the first place. But how will this happen? You need to understand how the game is helping the process of teaching. Knowing how the interaction with the game will happen is important because the game plays in particular manner. You also need to know how the evaluation will happen.

Your already achieved teaching skills which will be enough to solve most of the problems that will present themselves when using video games. It's important to make clear to the students that it's not just about playing video games, it is about learning. Some teachers have reported to us that they have made the mistake of telling the students that they were about to have some fun. Fairly soon they faced comments like 'the game, it's not very good' or 'I have a better one at home'. The students must understand that they are in a classroom, even if video games can be fun.

Therefore, the teacher should introduce the game as another classroom activity, that needs effort and commitment. It's not just about play, the purpose is to play in a certain way and for learning purposes. The roles and goals need to be perfectly clear to

the students. They should know what is expected from them and what they should achieve.

Gaming on their own or altogether?

Some decisions must be made in advance, concerning the distribution of player per device. In a single player game you must decide if the students will be playing in pairs. This can be good for creating moments of dialogue between the students. How they handle it can be a source of information for the teacher. When the students are playing on their own, you must create necessary conditions for students to compare and discuss ideas, so that you have the opportunity to observe and evaluate the students.

In a multiplayer game it's necessary to understand how the players relate to each other, in the game and out of the game (in the classroom). The activities in a multiplayer context will factor into the interaction between the students in a greater degree. That's an opportunity for teaching but can also introduce new challenges because this interaction is not always peaceful and needs to be addressed with clear rules.

The relationship between the students and the game can have many layers. Most of the games that are used in schools tend to have low complexity. Factors such as interface, controls, difficulty and the complexity of the games are many times avoided by not choosing them. That philosophy may sometimes exclude video games with good educational potential. We won't go deep on this matter, because you will find help for this in subsequent chapters Nevertheless, watching some videos of the game and trying it out are part of the solution.

You are the expert to identify and evaluate the right game!

Knowing where to find opportunities for learning and how to engage in evaluation are fundamental things. Some suggestions are made in the nexts chapters, but in most cases that won't be a problem.

A science teacher, for example, will identify the learning opportunities in SimLife, and an IT teacher will spot right away what a game like Human Resource Machine can teach. These are just some possible approaches to games for learning.

Most teachers will identify if the game that has potential for their learning goals. Most problems are related to the use of it and not to identification of the good features, when they exist. The evaluation process can be very easy, if the game focuses directly and explicitly on the what the teacher wants to address. When the game challenges the students to sum A with B, the process becomes self explanatory in terms of evaluation. Other video games may require you to create your own evaluating process, because their teaching value is not so obvious. If the games is about the management of a zoo, math becomes implicit and less obvious and the evaluation must take that into account.

Understanding the basic game mechanics of the game can be explained by what you do as a player and what happens in the game. This can have a bigger or smaller impact, depending on how it's related to teaching. If the objective is just to spark interest in a topic, the game mechanics just have to be functional. If the game mechanics are directly related to the learning process, they have to be well understood. Understanding the game mechanics may require some time. The teacher does not have to be good at the game, he just need to understand it. Once again, try the game.

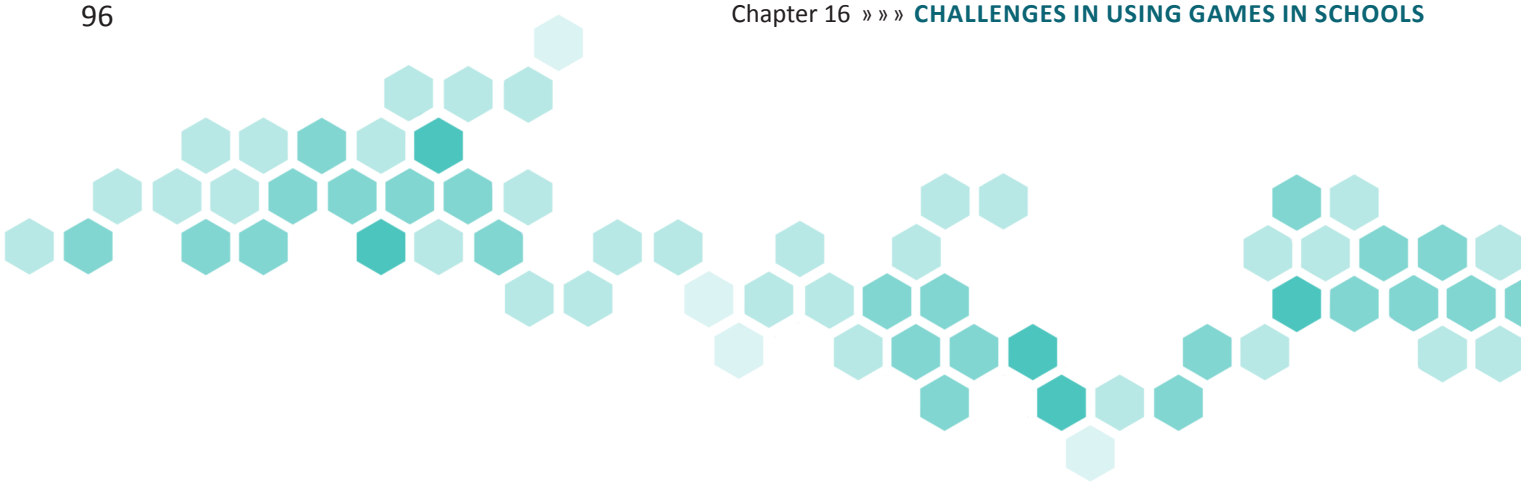
During the game session

Video games can be approached in many ways that are sometimes very different from other kinds of class activities. We have already stated that it is important to know what the students will be doing and how they should relate to the game. The game may impose its own rules on the player and the teacher must take that into account.

In the first minutes of the activity you must make sure that the students have the time they need to understand the game; its interface, how it works and what is expected of them. Also, issues using the controls can arise and you should notice that some students may be struggling with the controls. They might need help or extra time with the game. A situation could happen where some of the students can't achieve the necessary degree of control. However, that will be rare experience, unless some very difficult game was chosen. The solution could be to have the player with most difficulties watch a peer play, helping with the decision making process. You should have some idea whether or not the game is not very difficult in general. The objective is to use the game to teach and not to teach how to play hard games. It's important not to confuse difficulty with complexity because the former can be overcome as long the game age is appropriate. However, difficulty can create an impenetrable wall.

You need to evaluate things. Some games may make getting information that you need easy to get, but that's not always the case. Also, you can't be everywhere putting out fires, even in games that allow you to observe what happens easily. Games that allow for overseer mode, screenshots, recording of the gameplay and give statistics can help. In other situations, you may need to create your own systems of evaluation. In this sense games can be different from other forms of multimedia because they are more interactive.

Time can be an issue, especially because the class has a fixed amount of time and there are just a certain number of classes in a year. There is the need to take into account the time students need to learn the game and the time the game will be played in the class. At some point the class must end and if the student did not finish the activity by then, you should have an idea how the game will progress in the next class. An important point is how the current position of each student can be saved. Some games have 'save game' options and



others have different systems of saving progression.

The space in class can also be problematic, especially when you have more than one student per device. This new space arrangement may create behavioural challenges. Moreover, different devices may require different amounts of space, as what laptops require is not the same as what you can get away with using tablets or a console. The different ways of interfacing with the game mean that they require different amounts of space.

For example, using Kinect Adventures would require that the tables need to go out of the way against the walls but MinecraftEdu is generally ideally played with a U shape table set up. You may be able to go beyond the classroom space. The assembly hall and other open school places can be an interesting areas to use video games. You can use special and commemorative days, like the 'Hour of Code', 'Human Rights Day', for example, to set up activities in open places. It may not be video games in the classroom anymore but it will be video games in the school.

After the game session

If the activity was not completed the teacher must have a way to continue. Some complications can appear: who was using what device or maybe the game was not saved, and so on. You must understand how the game works regarding saving progress, which is why one of the important factors when choosing a game is matching the amount of time you have in class to the frequency with which you can save. If you can only save at specific points in the game, then the players need to have enough time to get to that point during the session you have set up.

You should reflect on the experience.

- Was it useful and in what manner?
- Could other solutions have been better for teaching? Could another kind of approach to this video game or another video game have done better?
- How did the students react to the activity? Did they like it? Did they learn better?

Asking yourself these questions lets you figure out what works for you and your learners. In the end, it doesn't much matter what worked for a different class, what matters is what works for yours.

Chapter 17: Choosing games to fit your needs

Making the right choice

In this chapter we will be exploring the process of choosing digital games. We will address the initial approach to the game and then we'll move on to the process of selecting the game. However the selection is not independent from the use of the game in classroom, so we will also be giving some advice on that. Finally, we will give some examples of why we chose certain games. This chapter does not intend to be the only or definitive solution, but we hope that it will give some help on the process of choosing video games for your classroom. After all, part of the fun of adding games to your classroom is the process of discovering the games that work for your situation, and every class and teacher combination is unique.

