Sharing Experiences with Serious Games

The EduGameLab rating tool for parents and teachers

Maurice Hendrix

Serious Games Institute
Coventry University
Coventry, UK
maurice.hendrix@coventry.ac.uk

Per Backlund, Mikael Lebram, Henrik Lundqvist
Interaction Lab
University of Skövde
Skövde, Sweden
{per.backlund, mikael.lebram}@his.se,
a08henlu@student.his.se

Abstract— **Computer games have been recognized for their educational potential for some time now and the number of educational games available has steadily increased in recent years. As the number of educational games available increases, serious games are starting to face a similar dilemma to other types of educational resources: how can educators or parents easily find the most relevant games and share their experiences from using these games? To this end, the EduGameLab project has developed a tool for sharing experiences about educational games among educators and parents. The development of this tool was based on a metadata schema for formally describing serious games and experiences with these games. In this paper we report on the development of this tool, revisit and refine the metadata schema based on our experiences and evaluate the usability and usefulness of the tool based on feedback gathered at practical workshops with educators.**

Keywords—games; education; metadata; rating; sharing

I. INTRODUCTION

The use of computer games in education has grown over the years and the potential of educational games to enhance efficacy [1] and motivation [2] over traditional learning methods is increasingly being recognized [3]. Educational computer games differ from traditional learning methods in that they often combine high fidelity audio or video with elements of game play. This can offer a more immersive learning experience that provides even higher levels of engagement and direct feedback. However, it also means that educational games often contain multiple learning objectives and that it is very difficult if not impossible to take them apart in easily manageable blocks of learning content. This, combined with the growing number of games, makes it more challenging for educators to determine which game to use in their teaching. At the same time parents who may want to introduce an educational game to their children are also faced with a large number of games but no easy way to find and compare the ones relevant to their child. Various standards have been established for describing more traditional educational content [4], and there is a movement towards describing learning content as learning objects [5], which contain one single learning objective. However these standards do not effectively describe educational games, as they lack both key technical aspects, such as the platform, as well as key

descriptive aspects of games, such as the intended age group or game genre. In order to remedy this situation, we have previously introduced a metadata schema for describing serious games [6], for integration with the IEEE LOM (see http://ltsc.ieee.org/wg12/files/LOM_1484_12_1_v1_Final_Draft.pdf) standard. After the development of this metadata schema, we realized that since games often combine multiple learning objectives they can be used in various different situations with diverse purposes, for example with different groups of learners or even to teach different topics. Hence it was necessary to include descriptions of experiences of using these games in particular contexts in the metadata schema. This led to the development of the EduGameLab tool for sharing experiences of educational game use.

This paper is organized as follows. Section II briefly introduces the concept of serious games. Section III introduces an update metadata schema that our tool is based on and discusses the process of searching through a large set of games described in it. Section IV details the development of this serious games experiences sharing tool. Section V outlines the results of a preliminary evaluation conducted at workshops for teachers in France and the improvements we made as a result of this evaluation. The section also outlines how we plan to further develop the tool to address the feedback. Finally section VI concludes and outlines our future plans.

II. BACKGROUND

The term *serious games*, was defined by Zyda [7] as: "...a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives." There are many studies about the use of serious games and their effectiveness in formal education. In a structured literature review, also presented at this conference, we identified 99 articles published between 2002 and 2012 and many more games have been developed commercially without scientific studies. Hence there is a clear need for an easy way to find the most relevant games as no individual teacher will be able to review all serious games. There is a clear trend towards a few popular topics such as mathematics, natural sciences, language learning, higher skills, behavioural change, computing, geography and surgery.

An important aspect of sharing experiences in any system is the ability for other people to be able to find the information. To this end, it becomes necessary to consider how an educator (a teacher, or a parent), might be able to search for a serious game in a shared experiences tool [8].

III. UPDATED METADATA SCHEMA

In our previous work, we introduced a metadata schema for serious games [6], that contains descriptive information and reviews for sharing practical experiences with games. The experience of building the tool, as well as the observations on how a teacher or parent might search for a serious game, has made it necessary to update the metadata schema. In the tables I and II, we present our updated metadata schema, highlighting the fields that have changed in bold.

