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The Red Circle project: How mathematics can be embedded in online gaming quests for enhancing learning and teaching

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Introduction

‘The Red Circle’ is a game that explores how mathematics can be embedded in online gaming for the benefit of the current mathematical teaching practices. It is a part of a larger project that aims to promote learning through virtual, social and competitive environments by establishing a new gaming genre named EduMMORPG. The name derives from the word Educational and the already existing gaming genre of Massively Multiplayer Online Role Playing Games. The wider project will take place in a PhD degree and aspires to introduce a new approach to learning, using pedagogic techniques of teaching mathematics in an attempt to create a multiplayer game that is worthy of comparison to alternative competitive games in terms of mechanics, balance and entertainment. ‘The Red Circle’ is supported by the ISC, University of Sussex. The educational level that it works with is GCSE to A-Levels and can assist adult learners who need to refresh their knowledge or learn mathematics.

‘The Red Circle’ project started in August 2018 and it is expected to be completed in June 2016. The game was made using UNITY’s game engine to create a fantasy world that was built to accommodate a story line. In the workshop, along with the presentation, the participants will have the chance to interact with a demo version of the game.

Method

The aim of this project is to explore how an engaging story line can be combined with the learning of mathematics. The story line follows a series of quests. The quests are tasks within the story line that are given to guide each player through their knowledge path. As they are essentially the main teaching part they contain mathematical questions ranging from short to long questions, covering basic algebra, geometry and statistics. NPCs (Non-Player Characters) interact with the player, giving directions for the quest along with maths questions (medium questions). The player has certain abilities (skills) which can be used during a fight. The activation of certain skills also requires the use of mathematical calculations (short questions). Moreover, there are certain interactive items (chests) which contain long maths questions and give rewards. When the player needs further assistance to solve the mathematical questions, ‘billboards’ are set on the scene with the relevant information.

Participants are expected to complete the quest line and answer a questionnaire upon completion. Data from the questionnaire will be collected and analysed.

Expected findings

As the collection of data is expected to take place in June 2019, the expected findings of this project are anticipated to answer the following questions:

- How engaging was the game?
- Were you able to find information in game to complete the quests?
- Was the quest line clear? Did you know what you were asked to do?
- Which parts did you find more enjoyable?
- How difficult was it to navigate and use the UI?
- How much did the maths questions distracted your entertaining experience?
- How difficult were the maths questions for you? Which topic did you find more difficult?
- How engaging did you find the story line? Are you looking forward to the continuation of the story?
- Would you play this game again? Would you recommend it to a friend?

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Impact of Virtual Reality (VR) and Augmented Reality (AR) on teachers delivering mathematics in further education

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Introduction

Virtual Reality (VR) and Augmented Reality (AR) technology have been in existence for a while, an immensely innovative development capable of transforming and enhancing life. Presently the gaming industry is making the most of this innovation and whilst this technology brings vast opportunities for all, the education sector has not fully embraced this or taken full advantage of the technology. There may be many reasons for this including lack of understanding and investment, teaching practitioners not skilled in using this technology or do not know how to best use these tools pedagogically. Other reasons could be to do with pressure of having to cover a curriculum within a tight timescale with a view to maximising learner outcomes which can often lead to being risk averse and perhaps some practitioners are set in their own ways, not willing to change.

Brent Start, an Adult and Community Learning provider for London Borough of Brent; Wembley, London, serving approximately 3,000 learners, in over 50 centre across Brent, have recently invested in developing a Virtual Learning Environment, which we fondly call The Virtual Pod (VP). The VR is fully kitted out with AR and VR technology along with a “Wonder Wall”; a fully immersive corner of the room where the floor and the two adjacent walls are fully interactive with integrated sound system. Brent Start recognises the need to develop digital technology and digital curriculum to enable Flip/Blended learning to flourish. Studies have shown the efficacy of Virtual Reality in the developing spatial ability (Durlach et al.,2000; Rizzo et.al., 1998)

We have started to convert our learning resources to digital resources so that learners are able to access learning from anywhere, anytime and anyplace. With the investment in AR and VR we are going a step further by enhancing learning through virtual stimulation and simulation, developing spatial skills and cognitive thinking without having to leave the classroom and also brining objects to life so that learners can truly visualise objects, thus provide better conceptual understanding.

