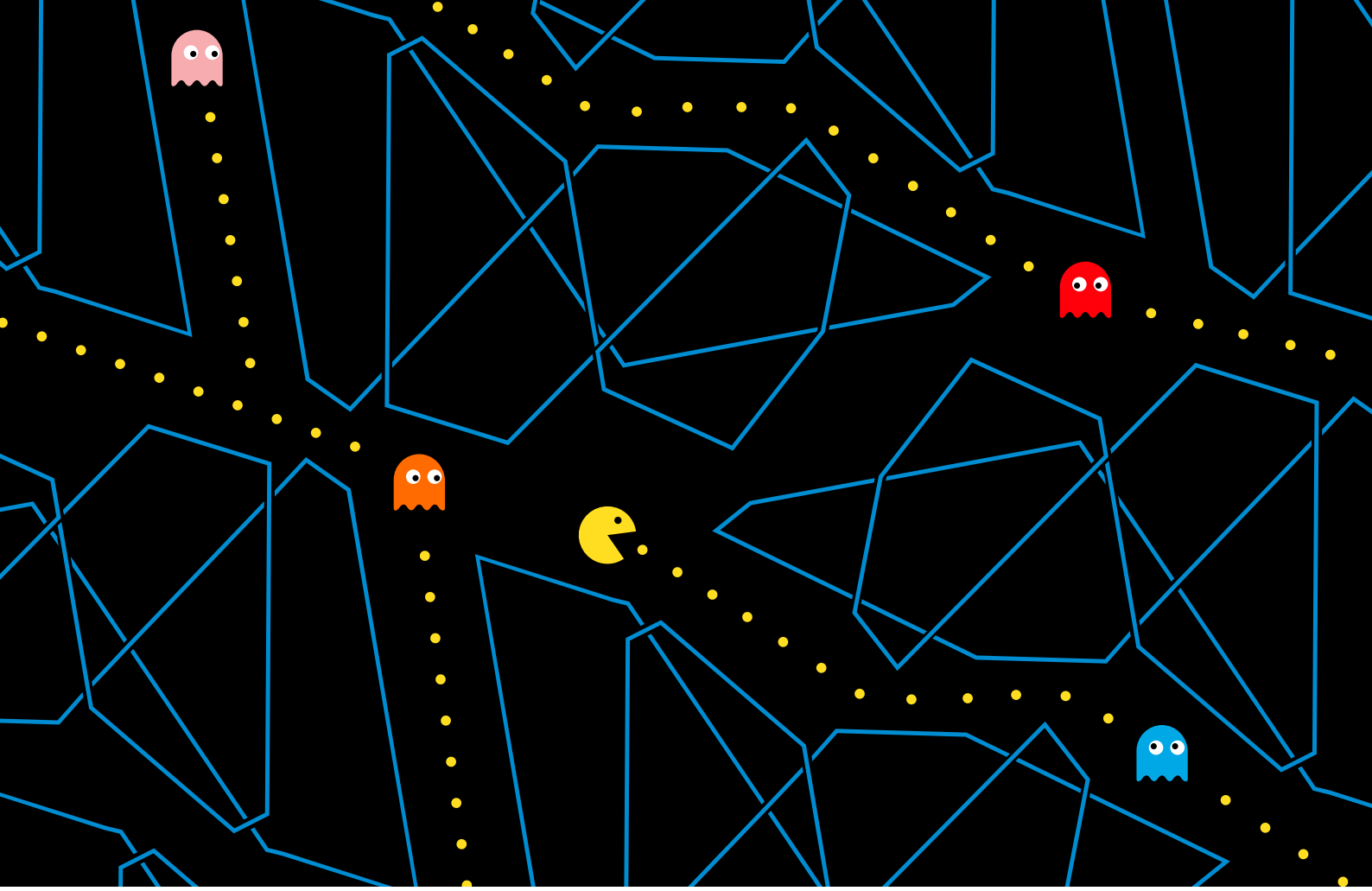

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# DLTV JOURNAL

The Journal of Digital Learning and Teaching Victoria

Volume 1 | Number 1 | 2014

Digital Learning and Teaching Victoria

# Contents




DLTV Journal
The Journal of Digital Learning and Teaching Victoria





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Digital Learning and Teaching Victoria
Statewide Resources Centre
Level 2, 150 Palmerston Street
Carlton VIC 3053 Australia

Phone: +61 3 9349 3733
Fax: +61 3 9349 5356

Email: office@dltv.vic.edu.au


**Invitation to send contributions to**
publications@dltv.vic.edu.au


Digital Learning and Teaching Journal is published as a resource for all educators engaged in the effective use of information and communication technologies for teaching and learning.




The editors welcome contributions to the bi-annual issues from classroom teachers and other educators in the form of articles, reports of school-based projects and other reviews. Text and graphic files may be submitted to publicatons@dltv.vic.edu.au

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The journal is published by Digital Learning and Teaching Victoria, the new association formed from the merger of the Victorian Information Technology Teachers Association (VITTA) and ICT in Education Victoria (ICTEV).