TABLE I.   UPDATED METADATA SCHEMA FOR SERIOUS GAMES

Field	Type	Multi-plicity	Content
Game developer	Text	1	Name of the developer/publisher of the game
Sponsor	Text	*	Name of the institution who commissioned/ sponsored the game
Age group	2 non-negative numbers	1	Intended age group. Specified by a lowe and higher age (e.g. 12 and 14 represents 12-14 years old)
Language	Text	+[a]	Languages (ISO 639-1 2 letter codes)
Advised gaming experience	Enum	1	None, Beginners, Moderate, Experienced, Experts
Learning objectives	Complex	+[b]	Combination of subject & content type (1 of): • Learning/self assesment • Applying Concepts/Rules) • Decision-making • Sensorial/dexterous knowledge • Factual knowledge • Social Interaction/values/cultures
Game genre	Enum	+	The genre of games: (Action shooter, action-adventure, adventure, role-playing, construction and management simulation, life simulation, vehicle simulation, simulation, strategy, music, exercise/ training, sports game)
Type of game	Enum	+	Virtual world, 3rd person, 1st person, board game, turn-based, card, other
Technical platform	Enum	+	E.g., PC, Mac, iPhone, Android, Playstation3, Wii etc
Platform type	Enum	+	(Pc, Console, Mobile, Other)
Multi player capacity	Enum	+	**Online, single player, multi player**
Performance indicators	Enum	+	E.g., In game score, time, completion, appreciation, success, failures
PEGI rating	Enum	[0..1]	PEGI rating, only if official rating is available: (3,7,12,16,18)
PEGI reasoning	Enum	*[c]	PEGI rating, only if official rating is available: (Bad Language, Discrimination, Drugs, Fear, Gambling, Sex, Violence, Online play)
Links	Text	*	URLs
Review	Complex	*	See table II

<div align="right">
a. * = any number, += 1 or more
b. Enumeration, i.e., a choice out of a given list of values
c. c. If there is a PEGI rating other than 3 than the multiplicity is + otherwise 0
</div>

TABLE II.   UPDATED REVIEW ENTRY

Field	Type	Multi-plicity	Content
Learner Specifics	Complex	1	Composed of each of: • Age • Occupation (e.g., In full-time education, unemployed or one of the items of the Standard Occupational Classification 2010 [9]) • Subject area if in full-time higher and further education, e.g., one of the topics from Wikipedia for easy translation • (0 or more) competences using either HR-XML [10], IEEE RCD [11] or IMS RDCEO [12]
Pedagogy	Complex	*	Point on Kolb's learning cycle [13], or other pedagogical models such as Boolms taxonomy [14], or Gees Learning Principles [15]
Context	Complex	1	• Context the game is used in (by the reviewer) composed of each of the following sub-fields: • Place (one of school, home, museum, mobile, other) • Subject (free text / Wikipedia topic for easy translation) • Time of the pedagogical activity involving the game • (0 or more) supporting resources
Rating	Complex	+[a]	(0,1,2,3,4,5) indicating the subjective pedagogical quality, based on the distance between the aim and the result of the evaluator, compared to their usual approach

How can we find a particular game in a set of games described using this metadata schema? The main target audiences of the tool for sharing experiences with serious games are teachers and parents. This may range from the innovative teachers who are familiar with serious games to those that have never used them before and also from parents who have played games and are aware of or even have used serious games to those that have never played a game before. This means that the search process needs to cater for both novices and experts when it comes to games. The fact that the target group both encompasses teachers and parents also means that a search function needs to allow for both a pedagogical expert (e.g. an experienced teacher) as well as a novice (e.g. an interested parent with no formal teacher training). A search needs to include the ability to search the purpose of a game [8]; the circumstances it was intended for or is used in; the pedagogy it was intended for or used with; and needs to cater for users ranging from novice to experienced gamers.

IV. TOOL FOR RATING AND SHARING EXPEREINCES

The design of experience sharing tool is based on the observations on search and the updated metadata schema presented in the previous section. The tool (see http://edugamelab.hosting.his.se/sgdb/) was implemented as a web-based system, loosely based on the Drupal (see http:// drupal.org) content management system. Hence any parent or teacher with internet access can use the tool, search for and submit games and reviews. Searching and browsing can be done without creating an account. The tool is available in

French and English, showing only content in the relevant language and features a search interface. The search interface has a free text field, for searching in game titles and descriptions, similar to many search interfaces in web sites such as search engines. In addition, it features an interface that allows teachers or parents to find games based on what they plan to achieve with the game. The top of the page has the number of games and reviews found. For example, if a teacher is looking for a mathematics game to use in the classroom, the number of games found is too large. By further indicating target ages and educational context (e.g. primary school) the teacher can then restrict the games and reviews to a lower number of just those games that might be of interest.

Results are shown in an overview. This overview contains both games and reviews that fit the search criteria. It is possible that a game does not show up while one of its reviews does or vice-versa, if a reviewer used a game for a purpose other than it was originally designed for.

In order to achieve our aim of creating a tool that supports sharing of experiences with educational games, it is important to find a balance between requiring very detailed information, to enhance data quality, and the amount of effort needed to add games and reviews, which is linked to people's willingness to add data, affecting the quantity of data available. The fields in the tool are based on the metadata set but only a small set is mandatory. The tool is also pre-populated with games with a PEGI rating. In the next section we will see that this actually causes some confusion as it initially leads to a large amount of games with only minimal information and very few reviews. It does however mean that for a large amount of commercial games users do not have to add them completely from scratch. The interface displays the available choices for most fields such as technical platforms, making it considerably easier to fill in. We also decided to make only few fields mandatory.