Approaching digital games

You can have very different experiences with games. Card games, for example, can be very simple or extremely complex. Some games can even put you off because of their complexity. However, if you stick with them, they can be quite rewarding Satisfaction can come easy in simpler games, but can be greater in more complex games. But for mastering these games you have to invest a lot of time and energy in them.

When we bring this kind of medium to the classroom we need to take this aspect into account. More approachable games are likely a better place if you are just starting out. Then we will look at more complex game and suggest ways to approach to them. Honestly, it can often just be a matter of opinion as to which games are complex and which are not, but we hope to give you some general insight that will help you choose games for your classroom.

What makes a game approachable is based on several factors:

- accessibility of the game in a technical sense (device/platform it runs on) and in how to start the game (intuitively understandable or not)
- complexity of the game mechanics (intuitively understandable or not)
- difficulty or ease of the controls
- difficulty or ease of the interface

Easily approachable video games

Perhaps you remember seeing older relatives play a game of Solitaire on the dinner table with a pack of cards. These days, those same relatives are likely to play it on their phone or via Facebook despite the fact that neither you nor they would consider them to be gamers, especially 'video gamers'. Some games are very easy to use, because of their lack of initial complexity and/or because they resemble something that the player already knows. They might have an accessible and easy to understand interface and the platforms they run are easy to manage. A video game like Crayon Physics, when used with a smart board, becomes very natural to control. Its interface doesn't require new skills. When you use the digital board, it's just

like using a pencil. The goal of the game is perfectly clear. The player has to transport a ball to a yellow star by drawing lines and shapes on over which the ball can navigate. In many games, rules become obvious after some short first contact with the game. Back in the 70s, the first digital games were very simple and easy to understand. Classic games like Pong had a minimalistic approach to simulating the 'real' game of ping pong/table tennis and that was part of its success. It was easy to see what the aim of the game was, and the controls were easy to figure out.

A good example about the difficulty of control would be using the joystick to control the character in PAC-MAN. This simple game does not pose the control challenges of a flight simulator, where you have a lot of physics involved, like inertia for example. A plane cannot be turned around like the PAC-MAN character. It must be made clear that PAC-MAN may be a more difficult game than many flight simulators, it's just easier to have control over it. This accessibility can be a good thing when you want to introduce a game in the classroom. This doesn't mean you should automatically exclude games from the classroom that are more difficult to control, however, the complexity must be addressed. Different factors will determine the difficulty of a game, and it's important to remember that even if it has learning value, the game shouldn't be so hard that no one wants to play it. Nonetheless, difficulty can be a very subjective thing.

To be safe, start by using video games that are easy. Don't worry, this doesn't mean you have to be an expert in handling the game. Even if you control the game badly you can understand how the game works. Regardless, giving the game a try before bringing it to your class is always a good idea.

Not so easily approachable video games

Don't worry about having little digital game experience. In our opinion, within the classroom your teaching skills with the usual classroom games and games in general can already help you. You will have to adjust your skills with regular games and teaching in general to video games, but you are a trained educator so you're up for the task! Video games can look alien if you've had no prior contact with them. After a while they will start to become more familiar, especially if they are similar to something that you can recognise, like the previous examples of a digital version of solitaire or the table tennis.

Some games can be more complex, even if they have simple game mechanics. The board game of Checkers, a strategy game, with its simple rules can be a good example of this. The game is 'Easy to learn, difficult to master' which, according to Nolan Bushnell (co-founder of Atari) makes a good game. Many video games could fall into this category but others are harder to approach. That can be made more difficult if the player has never tried anything like it before. When the students are used to playing complex turn-based strategy games

they can transfer the general rules of that game to another of the same type.

However, the teacher would have to explain the rules in this new game and do some tryouts, before actually using the game for learning. On the contrary, a complex digital strategy game, like Civilization, would require some time to learn how to play it, as it was the case of the Game of Thrones board game.

Civilization (1989-2016)

Civilization V is the last version of this grand strategy game about the global control of the earth by different \ civilizations. There were other games of the series that were outside the earth: Alpha Centauri and Civilization: Beyond Earth.

The game is about global dominance of different civilization and covers many aspects such as religion, economy and war. It is a complex game and requires time to be fully understood. The game is menu heavy and requires a lot of reading of descriptions. The game can be played single player but also has a multiplayer component. The game is in English by default. Competencies that can potentially be addressed: This kind of game can have many approaches. History, Economy, Geography, Math, etc

How should you approach more complex video games in the classroom?

To help explain our ideas, we use an analogy of complex video games with a natural science experimental activity. There will be the need for enough space or a different classroom organisation which is equivalent to the platform and technical requirements of the game. Instruments and knowledge of techniques may be looked as equivalent to the means of interaction required by video games. The students need to be prepared for doing the activity so they can work on the solution for the problem. Their new laboratory skills will allow them to participate in the activity presented by the teacher. However, other classes that requires instruments and techniques to teach the subject, could be used as an analogy.

Knowledge and time are of the essence

When choosing a game, you have to take into consideration own your knowledge and experience. The physical resources you have available, the available space, and amount of time are also important. You should also consider what the students are trying to learn plus what they need to already know to be able to participate in the learning activity. An example would be in the natural sciences, where the teacher should introduce the students to the instruments and materials to perform the experiment. When the students need to observe cells, they don't just observe them, they must know how to handle a microscope and that is

a skill that they must learn.

You should weigh and balance the time and money to be invested in doing the activity against what the students will learn. Class time must be used for something that's really worth it. Teachers should only use video games, if they think this approach is better than any other they can choose for the topic at hand.

Game literacy

When using a video game, the students will need time to learn the interface and understand the game mechanics. It is likely that the students will have some prior digital game experience, which means that some students will know their way around video games and have a general idea how to proceed the moment they encounter the game. That can make the use of video games a good option in many situations, because they may allow exploring a complex process without having to make a complex classroom setup.

Even so, remember that not all of the learners will have the same level of experience with digital games. It's a good idea to know that in advance and use what the learners can already handle. This will greatly improve the ease of introducing certain games, which normally come in many flavors.

Interface and game mechanics

People interact with digital games by way of the interface and the game mechanics. They need to be addressed before game can be used in an activity.

UI

User interface: all the parts of technology that allows a person to interact with the technology. These include the physical manners of interacting, such as touch screens, keyboards, mouse, but also include the software elements, such as the actual buttons that you click on the screen or the commands that you choose in a program. Sometimes the software interface is referred to as GUI for graphical user interface to contrast it with the physical interface.

A typing game is a good example of a video game with an 'easy' and clear interface. The game mechanics in such a game are directly related to the interface and method of control, the keyboard. One game mechanic could be typing a word in a certain amount of time, that would require typing skills and you will fail if you aren't fast enough.

A military flight simulator with a real cockpit has a more complex interface, the interface being as close to a real flying situation as possible. The player needs a lot of additional knowledge just to understand the cockpit and practice to control the virtual plane.

Just by trying to explain what is in place in both games, we can easily see that the flight simulator is a mechanically more complex game and not a game that you would introduce blindly in a classroom. The typing game would naturally fit very well in some classrooms, with almost no need to for any tutorial. Both of the video games could

serve different purposes and none of them is better than the other. The importance of this comparison is that the teacher should take the interface and game mechanics into account when selecting a video game to the classroom. But that may require time and energy.

Time to try the game

Fortunately, there are many games with educational value that are easy accessible. Nevertheless, you should take into consideration the first contact with the game. A bad experience can put off student and even the teacher. The difficulty of the game and particulars of the interface may need time to be overcome.

The students usually have different gaming experience and some kids don't even play digital games that much. A game that is harder to handle may still worth the time investment, some time must be given for the students to try and learn how to play the game. This can be quite obvious but is can be a must with many games.

Installing and setup

In the 80s, when the arcades were still going strong, someone could just insert a coin and play. The first consoles were a little like that, insert a game cartridge and play. This is still similar today on consoles and mobile devices.

PCs can be more tricky but online game stores, like Steam, can simplify the installation process to a certain extent. However you still can run into problems. The great success of consoles is related in part to the fact that they are a more 'coin-op' experience. On the PC the installation of a video game can sometime be an obstacle for using it, especially if you are not a savvy user,. Also, with PCs you'll occasionally find that some of the hardware, that is the physical 'guts' of the computer, don't play well with the game. Things like not having a powerful enough video card or fast enough processor create another layer of complexity. Don't despair as there are many options and things are getting easier with many video games being almost as easy to use as other mediums.