# Editorial


## Michael Phillips and Dr Michael Henderson

Editors
Faculty of Education, Monash University


Welcome to Volume 1, Issue 1, of the DLTV Journal. Although this is the first publication under this title our pedigree goes back more than two decades and incorperates excellent quality publications including VITTA's journal *Infonet* and ICTEV's journal *ICT in Education*. The recent combination of VITTA and ICTEV also includes an amalgamation of the two journals thereby, warranting a new look, a new title and importantly a re-visioning of our goals. We hope you enjoy the changes and give us feedback along the way.

The journal is only one of the media outlets in DLTV's communications strategy. The other main outlet is the weekly email newsletter/bulletin. Since the email newsletter is regular, frequent and sent directly to registered members, it is best used for: updating members of events, professional learning opportunities, association news, and other topical content. The email newsletter is a valuable resource available only to financial members. However, the email newsletter is not suited to communicating extended texts. In contrast, the journal will provide a forum for communicating an edited selection of extended articles with the goals of:

- providing relevant, quality articles for the professional knowledge and learning of DLTV members,
- engaging members and the wider community in current issues in digital learning in Victoria, Australia and internationally,
- promoting DLTV to Victorian teachers and the wider community as a significant professional association in providing leadership, empowerment and excellence in digital learning and teaching

Our audience is wide ranging. The primary audience of the journal are members *and* future members who are educators across a broad spectrum: "Early years to Careers" and "Pre-service to Principals". The secondary audience are education leaders in other domains, enterprise, government and policy makers. The breadth of audience means that in any one journal issue we cannot cater for every member's specific interests or contexts, however it is our ambition that each issue will include:

- articles of interest to those involved in teaching students in early, middle and senior years,
- articles of interest to those new to using digital technologies in the classroom through to leaders in the field,
- a diversity of article/content types, such as tips/tricks, case studies / stories from the field, research with practical outcomes, reviews of research or strategies, opinion pieces, reviews of policy and curriculum.

Throughout this journal you will also find advertising which we hope is relevant and of interest. We welcome advertising that is relevant to members. However, the journal content remains independent. We do not shape the content of the journal because of advertisers or sponsors. In some cases industry representatives will write articles of professional value for members, and in these cases the authors are clearly marked as employees or market representatives.

## An invitation

It is our ambition to provide a balance of articles; however we are dependent on the type and quality of submissions from fellow teachers and the wider community. With this in mind please help us and your colleagues by considering submitting stories of your own practice. Also, please consider encouraging your colleagues and even your students to submit their stories.

We will help you to shape your article prior to publication. This is a great opportunity to not only share your story but also to get published and be supported along the way.

The article can be as short as a few pages to something much longer. In addition to the more traditional article format we also warmly invite you to submit:

- lists of effective tools, strategies and practices (eg. the best 3 classroom activities using robots, the best 10 iPad apps, the best websites for programming Scratch)

- unit plans, lesson plans and/or resources
- case studies of students, classes and activities
- and more….

Over the coming year we will be investigating how we can also include video and other media in the journal. We are always looking for a challenge so if you have ideas about how the journal should be presented, or want to contribute multimedia in your articles, then please don't hesitate to email us.

## About this Special Issue: Digital Games in education

Every issue will include topical 'big picture' discussions from the DLTV president, VCAA and others. Through these articles we want to connect you to discussions, debates and news affecting the association, profession, and curriculum.

In addition, this particular issue has a special focus on using or programming digital games in the classroom. The contributors to this first edition represent the wide diversity of our membership and include pre-service teachers, experienced educators and industry professionals. The range of articles that we have curated include different approaches, technologies and contexts that cater for educators working in early years contexts through to VCE and tertiary settings.

When you read the articles in this issue you will be introduced to the notions of game based learning and gamification. While many of you will be familiar with these concepts, it may be worth taking the time to briefly describe them here.

Gamification is the use of game design (mechanics & dynamics) in non-game environments such as the classroom. Some of the elements we might use when applying gamification to curriculum activities are: levels, badges, points, competition, and status. There are many more, but importantly gamification is more than simply changing the age old 'gold star' reward in a classroom to a 'badge' or changing the name of lesson to 'level 1'. Time, and ultimately iterative design needs to be invested into the mechanics (eg. levels) and the dynamics (eg. when those levels are unlocked). In addition, deeper considerations of game play need to be imbued into the instructional design including notions of 'permission to fail' (in games students 'die' all the time), can make choice and strategies for success (in games students have immediate feedback on their success/fail and can hypothesise how they can succeed the next time). Another consideration is how to encourage curiosity, imagination, and a state of flow (a state of full immersion in a feeling of energized focus).

In this issue we only touch on gamification and we encourage all readers who know of examples of gamification in the classroom to write to us and share their story.

In contrast with gamification is the use of games for learning. This is sometimes called game based learning and can be focussed on content and/or skills. Game based learning in schools has had a rocky history with many purpose built games only having moderate success, largely due to the instructional designers not being able to authentically integrate game design and theory with the curriculum content and learning goals. However, Commercial Off The Shelf (COTS) games such as SimCity have had greater success in terms of student enjoyment, but continue to be criticised by some for their limited relevance to the curriculum or learning goals. This is not to say that powerful learning does not occur in these environments. The research literature clearly indicates an immense amount of cognitive skills and learning goes on when playing games. However, they do not necessarily relate to the formalised curriculum of schools. In addition, even if the use of the game is justified in terms of learning outcomes the literature also confirms that it is important to ensure students are required to apply what they have learned with the game into another context (eg. a group activity, essay, problem solving, etc.).