However, to maximise the benefits of VR and AR for our learners, we need teachers to develop technical and pedagogical skills to make the most of this technology. Without practitioners being fully conversant with the technology, the learning will be ineffective. Teachers need to appreciate the complexity of the technology as well as the potential it brings; be aware of the pitfalls, learn how to make topics interactive and how to develop schemes of learning oriented around VR and AR. It is also acknowledged that teachers

with the help of AR can raise interest and motivation of learners, enhance learning and raise better understanding of the subject matter (Yingprayoon, 2015)

Within Brent Start, along with other Skills for Life programmes, mathematics is a prominent curriculum area with high concentration of entry levels to level 2 learners from a various socio-economic backgrounds and from various ethnicity. For some learners, attending learning is an achievements whilst other aspire to attend university degrees. Many of our learners are challenged due to social, emotional and mental well-being and many also have numerous barriers to learning including technology. With this in mind and given the nature of our learners, lacking the willingness to engage in learning, it is essential that we are able to motivate and encourage learners to participate, excite them in the learning process whilst maintaining their commitment to successfully complete their programme of study, particularly for our female learners, which represents 86% of our intake. We know that maths is often frowned upon by many people, this may be due to many factors including poor personal experience in learning maths. Moreover, Geometric questions are in the main difficult and the subject matter is closely related to spatial skills and it is known that students have low achievement and have negative attitude towards geometry (Bako, 2003). Hence the need to look at new ways of improving teaching and learning that will capture their imagination.

Likewise, our teachers have differing views of educational technology, is not that they are averse to new technology or new ways of teaching, it is more about being confident, having the skills to navigate around the technology and being able to articulate and engage learners with their new pedagogical skills. In addition, it is also about demonstrating benefits of using new technology. Once practitioners are able to see the benefits not just only for their learners, but also for them in terms time and effort, they will embrace this change which will be a positive one.

Method

So in order to maximise the use of VR and AR technology, we have developed a small but focused study to ascertain the impact of VR and AR on teachers in delivering Mathematics (3D shapes) with a view to see how teachers change their pedagogy. By working in 3D space, complex 3D problems may be understood better and quicker than traditional methods (Kaufmann 2009).

We will use the Class VR Technology as the VR & AR tool and use resources developed internally using the software Paint 3D, which is compatible with Class VR, to conduct this research.

The research will focus on 6 teachers using VR and AR technology and will collect their feedback and views and how VR and AR has shaped their thinking in their teaching practice. In addition, we will collect feedback from other experts.

Workshop

In the workshops, we will be share some of the findings and advise delegates on some of the things we have learnt, we will also bring along the hardware (VR and AR equipment) together with curriculum resources for delegates to have hands-on experience in using this technology.

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Make Your Own Escape Room

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Introduction

Escape rooms have grown in popularity in the past few years. At their core, escape rooms are games in which players need to complete a series of challenges to win. When the first generation of escape rooms focussed on difficult logic puzzles, escape rooms today have evolved into fully immersive environments with high quality props and effects (Wiemker, Elumir & Clare, 2015).

Escape rooms encourage players to think creatively and engage in critical thinking. Solving a puzzle and ultimately winning will require individuals to work on the puzzles using multiple approaches to knowledge.

Escape rooms help develop skills in team work, creative problem solving and critical thinking. Considering an escape room can be themed with almost any topic, this makes it appropriate for the classroom. Educators at all levels can benefit from the use of escape rooms from primary levels graduate level.

Method

Escape rooms are booming. How nice would it be if you can use one in your math lessons.

The skills the student needs are: searching, observation, discernment, correlation, memorization, math, words, pattern recognition, compartmentalization. All skills that are very useful for numeracy.

In this workshop we teach you how to build your own mobile escape room, to be used as a motivating activity in your classroom. During the workshop we will do several logical assignments with the aim to unlock boxes. We explain the format that we used successfully in several workshops in The Netherlands.

Expected findings

You can use our format to finish the escape room you made a start with during the workshop.

References

*Markus Wiemker, Errol Elumir, Adam Clare, November 2015, Escape Room Games: “Can you transform an unpleasant situation into a pleasant one?”