The The Mouse Hunter is a video game where you must take the role of a predator and try to find a white mouse in a different background, simulating the effect of camouflage on predator pressure. The great thing about this web game is that it does not require installation, only that the student can access it via the internet. The game has a very accessible interface and game mechanics that simulate an aspect of the process of natural selection. The teacher would be using the game to enhance teaching with a quick and easy access. The game is already setup to play. Be prepared to immediately start the learning activity with no need for extra configurations.

EVO ED: CASES FOR EVOLUTION EDUCATION

The Mouse Hunter game can be found with a few other such games at http://www.evo-ed.com. This site supported by Michigan State University also has some reading material and other resources for the science classroom. If you teach science, or want to combine science with English language practice, consider checking it out.

Streaming gaming may be a good answer in the future, since there is limited to no installation at all with streaming game services, much like when you stream a TV show or movie. Playstation Now (PS Now) is already doing exactly this and could make things easier for teachers, though as of now there aren't any specifically educational games offered there. Nevertheless, other problems must be address, for example you still have to setup the game for the activity. Maybe in the future we could have more serious game or educational downloadable content.

So all in all, it would be better to start with digital games with an initial setup that does not raise big challenges. After some experience, you could easily identify the games that are more suitable to you. Installation and setup of the games have many variables (especially on PC). Nevertheless, there is a lot of information online to solve these kinds of problems and even to modify the game to your wishes (modding). The student's can be a great help in solving some of those problems and teachers can learn many things with them. You have to take it in a case by case manner. You should choose a scenario you can handle and a game with a simple installation and setup can be a good way to start.

Chapter 18: Creating and Building Your Own Games

Do it Yourself Learning Games

Creating or building your own games seem to be challenging for many teachers and trainers. Often they say that they don't have enough IT or programming knowledge for this. But the truth is there are different ways of building a game and several of them don't require any programming knowledge at all.

The first step to creating a game is to decide if you want to do it with a lot of IT support or if you can do it in your institution without an expert or with just a little help. Here are the four core strategies for creating or building a game:

- Creating a game-enhanced didactical scenario for your classroom

  (low skills of IT-Knowledge required - 'nearly nothing required' level)
- Creating a game using classical computer programmes

  (not so much IT knowledge required - beginner level)
- Creating a game or a specific setting in a game with a game engine

  (not so much or medium IT knowledge required - medium level)
- Programming a new game

  (IT knowledge and programming knowledge required - high level)

1.

A game-enhanced didactical scenario for your classroom is a way to use games in your classroom without or with just basic IT support. An example is playing Pictionary in a foreign language class. A teacher can combine many games with learning content and this offers a broad variety of easy to handle own games. See Chapter 2: We Have Always Played for more examples and a fuller discussion.

Playing Pictionary in the Classroom

The teacher splits the class into 2 or 3 teams and posts a vocabulary field that all students learned in the last period of time. Students from each team choose vocabulary words. Taking turns they have 30 seconds to draw a picture of the vocabulary on the board. The team of the learner who is drawing has to guess the word. If they guess right within time, they get a point. The teacher can decide if after a correct vocabulary and a point the same team will draw again or if the teams alternate in drawing. Winner is the team, which collects more points within a given timeframe.

2.

Creating a game using classical computer programmes means to use computers as a support to create resources or offer easy games. In a very easy way this could be a text program (like Microsoft Word) or a presentation program (like Microsoft Powerpoint or Apple's Keynote). You can create resources or very easy game structures with

TRUE AND FALSE GAME USING POWERPOINT FOR VISUALISATION ISSUES

The teacher or trainer split the class into 2 teams and presents a slide with the word true and false on the wall. The teacher reads out definitions. Sometime the definitions are correct and sometimes not. The learners have to gather under the True buzzer if they think it's a correct definition. The ones who think the statement is incorrect gather under the False buzzer. The team with more correct answers gets a score or each team gets scores according to the numbers of right answers in their team. The winning team with more right answers in a specific period of time gets a prize.

these tools. For example you can use a power-point presentation and a presenter to create a quiz like a true and false game and play it with the class.

3.

Creating a game or a specific setting in a game with a game engine sounds more complicated but usually, it is also quite easy to handle. There are tools available where the user is doesn't need to know anything about programming, such as Twine. Often this is a basic tool for creating text-based games. This is the easiest type of game to create. In most of the text-based games designed by teachers or trainers the focus is (a) on a story, (b) on a puzzle, to solve or (c) on an exploration adventure. Keep in mind that not every player is always happy if you offer a game without graphics.

TWINE

Cost:Free
Platform: Windows, Mac, Linux
Subject: Varies

en

The tool Twine or in its current version Twine2 is an open-source instrument for telling interactive, nonlinear stories which means that the core of Twine is a tool for creating hypertext. A challenge for many beginners is the fact that hypertext branches so much. The problem that may occur from that is that designers easy to get lost in their own work. Here the Twine tool offers support. Many parts of the programme is dedicated to helping you keep track of your own activities. It visualises the work's structure by using a story map. A crucial aspect of this story map is that you can see what your readers will experience. To create a game with Twine you don't need to write any code. It is your task to create a simple story. After that you can use Twine to extend your stories. It can be extended with pictures and images but also with variable and conditional logic. To create a game with conditional logic, means for example if the game protagonist finds some necessary information or a specific tool at a point of time in the game story, he or she can use it later. If you for example find a pencil in an office at the beginning of the story and you take it with you, you can write e.g. a short notice later in the story. Twine also offers and incorporates variables, which you can use for creating as hit points and scores.

Relevant link: *https://twinery.org/2/#!/stories*

Also programs and apps like StoryNexus, Visionaire Studio or Inform7 can be used to create such text-based games but they add more gameplay options and static images and offer more varieties to the designer and the learner. Programmes like GameMaker: Studio or Scratch offer broader possibilities to design 2D games.

SCRATCH

Cost: Free
Platform: Windows, Chrome, Mac, Linux
Subject: Varies

40+ languages

Scratch can be used by inexperienced designers as well as experienced ones. It is a visual programming language for children and youth. The teachers and trainers as well as young learners themselves can use Scratch to create own interactive stories, games and animations. It offers help for creative thinking and systematic and collaborative work. Scratch provides users with an easy and creative way of mixing together different media. Such media may include graphics, sound and other programs.

Today, Scratch is used in many different settings like schools, youth groups, teacher training, museums, libraries, community centres, companies, kindergartens and at home.

The tool deals with program structures and enhancing programming competencies without a deeper knowledge of other programming languages.

Relevant link: *https://scratch.mit.edu/*

4.

Programming a new game is only for teachers and trainers, who already have experience with programming languages or who would like to learn how to use them.

Usually most teachers are not able to do the programming and they also lack time for this. Programming is not a general competence of teachers and trainers and therefore we just mention this possibility here but leave this aspect for other books who explain how to do programming in detail to interested people.

In all four cases addressed above, it is important to rethink the content of your own teaching. Which content is appropriate to be transferred into a game? Only you can say. Moreover, the creative question is, what sort of game should I create?

Here are the 12 steps to take:

- Decision to use gamification or game-based-learning in class
- Revisiting the existing content
- Selecting the appropriate content
- Developing a creative game idea
- Defining the rules
- Describing the core steps of the game (storyboard if necessary)
- Creating resources (programming if necessary)
- Testing the game

- Implementation in the classroom
- Evaluation and feedback
- Revision and improvement of the game
- Permanent use of the game in an educational process

But there are also easy ways to realise the creation of you own games. A possible first approach is to use an easy visual programming software together with your students. Nowadays, this is so easy to handle that you can program your own games and even use it as part of a learning setting with your students. In the last part of this chapter we like to take you on trip into such an easy approach and use an example of game design at a school in Greece where the teacher ran a test of game design in science lessons for more than four years.

Example: creating games with the students in STEM class at Platon school

If a decision is made and creating a game is the way to go, you should follow the twelve steps mentioned before. You have to answer the question on how you or the educational technologists of your school will respond to a generation of students who have been raised on playing interactive games. Maybe they expect the same kinds of interactive experiences from their educational media like they know from entertainment games.

How can the students be persuaded to play the games that are selected by the teachers? Do they have to be as immersive as the entertainment games? For some learners it would also be great to create their own games and in this case they often accept that theses games are not on the same quality level than commercial entertainment ones. But in these cases their own involvement in the development motivates them to play a game they created.

In a STEM class at Platon School of Katerini a teacher, Ilias Batzogiannis, created games with his students. These tests of creating their own games have taken place four times during the last four years. Platon school is a Greek private secondary school in Katerini and the target group were 14 year old students who were not knowledgeable in programming before the test. The students really enjoyed the game design and were quite motivated and became more keen on computer science. This was due to the fact, that they realised that what they can learn in a science class is not only used in solving equations but it something that they can use in real life. The test was done with the Kodu Game development software.