Gamification and game based learning are useful strategies in our teaching kit bags. However, we can also teach our students to program their own games. It is this facet of games in education that takes up most of this issue. Various articles will indicate useful game programming environments, as well as examples of games produced by teachers and students. In this category we also include the act of creating or 'modding' (modifying) within games. An example of this is the use of Minecraft by students to create an environment. While all of these activities can look quite different we choose to think of them as a group of strategies mainly because they involve the students actively engaged in a creative problem solving task in which the goal is defined by themselves (eg. they choose a particular look, action or rule in the game). The literature shows that creating games can lead to great learning outcomes as well as engagement of learners, but as with any teaching strategy, not every student finds it easy or motivating.

The use of games, gamification and game programming for education are seductive ideas and can be powerful strategies for student learning. However, we have only scratched the surface. There is also a growing movement of 'serious games'. Games in which people work together to learn and make a difference. We can't possibly explain all of the variations of games in education, or explain game design and theory in detail. All we can hope is that the articles in this issue whet your appetite.

While these articles represent the ways in which games are being used in different educational contexts in Victoria, the history of games based learning and gamification draw on a rich tradition of research. If you are interested in reading further we suggest the following authors: James Gee, Kurt Squire, Catherine Beavis, Thomas Apperley, Valerie Walkerdine, and Karl Kapp. We also highly recommend reading and following the work of Jane McGonical who challenges us to think of games as a social good:

> "I want gaming to be something that everybody does, because they understand that games can be a real solution to problems and a real source of happiness. I want games to be something everybody learns how to design and develop, because they understand that games are a real platform for change and getting things done. And I want families, schools, companies, industries, cities, countries, and the whole world to come together to play them, because we're finally making games that tackle real dilemmas and improve real lives."
> – Jane McGonigal, Reality Is Broken: Why Games Make Us Better and How They Can Change the World

## A word of thanks

This issue represents many committee meetings, many hours of editing and most importantly the time and professional investment of all of its contributors. We look forward to your feedback. Please also consider writing to us with your story – whether it is a simple list of great ideas/apps/resources or a longer academic or research article.

Your feedback is important. Please email the journal with constructive feedback publications@dltv.vic.edu.au.

# From the President

Dr Donna Gronn

Welcome to the first edition of the journal of the newly formed Digital Learning and Teaching Victoria (DLTV). This Association has been formed by the merger of VITTA and ICTEV. These two associations have worked tirelessly for many years to advocate for and in support of educators of Digital Technologies across primary, secondary, VCE and beyond. DLTV is now dedicated to cover all educators from pre-service to principal across early years to careers.

## A little of our history

DLTV is the descendant of the first Computer Education Group in Australia. As you can read in the full article by Anne McDougall and Barry McCrae (2000) in Victoria during the mid and late 1970's there was a growing interest in education in the use of computers for both teaching and administration. Few schools actually had computers, but some had access to mini or mainframe machines in tertiary institutions. In 1978 Barry McCrae, a lecturer at Melbourne College of Advanced Education, who had recently been in the United Kingdom and observed the activities of the British Computer Education Group, saw a need for a similar organisation in Victoria. He called a meeting on May 1 to discuss the possibility. Barry expected perhaps 20 people to attend so was pleasantly surprised when 100 people attended. A second meeting in July, 1978, saw the establishment of CEGV. Membership was set at $10 and as a conference was seen as key to the association, dates in May 1979 were set aside for a two day conference to which interstate speakers would be invited.

Although CEGV was clearly seen as a state group, it saw its first conference as a national event. This conference was themed *Students, Teachers and Computers* and was held at LaTrobe University with more than 300 participants. Obviously teachers were keen to learn all they could about the possibilities for the use of Computers in the classroom in those early days. I know Tony Jones who was the first person to become a member of DLTV was in attendance at this first conference. These conferences continued biannually and were hosted in various states around Australia. These evolved into the Australian Computer in Education Conference (ACEC) and in 2014 it will be held in Adelaide.

In 1981 the practice of inviting international keynote speakers began. The first international keynote was Professor Seymour Papert from MIT. Seymour is considered by many as the father of educational computing. I am sure he would be very pleased with the direction the soon to be launched Australian Digital Technologies Curriculum has taken.

CEGV continued to develop through advocating for and assisting educators in developing knowledge, skills and experience in the delivery of Computer related classroom activities and research. Popular programs in the eighties were the Computers Across the Curriculum Programs CAPC & CASC -which I am sure many of you reading this will have attended.

In 1991 a new subject called VCE IT was to begin. In acknowledgement of the variety of disciplines that teachers were being drawn from to teach this subject, namely commerce and computer science, a decision was made to form a new teacher association with the sole aim of supporting teachers of VCE IT. So in 1990 VITTA was born. VITTAs focus was initially on the VCE IT teachers, but it soon developed to include secondary IT and more. VITTA prospered for many years and developed many great programs and supports for teachers in the secondary years of schooling.

In the late 90s CEGV who had continued to advocate for and support teachers from prep to year 10 decided that it was time to change the name of the association to incorporate more than computers. Thus ICTEV was born.

ICTEV and VITTA continued along their separate paths providing leadership and innovation in ICT education until it was realized that they could better advocate for and give support to educators across Victoria if they combined their strengths and became one united association in 2013: Digital Learning and Teaching Victoria.This has been a long process but a very worthwhile one with the result being one strong teacher association representing everyone across the state.