Adding a game is divided into 3 steps. In the first step a user is asked to fill in the following basic information *title*, *game producer*, *game developer*, *sponsor*, *release date*, *country*, *technical platform*, *additional technical platforms*, *multiplayer* and *license type*, with only the title mandatory. In the following step more information can be provided as follows: *content type*, *game genre, representation*, *intended subject*, *detailed subject*, *intended educational context*, *educational purpose*, *performance indicator*, *game language*, *interaction type*, *logging* and *links to additional resources*. These are all optional. Finally in the last step more information is added about the audience in terms of age range and *required gaming experience*.

Reviewing a game starts with a search for the game. If the game is not found, it needs to be added first. Once located a game can be reviewed by clicking on *more info* this then shows a review button, which opens the review interface. This interface is also divided into 3 sections. There is an important overlap between adding and reviewing games when it comes to indicating the pedagogy and context of use. This is intentional as games may be used in a context that is different from the context they were originally intended for. For example, Minecraft (minecraft.net) is a sandbox game that allows free play, but has been used for various teaching purposes, e.g.

mathematics, language, and history (see for example: minecraftteacher.tumblr.com/). The review does not have any mandatory fields. The first step asks a reviewer for details about the *Reviewer Role*, *Educational Context*, *Educational Context Keywords*, *Subject in which the game is used*, *Detailed subject*, *Group Size*, *Place of Use*. The second step gathers information about the *Play Time*, *Time of Pedagogical Activity*, *Teacher Role* and the final step about *Additional Context Details*, *Additional User Details*, *Relation to Curriculum*, *Valuable Experiences and Links to Additional Resources*. In this third step there are also 3 star ratings, for rating the game: *Rating as motivator*, *Rating as an enhancer of learning speed*, *Rating as enhancer of higher level skills*. The rationale behind this is that a game may be motivational but that could slow the learner down, or some type of games may increase either the speed at which players learn, or higher order skills such as critical reflection on the topic.

V.   PRELIMINARY EVALUATION AND IMRPOVEMENTS

We conducted a preliminary evaluation of the tool for sharing experiences with serious games at workshops in France. These workshops hosted training for teachers interested in novel teaching methodologies. In these workshops experts from the science museum Universcience in Paris and the CRDP de Créteil, a regional teacher and education network in the Créteil region of Paris introduced the topic of serious games and asked seven volunteers to try out the tool. Due to the low number of participants, collecting direct qualitative feedback was seen as more useful than distributing a questionnaire. Below we list the main findings of this evaluation and updates to the tool we have made.

- The import of PEGI rated games introduced a lot of games into the tool. In the trial phase, the tool contained few reviews since the workshop participants were among the first to use the tool. This created real confusion. The fact that for most of these games the metadata schema was only partially populated (due to the PEGI import) made this worse. For the current version we have hidden the PEGI imported games. When a user adds a game that is also a PEGI game, it will appear with the PEGI information already populated.
- Feedback from the workshops indicates that participants struggle to use the tool. Although there was a user manual and introduction planned for the workshops, the workshop hosts decided not to use these as they were only available in English. So clearly teachers will need some help and instructions to be able to use the tool. The user guide is currently being translated into French and should be translated into any future languages added to the system.
- Detailed feedback indicated that the grouping of fields was somewhat unclear. The latest version features a colour coding and revised grouping of fields. In particular when adding a game, fields are grouped by descriptive, technical and pedagogical fields. *Intended subject* and *content type* fields are together renamed as *learning objectives*, *representation* is renamed to *type of game* and *multiplayer* is renamed to *multiplayer capacity*, where *online* is one of the options that can be selected together with *single* or *multi player*. *Additional links* will be renamed to *links*.

- Some participants indicated wanting to access the games directly from the tool. While technically possible for many machines copyright implications prevent this.
- The distinction between *publisher* and *developer* was not understood by participants and it turned out that that this distinction was not seen as important. Therefore the current version features only the field *developer*. The relevance of the field *sponsor* was questioned, but some participants found it important to know who commissioned the game, which is the intended use of the field *sponsor*.
- *Choice of license* was found to be unclear and was renamed to *license type* with choices: *free*, *multi user* or *single user*.
- Some participants did not understand what a simulation game is. We feel that this is not something that the tool can address, but instead should be left to a translation of the user guide which contains information about all fields. Information icons were also added to provide hints to users while navigating the system.
- *Representation* was poorly understood. It indicates if the game is e.g. a board game, a 3d virtual world etc. An explanation is included in the manual and the field was renamed to *type of game*.
- Participants were unsure how to indicate *learning objectives* seemed confused about the difference between intended use (when adding a game) and actual use (when reviewing). A translation of the user manual may help with this issue. At the same time we recognized that the field *context type* was confusing and have grouped *subject* and *content type* and named it learning objective.
- Finally we fixed an error in the search. When selecting a field and a level, the level was not taken into account.