By using this program students are able to design their own digital game. They can decide how the scenery will look like, the gameplay, the heroes, the goal and so forth. By creating their own game students realise that they need scientific knowledge such as mass, velocity, etc., in order to create their own world and they express and explore fundamental computer science concepts [Church,2010],[Stolee, 2011].

Kodu

Cost: Free
Platform: Windows
Subject: Programming

ar-eu-zh tw-zh cn-cs-nl-en-fr-de-el-he-hu-is-it-ja-ko-lt-no-pl-pt-ru-es-tr-cy

The tool Kodu provides a simple visual programming language. Kodu offers learners an environment to create games on the PC in an easy way and offers different tools to make the work very transparent. It is not necessary to know a lot about programming and it was made specifically for creating games. Kodu is a software designed to introduce kids and learners to programming and therefore, it is well structured and programming is done through a simple IF-THEN principle and visualised by big self explanatory Icons. Game figures, objects and textures are provided. Through the many objects and through the free design of the world using diverse materials (lava, meadow, sandy soil, stone, water, etc.,) different games can be produced and it is possible to realise creative individual game worlds and game ideas.

Kodu can be used to teach creativity, problem solving, storytelling, and offers the enhancement of game design strategies and programming skills.

https://www.kodugamelab.com/

Kodu has also been used in a lot of research showing some promising results in improving the motivation for learning programming concepts [Fowler, 2012]

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Using Kodu the learners worked in groups of two. This was tested during 20 school hours. A teacher may start by having a discussion about how a computer works and ‘thinks’ and how we should ‘talk’ to it or communicate in so that the PC understands what it has to do. The programming is really easy and based on ‘if – then’ statements. Kodu includes a novel graphical programming environment based on a concurrent rule system without any code-writing involved [MacLaurin, 2009]. In a class it is possible to start with small tasks and as the class moves on the tasks become

more complex. And with the learning progress the support and help provided by the teacher gets less and less (inquiry method). A possible context in which Kodu can be used and in which it was tested with students is the learning about concepts and practices in the field of STEM.

While the students try to create their own game they have to adopt problem solving techniques because they have to make many decision about the game and its structure. During the process of the game creation smaller problems come up and the learners have to deals with such problems. And this can be accompanied by support of the teacher. The great approach within a class is the didactical possibility to let students try to create different games. In such competitive arrangements games sometimes get really complicated and become more difficult to win. But, at the same time the learning progress increases. The learners are more motivated as every group has to play the other's group game and there comes a competition of who created the best.

Hopscotch

Cost: Free
Platform: iOS (iPad and iPhone)
Subject: Programming

en-zh cn-es

Hopscotch (*https://www.gethopscotch.com*) is an app and visual programming language by Hopscotch Technologies for beginners to create your own games in an easy way. In teaching this can either be used to program games for the students to learn a certain content or for the students to design their own games. There is an introductory coding curriculum, which is free available (*http://hopscotch-curriculum-files.s3.amazonaws.com/Hopscotch%20Curriculum%202015.pdf*). It gives information for teachers, especially it includes six lessons to use in class. These lessons go step by step to create a certain game. The language is easy to use, but it is almost impossible to develop more advanced pieces of code. For that you would have to use a different language.

Chapter 19: History of game based learning

History of game-based learning

Today we can find many type of games,

- action games focusing on dexterity speed and reactions like Jump-and-Runs, first person shooters or racing games ,
- adventure games, where there is a story and solving tasks in focus like in point-and-click-games, collaborative task games or fantasy games as well as labyrinth games
- role-play-games, like real time fantasy games and open world games,
- puzzle and logic games
- simulations (cf. for example Schwan 2006)

Already in 1938 Johan Huzinga, Dutch historian had written about games and the playing human in his book 'Homo ludens. A study of the play-element of culture'. (In English in 1980) (German original: Homo ludens – Vom Ursprung der Kultur im Spiel).

He defined game as follows:

> *"First and foremost, then, all play is a voluntary activity. Play to order is no longer play: it could at best be but a forcible imitation of it. By this quality of freedom alone, play marks itself off from the course of the natural process. It is something added thereto and spread out over it like a flowering, an ornament, a garment. Obviously, freedom must be understood here in the wider sense hat leaves untouched the philosophical problem of determinism." (Huizinga, 8)*

and more concrete:

> *'play is a voluntary activity or occupation executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy and the consciousness that it is "different" from "ordinary life"' (Huizinga, 28).*

That was a huge forward step in discussions on games because it mainstreamed the idea that playing was a typical human behavior connected to learning and to developing culture.

Therefore, game-based learning approaches are not old but also not as new as we may think today.

In 1970 researcher Clark Abt published the book 'Serious Games' (cf. reprint Abt 1987). The core idea was to explain how games and simulations can foster the learning processes of decision makers. Abt stated that decision makers in industry, government, education, and personal relations can be trained.

Already by 1985 the educational video game ´Where in the World is Carmen Sandiego´ was very popular. It introduced geography and culture in an interactive way and combined it with a crime story where the player was chasing a thief. Sequels and other media were spun off from this game, including a game show for public broadcast TV in the US.

And in 1986 the Learner Company had a broad success with Reader Rabbit (cf. Learning Company

1986) though their first release was in 1983. In 1986, they addressed pre-school and elementary school learners. The game provided reading and spelling training, which were included in mini-games.

In 1987 in the game Math Blaster (cf. myabandonware 2018) learners had to solve a series of mathematics problems. The player had to point their cannon or blaster to the correct answer and fire to earn points and progress.

In 1989 Mavis Beacon Teaches Typing was used to learn typing in a slightly gamified way. And this programme is still available updated for today (Mavis Beacon 2018).

At the same time in 1989 The Sims and SimCity were developed by Will Wright and offered a simulation game of daily life and the simplified work of a town mayor (cf. Wright / Joffe 1989).

Everything changed when in 1991 the World Wide Web went live. This meant that more information became accessible and that it was much easier for users to find learning opportunities and games, too.

In 2003 Scratch (cf. MIT 2018, see also the Scratch Box in this book) addressed teaching elementary students easy ways to get into programming games in educational contexts. This was a new opportunity to create their own serious games without a lot of technical knowledge or programming skills.

In the same year David Freeman provided the game design book 'Creating Emotion in Games: The craft of emotioneering'(cf. Freeman 2003) which offered insights in game design and addressing emotional techniques.

A short time later in 2005 educational games also reached the game controllers of Nintendo. With Brain Age: Train your brain in minutes a day (cf. NINTENDO 2018) for the Nintendo DS and Wii U, and such games become popular all over the world.

This was also the year when Raessens and Goldstein published their 'Handbook of computer game studies'(Raessens / Goldstein 2005) about Computer games, design aspects, the reception of games, genres and cultural phenomenon and a special chapter on digital game based learning by Marc Prensky which was published before his text from 2007 which is often seen as the beginning of the term 'Digital Game-Based Learning'.

With regard to the health sector a core starting point for serious games was 'Re-Mission' (cf. Hopelab 2018) in 2006. Re-Mission is a game concerning cancer. It addresses young people and offers both information and a motivating game approach.

Prensky writing in 2007 had a huge impact on the development of Serious Games and the further discussion and is often cited. He created the term 'Digital Game-Based Learning' and provided an overview on theory and practice of games with an educational background. He focused specifically on the fields of education, training and military.

In the same year, 2007, the first serious game conference took place (cf. Nordmedia 2018).

Just one year later, in 2008, Leonard A. Annetta published 'Serious Educational Games' an overview on educational games with regard to different aspects, like the connection of theory and practice, problem-based learning, virtual environments, stories and storyboards, etc., (cf. Annetta 2008).

On the 1 June 2009 Ann May Thai et al. offered the 'Policy Brief: Game Changer: Investing in Digital Play to Advance Children's Learning and health' and provided a systematic view on serious games.

With the use of tablets which was introduced by the iPad in 2010 educational apps became more popular than ever.

In November 2010 Xbox Kinect offered a new dimension of serious gaming with regard to health and offered games where the player is moving, dancing, and doing gymnastics within a game context.

In 2011 Metz and Theis published the book 'Digitale Lernwelten – Serious Games' (in English: Digital worlds for learning – Serious Games), which focusses on vocational education and training and introduced ways of dealing with game based learning in this field. It offered didactical concepts, technical discussions as well as practical solutions from apprenticeship and further education.

In 2011 serious games focused on health games with regard to stroke patients. The aim was to help them become more mobile. In April 2011 JAMA addressed interactive games to promote behavior changes in prevention and treatment and at the same time the HopeLab explored a reward system to get children to exercise more.