Digital learning and teaching now has a committee of 20 dedicated members who have the support of a great team in the DLTV office. As an association we are working to advocate and support all educators of Digital Technologies.

## Australian Council for Computers in Education

DLTV is the Victorian member of the Australian Council for Computers in Education (ACCE). As President of DLTV, I am the DLTV representative on the ACCE Board. Across the past two years, the ACCE Board has been very active with state representatives on various committees related to the new Digital Technologies Curriculum.

Our national body offers all state members the chance to become involved on a National level. Apart form responding to any calls for feedback on advocacy matters through the ACCE website, three key ways are through the National Conference; the National Journal and the ISTE Study Tour.

**ACEC2014 - Now ITs Personal**

The 26th Australian Computers in Education Conference will

be held in the Adelaide Convention Centre on 30 September - 3 October 2014. The theme is focused on you and your learning. If you attend you will connect, collaborate and co-construct new ideas as part of formal and informal learning conversations before, during and after the conference. I encourage you to register to attend the conference and learn and network face to face with passionate teachers from across Australia and internationally.

### Australian Educational Computing

Don't forget to also read Australian Educational Computing. AEC is the refereed journal of the Australian Council for Computers in Education (ACCE) and is published twice a year. The journal has had a recent face lift so check out the journal websites:

http://acce.edu.au/journal & http://journal.acce.edu.au

### 2014 Study Tour – ISTE

Following the success of previous study tours (2008-2013), the Australian Council for Computers in Education (ACCE) has announced the 2014 study tour to North America. I can highly recommend this study tour having attended myself in the past. This tour includes school, authority and industry visits culminating in attendance at the ISTE 2014 Conference in Atlanta.

Depart Australia June 17, 2014 and return to Australia July 4, 2014. This included Silicon Valley, San Francisco, New York City, and the ISTE 2014 Conference in Atlanta.

Further information http://acce.edu.au/acce/acce-projects/2014-study-tour-iste

For more information on ACCE visit their website - http://acce.edu.au/

## DLTV Committee of Management

The Committee of Management (CoM) consists of 20 dedicated volunteers who meet approximately eight times per year. You will notice that part of our CoM are four seconded members. These members are a valuable part of the CoM as they enable us to be in touch with the relevant agencies within Digital Technologies Education. One of these links is with DEECD who are about to release their Digital Learning Strategy 2013-2017. In late November the Committee at ICTEV was asked to consult with DEECD on their Digital Learning Strategy 2013-2017. At that meeting we were briefed on the Strategy and were able to give feedback that was very well received. This is just one example of how these connections assist us to advocate for teachers across the state.

Our CoM consists of educators across the primary, secondary and tertiary sectors as well as some educators who have moved into industry. This enables us to see Digital Learning and Teaching from many perspectives. If you would like to join the DLTV team the Annual General Meeting will be held at the DLTV offices in Carlton at 6pm on Wednesday the 7th of May. To become a member of the DLTV Committee of Management you need to be an individual member of DLTV.

### DLTV Executive

Dr Donna Gronn, President
Dr Tim Kitchen, Vice President
Philip Brown, Treasurer
Laura Barker, Secretary

### DLTV Seconded members

VCAA – Paula Christopherson
DEECD – Wendy Macpherson
ISV – Irene Anderson
CEO – Simon Mitchell-Wong

### General Committee of Management

Nicky Carr
Melinda Cashen
Ben Gallagher
Roland Gesthuizen
Dr Michael Henderson
Dr Sean Maynard
Helen Otway
Michael Phillips
Kynan Robinson
Dr Nick Reynolds
Dianne Ruffles
Pennie White

## Digital Technologies National Curriculum

It is an exciting time for Digital Learning and Teaching in Australia with the Digital Technologies Curriculum available for use and awaiting endorsement for a 2015 release in schools.

http://www.australiancurriculum.edu.au/technologies/digital-technologies/Curriculum/F-10

This curriculum has been a long time coming and all Digital Technologies focused teacher associations, led by ACCE have eagerly provided input and feedback throughout the development process. Responses have been submitted at each opportunity throughout the process of the ACARA consultation.

Each state association has received a $5000 grant to assist with the development of resources for the professional learning of teachers around the new Digital Technologies Curriculum. DLTV has been funded to create resources to support teachers in implementing the Digital Technologies strand of the new Technologies subject within the Australian Curriculum by scaffolding educators' learning of the content descriptors. We are currently in the process of creating Info graphics and short videos to explain the terms 'algorithm' and 'abstraction' in further detail. DLTV is planning lots of professional learning around this new curriculum so keep an eye on our weekly email news and our website. http://dltv.vic.edu.au

## Key Conferences in Digital Technologies Education

There are many conferences in Australia and around the world that are valuable for educators of digital technologies. Below are four that I have attended in the past and have found useful, not only for their presentations, but also, and often more importantly for the connections I make with people that also attend.

**DLTV inaugural Conference:** Creating New Connections - Friday 25 and Saturday 26 July 2014 at Swinburne University. Thanks to all who have offered to present. We are planning an exciting 'new look' conference so make sure you put the date in your diary and go to http://dltv.vic.edu.au/2014-conference to register.