Brainstorming on a Numeracy Framework into the 21st century

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In a recently started Erasmus+ project four countries are working together to design a Common European Numeracy Framework (CENF). Considering numeracy as a social practice seems to be the most promising way forward to battle low numeracy and empower adults with a broad and effective repertoire of numerate behaviour to cope with situations in work and daily life. Therefore, a numeracy framework should contain much more than only content descriptions. Incorporating dispositions, attitudes, higher order skills, and affective aspects is as important. Such an elaborated framework can inform more multifaceted decisions on educational arrangements for adults who want to improve their numeracy behaviour repertoire to better cope with the quantitative problems in work and private life or to more fully and critically participate in the democratic processes in society. In the workshop we will brainstorm, discuss, and design elements of a “numeracy-as-a-social-practice” framework.

Introduction

In a recently started Erasmus+ project four countries - The Netherlands, Austria, Spain, and Ireland - are working together to design a Common European Numeracy Framework (CENF) and a set of professional development modules (PDM) for teachers and volunteers who work with groups of adults to improve, enrich and facilitate their numerate behaviours in situations they encounter in their daily life.

The driving force behind this endeavour is that too many European citizens lack the necessary numeracy competencies to participate autonomously and effectively in our technologized and number-drenched society. Consequently many citizens are overlooked for certain jobs and have problems in their daily life, dealing with the abundance of number-related circumstances (see Hoogland, 2018). The results of the last PIAAC survey (OECD, 2012; OECD, 2016) show that for almost all participating countries in PIAAC 10% of the (potential) working population have numeracy levels below level 2 of a 6-point scale. These results on numeracy give rise to serious cause for concern for the future economic development of Europe. This is an even more pressing issue since the amount of numerical data that needs to be interpreted and used is rapidly rising due to technological developments and the prevalence of (big) data.

Theoretical background

The design of the framework and the modules is rigorously grounded in literature reviews, Europe-broad surveys, and professional development trials, to build upon the

vast experiences of people in the field, the conceptual developments in adult numeracy education as they have been blossoming for the last 25 years, and the societal demands of the 21st century (Schwab, 2016; Voogt & Pareja Roblin, 2012). Furthermore the PIAAC Numeracy Assessment Framework (Tout et al., 2017) is used as a source of inspiration.

Considering numeracy as a social practice seems to be the most promising way forward to battle low numeracy and empower adults with a broad and effective repertoire of numerate behaviour to cope with situations in work and daily life. We cite Oughton (2013) : “A social practice view of numeracy not only takes into account the different contexts in which numeracy is practised, such as school, college, work and home, but also how people’s life and histories, goals, values and attitudes will influence the way they carry out numeracy (p16). An even richer collection of ideas on this approach can be found in Yasukawa, Rogers, Jackson, and Street (2018).

Among researchers and practitioners there is a growing consensus that a numeracy framework which describes numerate behaviour and numeracy practices should contain much more than only content descriptions. As important are dispositions, attitudes, higher order skills, and aspects of agency, and self-efficacy.

It is quite a challenge how to incorporate all these elements in a consistent and workable framework, which can inform decisions on educational arrangements for adults who want to improve their numeracy repertoire to better cope with the quantitative problems in work and private life or to more fully and critically participate in the democratic processes in society.

Method

The workshop is an elaboration of the backgrounds and ideas presented in the plenary talk “Adult numeracy practices in the 21st century: imperative implications for education”. In the workshop we will brainstorm and discuss the choices that can be made in the design of a “numeracy-as-a-social-practice” framework. But more important, we will also collaboratively design concrete descriptions of numeracy behaviour that can substantiate the more general ideas of the developing framework. We will dwell upon the expertise gathered at ALM to make the next steps in the development of a CENF.

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Presentation of the winners of the BVMBO contest “Best Math Idea 2019”

Kooske Franken

Albeda

Every year the Dutch organization of Dutch Math teachers (BVMBO) and Practoraat Rekenen organize a contest for Dutch math teachers in vocational education, called The Best Math Idea. Three prize-winners win tickets to the ALM, also hotel- and travelling expenses. This year the winners are:

Anne Marleen Tigelaar, ROC Friesland. She developed three digital lesson for her students in the tourist business. The students have to make all kinds of math assignments for the resort of the future and have to organize a trip for tourists called: Visit Holland.

Fedor Kerkhof, ROC De Leijgraaf. Fedor is a math teacher for students in the carpenters industry and he designed a technical assignment called The Wheel of Fortune.

Martijn van der Linden, Summa College The idea of Martijn is called Math Lab. He designed 4 challenges for teams. For every challenge the teams can win badges. The team who wins the most of the badges are the winners.