In 2013 Beutner and Pechuel provided the PVEC model for the design of serious games which offers elements and aspects to be addressed while creating one's own serious game.

In 2015 game-based learning activities and serious game were recognised as an important and interesting business field with an annual growth of 16,38% (cf. gamelearn 2018)

Currently in 2018, game based-learning and serious gaming is popular and more in discussion in educational contexts than ever.

CHAPTER 20: TEACHING ENGLISH IN FOREIGN LANGUAGE CLASSROOMS

TEACHING ENGLISH IN FOREIGN LANGUAGE CLASSROOMS (ELF)

'He who knows no foreign language knows nothing of his own'. This famous quote of the influential German poet Johann Wolfgang von Goethe not only presents the general social attitude to foreign language learning. Even more so it shows that society in general, but especially parents, students and colleagues at school demand a great deal of foreign language teachers.

Today, in the course of globalization, the rising importance of technology and modern media and the fact that the world is getting more and more connected, foreign languages gain in importance. There are many jobs which require good foreign language skills and in which it is necessary for employees to communicate well enough to be understood in languages which are not their mother tongue. If you want to get hired in the job market and to be successful at jobs these days it's a must to speak several languages. For example, a specific part of the European CV requires languages (cf. Europass 2018, cf. Bostick /Wiehager 2005). Particularly English, as a universal language, has become more important than ever before. Connecting and collaborating with companies from all over the world is more common than it was a few years ago. This also explains why foreign languages and especially English as a world language also loom larger than in the past.

Teachers are under a great deal of pressure to properly prepare their students for future employment. Students need to be ready to work in foreign languages and in particular in English in their future jobs. Parents of students are particularly eager for their children to have these skills that increase job opportunities and chances for a better life. The best way for teachers to help solidify their students' skill with language is through providing explanations, plus opportunities for practice and review. By doing this, teachers have a direct hand in helping improve the job prospects of the learners under their care.

Nevertheless, teachers often worry about how these great demands can be fulfilled by thinking about how language learning can be handled in the best way at school. This chapter presents various possibilities, how foreign language classrooms can be arranged in a way which appeals both to the students regarding their interests, proficiency level and age but also with their future career in mind, to the demands of the job market and employers who are looking for employees with distinctive language skills. When they apply for a job, students need to remember the basics of foreign languages they learned at school. It is necessary to choose a style of teaching in a foreign language classroom which works towards long-lasting learning results of the basic elements of language skills upon which further foreign language competences are based.

The most important goal to incorporate learning subjects at school in a way that students will not forget them afterwards can be achieved most effectively by connecting learning units in foreign

language courses with games. Students can learn subject matters in a playful way. Didactically, this has a great advantage, since students automatically associate specific learning assets with positive emotions evoked by the game the teacher used to reinforce what they have learned. Based on this awareness, it is necessary to be open to educational games and to integrate them in teacher's daily class routines.

There are various subject areas in foreign language classes which can be taught best with the help of educational games (cf. Sørensen / Meyer 2007). Not only vocabulary of the students can be improved dramatically with the help of games in class, also grammar can be made easier to understand and retain through games. Specific lexical fields, thematic lexis or applied geography of a foreign country can also be made easier with games. In general, it is also feasible to strengthen class community with the help of games, which is important to enable efficient lessons.

To introduce exemplary educational games, which are linked to the different teaching units, we will focus on their involvement in English foreign language classes. Nevertheless, it is also possible to integrate these games in language courses of foreign languages other than English.

The first game, which can be easily played without any digital support with students in English classes, is called 'Simon says'. It trains students in their vocabulary as well as their comprehension skills in English. Indeed, the game is easily structured, but still it is really effective to overcome barriers of language and to exercise various learning units in class. The teacher stands in front of the class and gives commands which need to be fulfilled by the students. They are only allowed to follow a command if the teacher started the command with the phrase 'Simon says'. The game can be adapted to different subjects which are discussed in class.

First, this game lend itself perfectly to enlarge the active vocabulary of students. An example would be having the teacher calls a word ('Simon says cold.') and the class has to answer with the corresponding opposite word ('Warm'). In this way, students come up more easily with an interconnectedness of the English vocabulary and the corresponding translation in their mother tongue but also link vocabulary again to opposite pairs. Therefore, students learn with the help of this method three things at once: The translation of the English word 'cold', the translation of the English word 'warm' and the interlinkage between 'cold' and 'warm' as a pair of opposites. Furthermore, they have to be paying close attention, because the rule of the game does not allow them to answer the right opposite if the teacher does not start his command with the words 'Simon says…'. This means that the students must not answer 'warm', if the teacher only says the word 'cold'.

Second, teachers can use the game to introduce different lexical fields. For example, if the current subject focus in class is on animals, the teacher gives a command as 'Simon says elephant'. Afterwards

the students have to mime the appropriate animal. Of course this can be used for a variety of vocabulary of different semantic fields. In that way, students can learn a lot of vocabulary in a comparatively short period of time. However, the great advantage of this kind of vocabulary exercise is that students automatically link the words with corresponding gestures, which leads to a quicker and stronger connection of the English vocabulary and the translation of them.

Finally, it is also possible to use this game for spelling exercises. Students also have to learn the alphabet in foreign languages. It is easier for them to get an approach to this subject matter, if the content is connected with a game. With the help of the game 'Simon says' (cf. Ellis 1998), teachers can deepen the learning of letters and spelling of words. As an exemple, the teachers has to give the command 'Simon says: Point to something B-L-U-E'. The students have to follow this command by understanding the spelled word and by fulfilling the request of the teacher and pointing to something which is blue. In particular, this variation of the game is effective for both the students as well as the teacher. The students have the possibility to playfully learn and improve their language abilities and handling of the foreign language. They become accustomed to word formation in English and simultaneously enhance their vocabulary by learning the spelling of English words. Teachers can also benefit from the game, when they can directly control the different levels of proficiency of the students. Teachers can see on the one hand if every student is able to understand English letters and to form them into known words. On the other hand, teachers can trace if the students know the requested vocabulary. They have to be able to transfer the command not only by creating a word out of the spelled letters, but also by understanding the word and pointing to the corresponding object. If some students have visible problems with the subject matters, the teacher can easily repeat topics and explain difficulties again, to instruct the students in the best way and to ensure that a topic is understood by every student.

The next game focuses on the training of thematic lexis and can be used to give the students an understanding of English speaking culture and society. Therefore, applied geography is instructed by this game as well. The game is called 'Perfect Minute' and requires creativity, spontaneity and swiftness of the students. The teacher chooses a word field and the students have to say in turn as many words which belong to the given word field

as possible within one minute. This game can be used as a vocabulary exercise in general, but also to expand the student's lexicon of specific subject matters. In English foreign language (EFL) classrooms, it is helpful to introduce word fields as English speaking culture, society, economy etc. to improve vocabulary and lexis of these country-specific topics (cf. Zaid 1999).

It becomes obvious that including games in foreign language acquisition, especially in foreign English classrooms, becomes more and more necessary.

Due to the fact that the English language develops as a lingua franca (Seidlhofer 2004) teaching methods in foreign language classrooms need to change as well. The rising importance of English needs to be integrated in English classrooms and influences the way the language needs to be acquired by the learners.

Nevertheless, it cannot be denied that language acquisition does not only happen in foreign English classrooms. Teacher also have to give their students the opportunity to learn English also outside the school. Nowadays, learners have different possibilities to improve their language skills. One really good way to do so needs to be presented by the teacher at school: language learning apps are great for the learners to review and summarize subject matters and to deppen what was learned in the foreign language classroom.

Language learning apps encourage the learning of foreign languages with the help of clearly structured learning units which build on each other (Godwin-Jones 2011). There are several examples of language learning apps. Probably the most common ones are called Babbel (cf. Stevenson 2010) and DuoLingo (cf. Garcia 2013). Both apps can be used to teach different languages, they provide learning units in over 100 of European languages. Common languages taught at school such as Italian, French and, most importantly, English are included in these language learning apps.

Probably the most significant difference between the two apps is in terms of cost. While DuoLingo is a completely free app, Babbel can be downloaded for free, but for joining the learning units, users have to pay for them. It is important to speak to the school's headmaster to clarify which app is going to be used in language classes at school and to cover the expenses which have to be paid by the schools.

Language learning apps and CALL (computer assisted language learning) have a tremendous impact on effective language learning and approaching foreign languages at school (cf. Blake 2013). It is helpful to use modern media considering the everyday life of students, in which technology and media plays a highly important role. They are more motivated to start learning new language if the subject is connected to their everyday life, in this case the modern media technologies.

Although it is important to mention that both presented apps, Babbel as well as DuoLingo make language learning more attractive by connecting the learning process with playful items. Both language learning Apps are set up as a game. Almost without noticing it, learners acquire a new language or deepen their knowledge in languages they have already learned.