**ACEC2014 Adelaide:** Now It's Personal - 30th September to 3rd October 2014 at the Adelaide Convention Centre. This is the 26th Australian Computers in Education Conference and they have apparently been inundated with proposals to present. So there will be a huge program. Register at http://acec2014.acce.edu.au

**ISTE 2014 Conference** This is the pre-eminant ICTE conference in the United States. Atlanta, June 28-July 1, 2014. See https://www.isteconference.org/2014/ for more details or look back at the ACCE study tour information in this report.

**World Conference for Computers in Education**

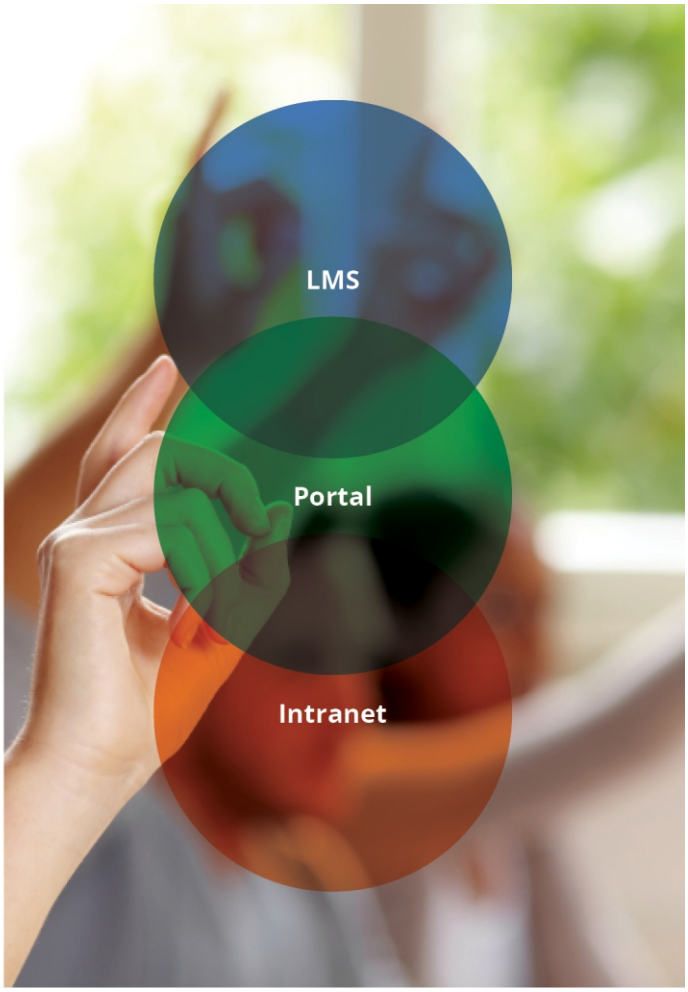
In 2013 I attended the World Conference for Computers in Education in Poland. This is the conference of the International Federation for Information Processing (IFIP), which is the leading multinational, apolitical organization in Information & Communications Technologies and Sciences. (http://www.ifip.org). The WCCE conference is held every 4-5 years. It is a great opportunity to network with educators with similar interests to us and of course visit some beautiful parts of the world. The next WCCE conference will be held in Dublin Ireland in 2017. Something to think about for the future.

This is your association. I look forward to meeting you at our state conference, or seeing you at one of our professional learning events. If you have feedback or suggestions for how we can support you and our other members better please do contact us. Finally I encourage you to take the time to read the articles in this, our first, Digital Learning and Teaching Journal.

## References

McDougal, A., & McCrae, B. (2000). From CEGV to ACEC2000: Australian Computers in Education Conferences come of Age. Australian Educational Computing 15(1)





# DLTV Launched


Dr Tim Kitchen

Vice President - DLTV


The Victorian Minister for Education, The Hon. Minister Dixon, MP who officially launched DLTV 19th March, has a proud history in education as a past teacher and school principal. He knows first hand how important it is to provide effective professional learning opportunities for teachers, especially with the new subject Digital Technologies hitting schools as part of the Australian Curriculum and the placing of capability in Information and Communications Technologies in equal status to capability in numeracy and literacy.

During the DLTV launch event, I had the pleasure of interviewing on camera Minister Dixon about the importance of Digital Learning and Teaching Victoria as a teachers professional association for Victorian educators. He said that the best professional learning for teachers is done by their colleagues and peers and that offering opportunities for this to occur is very important. He also said that DLTV has been formed from a very strong heritage and is well placed to encourage effective collegial learning.

The interview with Minister Dixon can be found via bit.ly/dixondltv.

## DLTV has an important mission

The Digital Learning & Teaching Victoria vision statement is Leadership, empowerment and excellence in digital learning and teaching. This is closely aligned to the DLTV mission statement which is every learner is enabled, inspired and empowered to participate, contribute and shape their world through digital technology.

As I said in my speech at the DLTV launch, in order to empower and inspire 21st Century students, today's teachers need to be able to use modern communication tools effectively and feel free to allow their students to do likewise. And Digital Learning and Teaching Victoria is here to help.

DLTV is a collective of primary, secondary and higher education teachers who are experienced and passionate users of ICT. We are also a mix of professionals and consultants who work in the ICT in Education industry. With a renewed focus on the importance of ICT and 21st Century skills in the Australian Curriculum, it is more important then ever before to help support Victorian educators as they prepare young people for a bright and exciting future.