VI. CONCLUSIONS AND FUTURE WORK

The educational potential of computer games has been recognized in recent years. The increasing number of games available raises the question how educators can effectively share their experiences and help each other find the right games. In this paper we have introduced a tool for sharing experiences about educational games among educators and parents based on a refined metadata schema for describing serious games. This paper makes two main contributions. Firstly we have extended the metadata schema and secondly we applied that schema to develop a tool for sharing experiences of using serious games.

Pertaining to the metadata schema, we find the extension of the pedagogy entry with a field for describing what the role of the pedagogue (i.e. teacher or parent) important as a game in a teaching situation is indeed a pedagogical tool. Furthermore, the refinement of the rating of the game into 3 different ratings: motivator, increasing the rate of learning and teaching higher level cognitive skills serves to put forward the various purposes of using a game in teaching. This is important as using a game should be a deliberate action with a pedagogical goal.

The workshops revealed a problem in making users understand the difference between the intended and actual use of a game. The intended use of the game is associated with the entry of game data, whereas the actual use is associated to a review. This means that a game can have many reviews attached to it thus revealing the vast pedagogical possibilities associated to it. This aspect will be clearly explained in the user manual translated in the various languages. The distinction between the intended use and the actual use is a necessary one, especially with an eye on the effectiveness of the search function, as it vastly improves the ability to find games and reviews that are relevant.

Future work includes improving the tool's functionality and appearance based on the workshops. We also intend to carry out a more comprehensive evaluation of the improved version of the tool, at workshops in The Netherlands. Finally the great challenge of populating the tool with high quality reviews remains. We expect that the stepwise procedure with few mandatory fields will encourage.

REFERENCES

[1] J. F. Knight, S. Carley, B. Tregunna, S. Jarvis, R. Smithies, S. De Freitas, I. Dunwell, and K. Mackway-Jones, 'Serious gaming technology in major incident triage training: A pragmatic controlled trial', *Resuscitation*, vol. 81, no. 9, pp. 1175–1179, 2010.

[2] D. A. Norman and J. C. Spohrer, 'Learner-centered education', *Communications of the ACM*, vol. 39, no. 4, pp. 24–27, 1996.

[3] C. Conati, 'Probabilistic assessment of user's emotions in educational games', *Applied Artificial Intelligence*, vol. 16, no. 7–8, pp. 555–575, 2002.

[4] A. Paramythis and S. Loidl-Reisinger, 'Adaptive learning environments and elearning standards', in *Second European Conference on e-Learning*, 2003, pp. 369–379.

[5] R. McGreal, 'Learning objects: A practical definition', *International Journal of Instructional Technology and Distance Learning (IJITDL)*, vol. 9, no. 1, 2004.

[6] M. Hendrix, A. Protopsaltis, C. Rolland, I. Dunwell, S. de Freitas, S. Arnab, P. Petridis, and J. LLanas, 'Defining a Metadata Schema for Serious Games as Learning Objects', in *eLmL 2012, The Fourth International Conference on Mobile, Hybrid, and On-line Learning*, 2012, pp. 14–19.

[7] M. Zyda, 'From visual simulation to virtual reality to games', *Computer*, vol. 38, no. 9, pp. 25–32, 2005.

[8] H. Lundqvist, 'Understanding Purpose and Circumstantial Context in the Use of Educational Games: Designing a Search Function and Updating a Metadata Model', MSc thesis, University of Skövde, 2012.

[9] P. Elias and M. Birch, 'SOC2010: revision of the Standard Occupational Classification', *Economic and Labour Market Review*, vol. 4, no. 7, pp. 48–55, 2010.

[10] C. Allen, 'HR-XML: Enabling Pervasive HRe-Business', 2001.

[11] 'Unapproved Draft Standard for Learning Technology- Data Model for Reusable Competency Definitions', *IEEE Unapproved Draft Std P1484.20.1/D5, Jan 2007*, p. -.

[12] I. RDCEO, 'IMS reusable definition of competency or educational objective', *Retrieved December*, vol. 30, p. 2007, 2002.

[13] D. A. Kolb, *Experiential learning: Experience as the source of learning and development*. Prentice-Hall Englewood Cliffs, NJ, 1984.

[14] B. S. Bloom and Krathwohl, D. R., *Taxonomy of Educational Objectives: By a Committee of College and University Examiners*. Longmans, Green, 1956.

[15] J. P. Gee, 'What video games have to teach us about learning and literacy', *Computers in Entertainment (CIE)*, vol. 1, no. 1, pp. 20–20, 2003.