All in all, it's obvious that games in foreign language classrooms can be integrated in different areas of language acquisition. Grammar, lexis and communication can be facilitated by language learning games. Subject matters from foreign language classrooms can be deepened at home to make the learning process at school more easy for the students. At home, English can also

be acquired playfully with the help of different language learning apps. There must be a new tendency in foreign language classrooms towards an integration of games in class.

Chapter 21: Future of serious games

Playing towards the future

Physics class. 6th lesson. The students stare at their mobile phones, even though the teacher is right in front of the class and the physics book is there on the desk. Nowadays this is a scenario that can be seen every day in classes around the globe.

But, here something is different! A glance over the shoulder of the students shows something unbelievable. The planets from the book have come to life and are moving on the student's mobile phone displays. The earth rotates around the sun as usual and the other planets also follow its orbit.

This is not a 2.0 version of a Harry Potter book.

This scenario may only be a dream now, but this scenario will become a common sight in teaching in the future, as some features are already in development. For example Westermann Gruppe, a German educational media provider, is developing an app called Zoom. This augmented reality app allows you to access additional content for a textbook by holding your mobile device's camera over the page of the book and relevant videos, audios, animations or other materials are opened up for you. So you do not have to search through a DVD/CD or browse the appendix of the book. Everything is available where it belongs: on the textbook page, quick and easy, and right before your eyes.

More and more interactive simulations and games are being developed which allow students to test things that are otherwise too dangerous, expensive, or difficult to do as laboratory experiments. Some can allow a chemistry test in a virtual lab, or virtual 'dissections' of cadavers.

In the future there will be a stronger focus on serious games with 'augmented reality' (AR). In schools there are many possible applications.

> 'Augmented Reality can be understood as a form of virtual reality, where the world is expanded or enhanced in some ways through the use of virtual elements' (Tim Fisher, technology writer, 2017).

Augmented reality (AR) is a form of virtual reality(VR), but instead of being submerged in an entirely simulated world like in VR , AR uses the real world and adds to it, placing virtual objects over real, physical objects or a real view. An example is a mobile phone app that lets you place 'virtual' furniture in a live image of your room so you can see how a particular table would look. This creates the illusion that the virtual objects have become real and are a part of the actual world. AR can be used with various devices such as displays, smartphones, game consoles or glasses. Although applications for AR are not currently very wide spread, this will change in the future.

The use of Virtual Reality (VR) will be important in the future as well. VR is created via software and presented to the user in such a way that the

gamer feels fully immersed in the game world the computer has created.

According to the site TechTarget (https://whatis.techtarget.com/definition/virtual-reality), VR can be divided into:

- ‘The simulation of a real environment for training and education’.
- ‘The development of an imagined environment for a game or interactive story’.

VR makes life more tangible for students. What if you could take your students on a ship while it arrives on Ellis Island? Or walk on the moon? VR will allow us to experience things in ways we never have before. An interesting side effect is that the students increase their empathy. They will be able to take on the role of a war victim, refugee or pioneer.

Maybe tablet classrooms or interactive smartphone books seem like the scenarios from a magical world or a science fiction comic, but it will become reality. It’s only a matter of time, and developers are already hard at work.

The most crucial question in relation to the new technologies is how their development will be accepted in the coming years. It is in the nature of humans not to accept and adopt new ideas immediately. Generally people just don’t like change. Too many of us like to stick with our routines Some people like to work with routine processes and tend to be suspicious and sceptical of new technologies.

So it’s no surprise that there is some resistance towards introducing serious games in the classroom.

Nolan Bushnell, an American video game developer and co-founder of Atari Inc, says of the development and use of serious games: ‘In some ways the world of education is going to go through one of the most massive changes in the next five years than it has seen in the last three thousand years. It's a perfect storm’.

According to the trends and tendencies, these 8 changes will encourage the use of serious games in teaching in the future.

(1) Hardware and software are becoming cheaper and cheaper

Creating serious games will get easier as the software and hardware both become cheaper. Costs are already less than 10 years ago.

(2) Contribution of female gamers will continue to increase

Anyone who believes that video games are purely a man's business is mistaken. 40% of the gaming community consists of women and girls and the number of the female gamers continues to rise. Also female gamers will have a growing influence on the gaming industry.

(3) Video games via one click will become more common

The technology boom in the form of tablets, smartphones and iPads also has a further influence on the serious games industry as touch screens become more common. Nowadays, you don't need a console to play a video game. Games can be played on your smartphone by downloading an app. Whenever and wherever, it is possible to play a game. This combination of tablets, smartphones and apps makes it more comfortable for players.

(4) Serious game are setting trends

We've already seen that there is a significant increase in the gaming industry in the area of educational games.

Even so the design and appearance of games are becoming better and will be able to compete with popular entertainment games. It is this development which increases the attraction of gaming, not only for educators but also for consumers in general. Serious games can enter the playroom and classroom daily and naturally. We'll see better interlocking of learning content and the games and greater user of learning analytics. User behavior can be collected, documented and analysed by software allowing the learning content to adapt to each pupil. Learners will also be able to get instant feedback.

(5) Pressure on schools to educate children better continues to grow

Serious games will be accepted more and more by teachers and play an important role in schools. The interactive role of learners is one significant reason for this development. Learners will be more able to improve their technical skills, which is indispensable in a digitalised world.

(6) Introduction of software for brain research

Current developments in serious games are also partly based on the latest findings in brain research, which show that game-based forms of teaching generate a more efficient learning outcome. According to some research, the outcome is even 10-20 times higher than learning with conventional learning methods .

(7) Fusion of Serious Games and other e-learning-tools

In the future, the transfer of complex learning content will be realised through the fusion of virtual classrooms (VC) and serious games. Current real examples already exist that show that knowledge that could typically only be trained physically can now be handled virtually, such as the 'Virtual Ship Classroom' led by Dr. Kitada of the World Maritime University (WMU), which uses a virtual classroom as part of the training of seafarers. Dr. Kitada trained sailors from several countries in these virtual classrooms and can be seen as a pioneer.

(8) Ubiquitous streaming and broadband

The serious games industry is already experiencing a further upswing due to the trend towards

increased access to good broadband quality and the possibility that brings of pervasive streaming technology. Also impacting this is the improved transmission of data through fibre optic networks.

These 8 trends are already with us and will have more and more influence on the future of serious games. However there are even more advances to come:

- Cloud gaming: Instead of having to install a game locally, teachers could be able to simply choose from a large menu of games from a virtual platforms. Games would be streamed live, like the system found on Playstation Now. Such a system for educational games would allow teachers to have access to a simplified process, and they could use less powerful and less expensive platforms.
- More flexibility on interfaces of computer games: Unfortunately, even to this day games are rarely designed with inclusion of people with disabilities. Though a handful of developers are working on this issue, hopefully those numbers will be increasing as more society gains greater awareness of the needs of the handicapped. Developers could work on creating game controls that adapt to the player's needs. For example, the company Leap Motion, Inc is developing a device you add to your computer that allows the user to control it with gestures instead of a mouse. Games that can be controlled by voice would be another possible solution.
- Educational downloadable content: Perhaps you've already heard of the popular 'sandbox' game Minecraft. Mojang and Microsoft have created Minecraft: Education Edition. This is a version of Minecraft specifically designed to be used in the classroom and contains features that make Minecraft easy to use in a classroom setting. If the tendency for using games in education continues, some companies might introduce educational and downloadable content of existing games for schools. That would potentially increase revenue for the company and, eventually, create good will from the players. One current day example is Assassin's Creed Origins 'discovery tour' mode. This recently released addition to the world popular action-adventure video game creates a more educational setting, disabling the violence inherent in the game, instead allowing players to take a virtual look at ancient Egypt (the setting of the game). Players can climb pyramids, walk the streets, and tour the Nile. At the start of the tour players are informed: 'With content curated by Egyptologists and hundreds of images sourced from museums and libraries around the world, we hope to share with you the passion that inhabited us for the four years it took to develop Assassin's Creed Origins'.

Perhaps with such an attractive name as Assassin's Creed, an important step has been taken in the direction of opening up video games for new

areas of application, including learning ones, even beyond explicitly educational games. With the continuous development of Virtual Reality it will be exciting to see what awaits us in the future.

Assassin's Creed-Origins

Discovery Tour

The player crosses Ancient Egypt by foot, horse or camel.

This game is designed to give players the opportunity to refresh their knowledge about history. Here Ancient Egypt is explored and experienced independently via existing tours. In the game's Discovery Tour mode, players can learn more about the history of Ancient Egypt through a total of 75 tours. In these tours there are different stations, which show specific facts for example how the nose of the Sphinx was lost or which professions were practiced at that time.