## New curriculum focus

During the launch event, I also interviewed DLTV committee of management member Paula Christophersen, the Curriculum Manager for Digital Technologies at VCAA (Victorian Curriculum and Assessment Authority). Paula said that the stars are all aligned for the birth of DLTV along side the new curriculum. She reflected that it is perfect timing for a newly strengthen teacher professional association that has a focus in ICT in education. Paula stated that for many schools, the content of Digital Technologies and an additional senior secondary ICT subject in Victoria will be very new for many teachers. She said that many teacher are confident with using ICT as a learning tool, as an enabling tool and a teaching tool but actually having to teach ways of thinking computationally, in

a systems mode and design thinking will be a daunting. Paula noted that DLTV has a great opportunity to provide teachers with a whole range of support such as professional learning about teacher's competency and capabilities with content and also supporting the development of teaching and learning programs that are really meaningful.

The interview with Paula Christophersen can be seen via bit.ly/pauladltv2014.

## The future is looking bright.

Professor Alan Kay, who is one of the key names behind the invention of the laptop and tablet computer said back in the 1970s that the best way to predict the future is to invent it. In a sense that is what DLTV is doing, they are inventing a future of support of Victorian educators who are keen to enhance their use of 21st Century communication tools.

The future is hard to predict, we can only speculate on the technological innovations that are going to affect learning and teaching in the future. As I reflected in my launch speech, 1991 was my first year of teaching at Kingswood College in Box Hill and I saved the $4000 dollars it cost to by a laptop computer. I was the only teacher at the time who carried a computer to and from school and used it in my teaching.

Today, I am very fortunate to have a job that takes me all over the world to help support educators and it is not uncommon for me to see teachers both in Australia and overseas using 3 or more of their own personal mobile devices in each class to enhance the learning experiences for their students.

One thing we do know about the future is that it is uncertain and the role of a teacher is changing from keeper of knowledge to facilitator of learning and having digital literacy skills is now a vital part of every teacher's toolkit.

## Help support DLTV

Thank you again for all your support, please keep it up by helping us drive memberships and please support the many Digital Learning and Teaching Victoria programs and projects this year and beyond.

More videos, comments of images of the DLTV launch can be found via http://timkitchen.net/2014/03/19/dltv-launch/

# DIGITAL TECHNOLOGIES IN THE AUSTRALIAN CURRICULUM


## Dr Nick Reynolds

Melbourne Graduate School of Education, The University of Melbourne


We are all aware of the place of ICT in the curriculum and I would imagine that most of us have been working with the ways in which AusVELS manages the Australian Curriculum notion of General Capabilities. There is now a new player on the curriculum block – well there certainly will be soon. The Australian Curriculum Technologies Learning Area has been released by ACARA and lives at http://www.australiancurriculum.edu.au/technologies/rationale-aims/technologies. It comes with the qualification that the document is 'available for use; awaiting final endorsement'. I can only guess (a somewhat informed guess) that this means that at the last Ministerial Council meeting the Technologies Area wasn't considered in depth. Of course all things can change but it should be noted that the Technologies Area is not up for review by the recently announced Curriculum Review; that review is only looking at Stage 1.

Perhaps the most significant aspect of the Technologies Learning Area, certainly in DLTV's eyes, is that it contains a compulsory subject: Digital Technologies. For the first time we now have in Australia a subject that must be offered from F – 8 as a compulsory component of curriculum. For Years 9 and 10 Technologies is still compulsory but schools and students will have a choice as to how it is approached. Those working in the final years of schooling will have to wait for that subject offering a little longer.

As an individual who was involved in the development process of this curriculum and one who understands the significant rigor and effort that went into producing it, I wish to highlight some aspects of the Digi Tech (I think that is the currently accepted abbreviation) curriculum and look at some implications for teachers and schools.

The inevitable question is “how is it going to be possible to actually 'teach' this curriculum?” The answer, of course, will vary from school to school and according to year level. One can safely imagine that secondary 'IT' teachers will be well placed to implement aspects of the curriculum. Their challenge will be refocusing from what has been a somewhat ad hoc approach (in the absence of clear curriculum outcomes) to an approach that embraces the intent of the new document. Primary schools might rely on ICT specialists if they still have them but there will be a new and significant responsibility for classroom teachers to get their heads around requirements and actually enact this curriculum in a meaningful and effective way.

The Australian Council for Computers in Education (ACCE) recently wrote a letter of support for the Digi Tech curriculum to the new Curriculum Review panel. DLTV is an affiliate of ACCE and we supported the ACCE position to that panel. Our letter of support focused quite deliberately on the Digi Tech Curriculum's use of computational thinking as its basis. We wrote:

> We are encouraged by the structure and scope of this curriculum and wish to highlight the strength of the Digital Technology curriculum's basis in computational thinking. This approach to thinking has huge international support and there is agreement about its meaning; something hard to achieve internationally. Building on that framework the Australian Curriculum Digital Technologies subject presents a truly innovative approach to teaching and learning that manages to go beyond the notion of solely focusing on teaching programming to all. What this curriculum offers is a way of learning about and developing skills and knowledge in working with Digital Technologies, as well as building critical thinking skills, project management skills and deep knowledge of abstraction and algorithm.
>
> The curriculum offers children and young people a meaningful and progressive experience into the complex and fascinating world of Digital Technologies. For teachers it offers clear pathways through what could be considered as very difficult teaching areas. The multi-focused approach that the Curriculum takes allows for an education in technical, human and social/ethical aspects of the Digital while leading towards a more specialised focus for the yet to be released Years 11 and 12 subjects.