Of course with the new technological developments and changes, questions about data privacy will be discussed in new ways.

The data of users, and especially of children is becoming more and more sensitive and accurate. By revealing consumer data through Virtual Reality, apps or games, people and students become more transparent. The location, age, friends, favourite movies. Nothing remains hidden.

In order to protect your students from giving away too much data, it is also your responsibility to make your students aware of the issue. This topic can also be taught to children in school in a playful way. One possible example is a game found at the US Federal Trade Commission's website (https://www.consumer.ftc.gov/media/game-0013-case-cyber-criminal). The Case of the Cyber Criminal is a flash game that uses simple animation, music, and a quiz to help students learn about protecting your personal information. The Australian government has a flash game found at https://www.esafety.gov.au/kids-quiz/. This is a quiz with a young girl's voice guiding the players, and with cute simple graphics. Both are only in English, but you may want to try doing a web search for similar materials in the primary language of your students. For more information on data security in general, please see the chapter 'Data, Ethics, and Safety'.

There is a growing call for the educational system to embrace and expand upon new technological innovations. Step by step, the educational landscape must open up to these innovations. Excluding serious games from schooling and failing to integrate the burgeoning technology into everyday school life would be like closing the door to the digital world. The children of today and tomorrow are already digitised. And not just for their entertainment, but for the future of jobs, training, social interaction, and further education.

So open yourself and your class up and try a short serious game with a topic of your choice, or try a bit of the gamification described in 'Gamify Your Class'. You might be surprised by how intuitively the children adapt and come to enjoy your classes.

So get your Game On - Seriously!

APPENDIX: KINECT CLASSROOM ADVENTURES IN SPECIAL EDUCATION

A TESTIMONY BY MARCO MEDEIROS, SPECIAL NEEDS TEACHER.

Teacher Marco Medeiros collaborated in the Kinect Adventures activity in Escola Secundária de Lagoa (see Firming Up Soft Skills). Here he takes a closer look at the performance of many students, who are noted by a single letter to protect their privacy.

He started using Kiinect with Mr. Freitas, around February 2011. The interface enabled him, as a special needs teacher, to develop a new method to work with children and young people with disabilities. The use of digital games and that specific interface made him look at the complex task of assessing a student's special educational needs in an innovative way. Until then, he used only traditional strategies and resources, such as: puzzles, Legos, engraving, and object manipulation.

Kinect's video games helped to identify the student's level of curricular and functional competence, in other words, what the student is able to do in each of the curricular areas. As an example, video games using this sensor allowed him to verify if, at the spatial location level, the child or young person manifests the ability to situate one object in relation to others, using right / left concepts; forward / backward; up down.

Marco Medeiros doesn't think that Kinect is a miraculous tool, that dispenses with other means and methods of psycho pedagogical evaluation. He and Mr.Freitas recognise the need to collect as much information as possible about the abilities of a student and the importance of traditional diagnostic methods. However, what both teachers experienced allowed to them to determine was that, in certain situations, a careful observation of a student using, for example, Kinect Adventures on different occasions helps to diagnose impairment of functionality in areas such as: psychomotricity, at the level of body schema, laterality and spatial orientation; perception, especially visual; and broad motor skills.

Mr.Medeiros worked with a significant range of young people with problems, such as: Trisomy 21, Autism Spectrum Disorders, Mild, Moderate and Severe Mental Deficiency, including Amblyopia and Ataxia (a non-specific clinical manifestation implying dysfunction of the parts of the nervous system that coordinate movement, such as the cerebellum).

The group of students that participated in the video game activities meets the requirements for different types of disabilities, with a cross-cutting emphasis on communication difficulties, simple and complex messaging and simple command and signalling, formulated by their peers.

Mr. Medeiros isolated some of the principal problem that emerged while playing the game with Kinect in the classroom activities. He and Mr. Freitas identified other situations but these were more obvious because they were more extreme. The problems were formulated by him in his special needs teacher point of view. The most used video game was Kinect Adventures but Dance Central

also played a role in some activities.

The problems

People with disabilities encounter limitations when using new technologies and, in the very specific case, of Kinect those are numerous. Let's look at specific cases.

Problem 1: Student A is diagnosed with moderate to severe mental deficiency, has great difficulties in the area of fine motor skills and cannot handle a command or joystick with precision.

In this case, experience showed that the use of Kinect enables perfect control of the game with few sessions of use, since the student intuitively performs exercises of the gesture, in a highly motivating way, with the intention to prepare the game. The manual coordination required in this task was achieved, with some adult guidance, in a very natural way. The process of command manipulation was accomplished by first exploring the area of visual perception, in the way that the student had to properly interpret the stimuli and select the virtual buttons that appeared on the screen. It was also verified that these procedures enhance the visual memory, since the autonomy of the students in navigating the menus is well-known, following the necessary steps at the beginning of each adventure (Kinect Adventures).

Problem 2: Student B presents an autism spectrum disturbance and cannot maintain a period of shared attention with his peers for more than a few seconds.

During the first year of attendance at the school, the student presented the following limitations: didn't participate in the classroom activities, didn't interact with his peers and couldn't maintain periods of shared attention with other students or teachers. In this case, the use of Kinect enabled the student to interact with a classmate for periods that started for about three minutes (duration of a single adventure), until an occasion of interaction of about ten minutes in which the student remained integrated into the group, prolonging the period of shared attention with one of his peers.

Problem 3: Student C meets the diagnostic requirements for mild mental deficiency, associated with severe communication difficulties.

This student presents a history of difficulties in the use of language as a means of communication. With a very reduced oral linguistic output, without expressiveness, intonation or other marks of emotionality, after eight months of using Kinect, the student was able to, during a Kinect adventure, transmit simple orders such as 'jump'; 'left'; 'right '; 'forward'; 'backward'. He did that autonomously and in a game context, establishing a partnership with a classmate and coordinating, seeking to establish moments of synchronicity at the level, for example, of jumps.

Problem 4: Students D and E present an Attention Deficit Hyperactivity Disorder, associated with moderate mental deficiency.

Both students present extreme difficulties in maintaining attention to proposed tasks, as well as in presenting periods of shared attention. In an initial period using Kinect, the teachers monitored their concentration by recording how often they looked away from the activity. In the first sessions, the number of times this occurred was enormous. After eight months of use, student D actively participated in Kinect sessions, being able to perform an adventure while presenting a very reduced number of distractions. More than this, we saw that shared attention had undergone a very positive evolution, since there were already periods of continuous interaction, with intentional communication and shared common objectives. Regarding student E, the period of using Kinect was of two months, so it wasn't possible to achieve relevant progresses.

Problem 5: Student F fulfils the diagnostic requirements for mild mental deficiency, associated with difficulties in expressive language, more specifically in the transmission of simple and complex orders to his peers.

The use of Kinect in this specific case allowed the teachers to develop a level of analysis different from the previous ones. As the young person, the student intuitively reached the previously mentioned nuclear objectives and took a leading role with regard his peers. The growing understanding of the game, as well as their performance in the different adventures of Kinect Adventures favoured a communicational scenario in which the student moved from a solo intervening level to one of cooperation and coordination in regard to his colleagues. At the time of the assessment, the student was already able to coordinate sessions of use of Kinect with his classmates, as well as situations of interaction between groups of regular students with students with disabilities. Strengthening his self-esteem and confidence in his abilities made this student a leader. This analysis was based on Kinect usage sessions and transferred to outside of game situations.

Problem 6: Student G was born with trisomy 21, with severe situations of estrangement and increased difficulties of interaction with her peers, associated to frequent emotional problems.

This student showed severe difficulties in participation in group activities, as well as in the identification of the class space, within the scope of the continuous interaction with her peers. The student's moments of exposure to the group often resulted in episodes of aloofness and/or refusal to participate in the activities. What the teachers could observe during the study was that the student, in the particular case of the use of Kinect, participated systematically in the activities, cooperating with all the colleagues that were assigned to her, in a natural way. Obviously, the levels of interaction varied the differences between the levels of the student and her peers. However, Mr. Medeiros and Mr.Freitas can say that her participation in group activities assumed a totally different dimension with the use of Kinect.

Looking back at the work developed by both teachers, Mr. Medeiros feels it was very innovative at the time because Kinect reached the market in October/November 2010 and the activities with this technology started at the school in February 2011. He understands now that at the time, at least in Portugal, very few had a clue about the potential of the technology that was being used in the school. He pointed out the fact that, at the time, Mr. Freitas being a gamer and having literacy in the matter allowed the idea to take form which led to the use Kinect in a pedagogical way. Because of the novelty of the approach, they didn't find any support in literature about the usage of that specific technology with video games in a special needs scenarios. Innumerable discussions and a step by step approach was what allowed the teachers to build the classroom strategy that enabled them to identify the areas they could work in the special needs field. Mr. Medeiros feels that they could have gone further with the work, but the lack of specialised bibliography and working alone did not allowed the activity to reach its full potential. He still believes in this technology's potential (Kinect plus video games) as a diagnostic tool to the problems he mentioned. The way to do it must involve a team of: teachers, gamers, game developers, neurologists and psychologists in order to identify the areas Kinect may approach, diagnose, and even work to overcome disabilities.

Dance central box

For a period of three years, Mr. Freitas and Mr.Medeiros organised Dance Central contests at Escola Secundária de Lagoa.They were organised by the teachers and developed by the special needs students. One of the pupils was better at performing the role of captain. He also did a better job at managing the various contestants. These two roles during the activities helped the special needs class to shine among the rest of the school population and this contributed to their acceptance and integration. The video game was creating social integration and inclusivity inside the school. When in front of a game, any student regardless of special needs is just a player. We had many pairs of contenders from different kinds of classes, all playing the game. This type of connection with the rest of the school contributed to a better integration of the special needs students who became more at ease and accepted in the playground. The fact that this activity became a case study for Microsoft and they even participated in a promotional video (https://www.youtube.com/watch?v=nA28i1WAs38) also contributed to the popularity of the students in the school and their self-esteem. We think this is a good example of a very positive effect of a video game in the school, and that the idea that video games only serve to isolate kids is not true in all situations.

Appendix: Games for Health (G4H) in general

Gamification has become the new buzzword in the healthcare industry. Games for Health, also sometimes shortened to G4H, is the leading professional community in the field of health games, bringing together thought leaders, innovators and health technology companies focussed on advancing game technologies that improve health and the delivery of healthcare. Games for Health works to foster awareness, education and development of games that make a positive impact on the health of patient populations and the healthcare ecosystem. The Robert Wood Johnson Foundation is the original and an ongoing supporter of the Games for Health Project. Examples of applications in healthcare include rehab, wellness, therapy, training and coaching, patient empowerment and medication adherence.

Up to now different game-based technologies are used in and for different fields and supports the three target groups: (1) patients, (2) doctors and (3) medical students.

There exist many case studies which test the patient's engagement. Patients can learn by gaming how to take better care of themselves in order to improve their health conditions. This changed behavior can save their lives in a long-term and short-term. The motivation of the patients is especially a key factor for that. This motivational aspect is particularly important for the treatments. Therefore, the video games should motivate the users to learn how to manage procedures to improve their health.

In addition, a doctor and medical student have to keep training in order to reduce their mistake rates and improve the reaction time for example during a surgical operation. Therefore, it is possible that surgeons can fine tune their motor skills through gaming.

Training of doctors and medicine students

Technical innovations and simulations are used in medicine for training and further education. The use of video games for the training of medical students is growing though it is still a very young and underdeveloped field. These video games are designed especially for training and education purposes. Furthermore, there exists a shift from learning with cadavers to 3D interactive software to teach technical skills in medicine. Technical skills, such as the skills a dentist needs, can be trained by realistic tactile sensation situations using a high-definition 3D head neck anatomical dataset with a haptic interaction, just to name one example.

The usage of these 3D simulation models causes great reduction in the time needed for the dissection of cadavers and anatomy teaching in medical and surgical education and has increased the requirement to supplement learning with the use of virtual gross anatomy training tools.

Regarding patients, there are several approaches to support them.

1. Improving physical and mental fitness at home

The Xbox 360 console game 'Your Shape: Fitness Evolved' by Ubisoft ,which requires the use of the Kinect system (no longer supported by Microsoft), animates the player through precise movements to work out the muscles. The hand-motion menu saves data about your age and weight and offers you exercises which will not overexert you as a player. The game offers a wide range of opportunities for a hard workout, but also more gentle Tai chi and yoga moves with an on-screen instructor. In order to keep the player motivated, it gives you a score for your performance.

A widely known game with a big impact was the fitness app 'Zombies, Run' (https://zombiesrungame.com), released in 2012. The player is introduced to a scenario of a zombie epidemic. Only a few people survived it. The player is a runner, who tries to reach one of the last remaining outposts of humanity. It has to be noted, that this game is not made for patients, since it doesn't adjust the goals to personal fitness and conditions, but is meant for people who are otherwise in acceptable health.

SPARX (https://www.sparx.org.nz) is an example on how to improve mental fitness. It is an online e-therapy tool provided by the University of Auckland, and funded by the Prime Minister's Youth Mental Health Project. It uses a 3D animated game environment to engage young people and teach them skills to manage symptoms of depression (e.g. dealing with negative thoughts, problem-solving, activity scheduling, relaxation), in a self-directed learning format. Users are able to customise their avatar and journey to seven provinces, each with a unique set of challenges and puzzles. The guide explains how the skills in the game relate to the challenges a young person may face in the real world. It can be used with minimal oversight. The game is based on a successful pilot study carried out by Dr Karolina Stasiak, as part of her PhD.

2. Supporting medication and chronic condition management

The app 'Mango-Health'(https://www.mangohealth.com) reminds the patients to take their medications at specific times. Taking the medications earns the user points, which can be used for vouchers. In this case, the use of games in the healthcare industry can be seen as a substitute for a companion or a guide.

There is a wide range of video games on specific diseases like asthma, bladder and bowel dysfunction and diabetes. Randomized clinical trials show that playing health education and disease management video games, reduces emergency visits of 77% for asthma and diabetes patients.

3. Physical therapy and rehabilitation

Serious injuries and strokes can change a person's life overnight. To get an idea of these dramatic changes, one can try the SCI-Hard gaming app of the University of Michigan (http://cthi.medicine.umich.edu/sci-hard). In this app the player has 30 scenarios with mini-games, which show the everyday challenges after an accident.

Further examples:

- Reflexion Health is a company for rehab which uses a video-feedback system in order to correct the movements of patients during exercises. One advantage is that the system can be practiced at home. (http://reflexionhealth.com)
- GestureTek Health (http://www.gesturetekhealth.com) has created interesting innovations in gaming. It developed applications for health and rehabilitation. Using these the patients train their physical and cognitive capabilities. The patient trains its hit region with help of games.
- Another approach is the app 'MusicGlove' (https://www.flintrehab.com/product/musicglove-hand-therapy/). The glove is used for hand therapies. The player exercises therapeutic moves while playing an engaging musical game like 'Guitar Hero' . The movements minimise the monotony of painstakingly practices. Tests show that the use of the glove during a game improved hand function in two weeks.

5. Supporting the treatment of children

Children in particular are an important target group. Usually children do not understand the urgency of therapy or drugs. They often are resistant to taking pills, eating vegetables or staying in a hospital.

Games can help children to forget that they are in a therapy or medical treatment. It is a common practice to try divert children during treatments or therapies by gaming. Many studies show the positive impact of gaming on side effects of cancer treatments. Games have a kind of therapeutic effect, because they provide a new focus and can distract children from the negative aspects of their treatments and illness. Results show that during chemotherapy gaming reduces nausea, anxiety and pain. The Gamers Outreach Foundation (https://gamersoutreach.org) developed so called 'GO Karts' for hospitals. These 'Go-Karts' are created from hospital grade carts with integrated gaming consoles, monitors, assortment of games and controllers. These reduce anxiety during painful treatments, too.

Another gaming example for children in healthcare is an app from the American Red Cross called 'Monster Guard' (http://www.redcross.org/monsterguard). The monsters Maya, Chad and Olivia prepare children for emergencies at home or around the country like fires, earthquakes or other disasters. The player earns points for the correct behavior during a task, for example demonstrating what to do during an earthquake. Another example for an app like this is 'Sai Fah - The Flood Fighter', a Japanese app for children that has a similar approach.

G4H will continue to be more and more present in the future. Therefore, as a teacher you should not ignore the use of G4H to help show children a new way how a healthy lifestyle can look like. You

should be aware that the use of G4H only serves as an inspiration and can have an influence, for example, to find fun in sports or a new diet.

Here too, the technical innovations will lead to further developments in education.

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With the rapid growth of mobile devices in recent years gaming has become omnipresent. For young generations playing games is a normal part of their every day lives. However, despite talking a lot about it we haven't managed to take advantage of the fascination and motivation that games hold for young people when it comes to education. It is easy to see the huge potential of games in education but the real difficulty is taking advantage of this potential.

Find out how you can take the first steps in using games to teach learners and what it can do for you. This book is for teachers with and without experience in game-based learning alike. We want to take you on an adventurous journey through the world of game-based learning and we want to help you explore and navigate the sometimes confusing roads that lead to a variety of different fields in which games can be used. Get the confidence and knowledge you need to superpower your classroom and become a teacher of the future.

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