It is easy to argue that computational thinking is nothing new; in many ways it isn't. It is less easy to argue that it is just the same as any other critical thinking, problem solving strategy. There are many definitions of computational thinking and I provide a few here.

- Jeanette Wing defines it as "a universally applicable attitude and skill set everyone, not just computer scientists, would be willing to learn and use" (2006, p. 33).
- Woltz et al. define it as "a mode of problem solving that emphasizes the processes necessary to express a computing-intensive solution in a structured, dynamic way" (Wolz, Stone, Pearson, Monisha Pulimood, & Switzer, 2011).
- *The Report of a Workshop on The Scope and Nature of Computational Thinking (2010)* says that "computational thinking is a fundamental analytical skill that everyone, not just computer scientists, can use to help solve problems, design systems, and understand human behaviour".
- Seymour Papert uses the term "think like a computer" quite freely but qualifies the term so that it does not mean to only or always think like a computer, rather as "a powerful addition to a person's stock of mental tools" (Papert, 1993, p. 155). When Papert asks himself to think like a computer, he does so knowing that "it does not close of other epistemologies. It simply opens new ways for approaching thinking" .

As a Papert fan I kind of like the way he puts it. Of course it is more than thinking like a computer – that's not possible. Knowing how a computer 'thinks' and understanding ways in which we can use that 'thinking' in the creation of solutions to real world (digital) problems is possibly at the heart of the matter. Jeanette Wing talks about 'metal' and 'mental' tools. This is a nice way of putting things and helps me clarify my thoughts about computational thinking. She says "the power of our 'mental' tools is amplified through the power of our 'metal' tools" (Wing, 2008, p. 3718).

It is important to understand that the Digi Tech curriculum is much, much more than just teaching/learning programming. This is an inevitable and essential aspect of the curriculum but is in many ways an easy way out. The notions of abstraction and algorithm are deeply embedded in the curriculum and can be learnt and taught outside of a programming environment (and, of course, inside one).

The introduction of this curriculum into Australian schools will no doubt put some trepidation into many teachers' hearts and minds. It is my view that that trepidation is unwarranted. The wording of some aspects of the curriculum has been criticised for being too technical and too far removed from teachers' understandings. The response, and one that I support, is that this document describes a discipline and its practices. It is not possible, nor necessary, to simplify the discipline specific grammar of Maths, of English, of Geography, of Science, of Music or of any other area. It is likewise not possible to do so with Digital Technologies. Schools will need to understand what is required and will need to act to support teachers in their developing competence. Teachers will need to look beyond the technical wording of some aspects of the document and seek to find meaning to their practice.

Organisations such as DLTV and ACCE are already investigating ways in which we can provide support and guidance to schools and to teachers. Universities are beginning to understand the importance of this learning area to their teacher education programs.

This new curriculum is something to celebrate.

**References**


Papert, S. (1993). *Mindstorms: Children, computers and powerful ideas* (2nd ed.). New York: Basic Books.

*Report of a Workshop on The Scope and Nature of Computational Thinking.* (2010). The National Academies Press.

Wing, J. (2006). Computational Thinking. *Communications of the ACM, 49*(3), 33-35.

Wing, J. (2008). Computational thinking and thinking about computing. *Philosophical Transactions of the Royal Society A*, 366, 3717-3725.

Wolz, U., Stone, M., Pearson, K., Monisha Pulimood, S., & Switzer, M. (2011). Computational Thinking and Expository Writing in the Middle School. *ACM Transactions on Computing Education, 11*(2), 9:1-9:22.

# From the VCAA Corner


## Paula Christopherson

Curriculum Manager | Digital Technologies
Victorian Curriculum and Assessment Authority


Welcome to the first article 'from the VCAA corner' for Digital Learning and Teaching Victoria. It is my pleasure to be able to contribute to this first issue, as it was my pleasure 23 years ago, to edit and contribute to, the first issue of *InfoNet*, the journal of the Victorian Information Technology Teachers Association (VITTA). Significant changes have occurred in ICT/digital technologies education over these two decades, and we are now on the brink of significant curriculum changes, but this time occurring within a considerably shorter timeframe.

In each issue of this journal I will endeavour to provide you with the latest curriculum developments and policies as they relate to Victorian schools. At times I will also indulge in sharing some readings/research that are of interest to me, and hopefully you.

## AusVELS Digital Technologies

While there is a national curriculum, each state and territory has been very keen to flavour it with their own nuances and characteristics. In some instances there is a legal obligation to do so, such as in New South Wales, where a curriculum must be published as a syllabus. This not only tells the teachers and the public what should be taught, but when. This is like the French system where you would possibly know what topic/content every child was studying in the same week, regardless of the school.

Victoria's position has always been that schools are best equipped to determine how the curriculum is structured and delivered. In Victoria, the curriculum is set out in AusVELS, the Victorian Essential Learning Standards that incorporate the Australian Curriculum. Digital Technologies will be one of two Australian Curriculum offerings within the Technologies learning area (the other being Design and Technologies) in AusVELS.

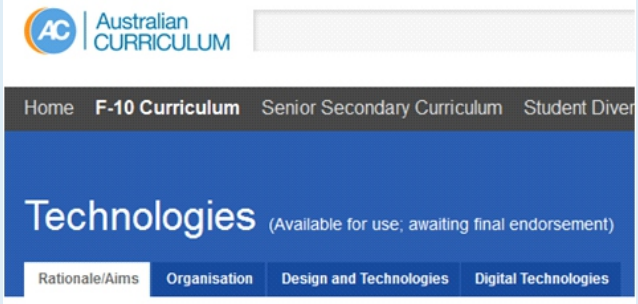
From 2012 to 2013 a team of writers, a national Technologies Reference Group and a National Technologies Panel formulated a Digital Technologies curriculum, taking into account considerable feedback from stakeholders – not just from educators but also from industry and professional associations. DLTV was very fortunate in having representatives on the writing team as well as the reference group and national panel.

While the Australian Curriculum, Assessment and Reporting Authority (ACARA) Board has approved the Digital Technologies curriculum (November 2013), its final endorsement from the state and territory Ministers of Education is still pending. The reason for this delay is not due to concerns with the curriculum but rather to do with the current review of the Australian Curriculum, initiated by the Commonwealth government. Once the review has been completed, and its recommendations considered, then the Digital Technologies curriculum should receive its final endorsement. It is hoped that this will be in term 2 so that the second iteration of AusVELS will be available in early term 3.

As an interim measure, ACARA has released the Digital Technologies curriculum, along with Design and Technologies, Economics and Business, Civics and Citizenship, Health and Physical Education and The Arts on its website for schools to begin the development of their teaching and learning programs, ready for implementation **from** 2015. The media

The Digital Technologies curriculum (pending final endorsement) is available at: http://www.australiancurriculum.edu.au/technologies/rationale-aims/technologies

Source: http://www.australiancurriculum.edu.au/technologies/rationale-aims/technologies (19 March 2014)



release outlining these decisions is located at: http://www.acara.edu.au/verve/_resources/Australian_Curriculum_available_online.pdf

The statement 'from 2015' is critical. Between 2015 and 2017 government and Catholic schools have to implement teaching and learning programs that provide all students with the opportunity to learn the Digital Technologies knowledge and skills defined in the curriculum. Some schools are already offering Digital Technologies programs in 2014; others will stagger the introduction between now and 2017.

It is very important to note that this curriculum must be made available to all students. Again this doesn't mean that Digital Technologies needs to have a regular spot in the timetable in every semester, however over the three stages of schooling (F to 2; years 3 to 8; years 9 to 10) students must be provided with learning opportunities to demonstrate the achievement standards. Further details of these requirements are available in the Victorian Curriculum and Assessment Authority's document *F–10 curriculum planning and reporting guidelines*, February 2014, I would urge you to have a read (http://www.vcaa.vic.edu.au/Documents/auscurric/F-10CurriculumPlanningReporting.pdf).

***Digital Technologies in a nutshell***

At the heart of Digital Technologies (I call it Digi Tech!) is computational thinking: this is a process of recognising aspects of computation in the world and being able to think logically, algorithmically, recursively and abstractly. It's a way about thinking about problem solving and it's about being able to:

- Formulate problems by breaking down tasks into manageable parts;
- Logically organising and analysing data. This can include making sense of data, finding patterns and drawing conclusion. It also involves reducing complexity to define main ideas and creating models of a process;
- Formulate and sequence processes (algorithms) that can be implemented using digital technologies;
- Evaluate the quality of the solutions and transferring features of previously solved problems to new situations.

Digital Technologies is more than that, but its core is computational thinking. The curriculum also addresses the technical underpinnings of digital systems and how they are, and could be applied, the implications of their use, as well as ways of creating and managing projects collaboratively and safely in online environments.

These knowledge and skills are critical for our students as they will be participating in a globalised society and economy, abundant in digitised data. At the macro level they will be developers of intellectual and social capital, cornerstones of an increasingly knowledge-based society. They will need to apply new ways of thinking when developing this capital and be able to manage risks when communicating and collaborating. Students needs to become critical consumers of information, mediated by digital technologies and to be creators of solutions using digital technologies.

Digital Technologies as a curriculum does not equate with ICT as a general capability, as espoused by ACARA. Digi Tech is not a new name for ICT as the interdisciplinary domain or general capability. Digital Technologies is a discipline domain with content that must be taught and standards that indicate measures of student learning. For example, at level 4, students should be taught about '… different types of data and … how the same data can be represented in different ways' (content description), and the standard associated with this is 'They explain how the same data sets can be represented in different ways.'

In the second iteration of AusVELS it is proposed that the curriculum design will change from a triple-helix model (three strands of Personal and Social Learning, Discipline and Interdisciplinary) to a double-helix model (Learning areas and General capabilities). However, the number of general capabilities in AusVELS will be four, not seven as in the Australian Curriculum. What will not be on this list are ICT, Literacy and Numeracy. This doesn't mean that they have gone missing – they have been allocated to their 'parent' discipline in the Learning area strand, namely English and Mathematics and Digital Technologies (when endorsed). This does not mean that students don't apply literacy, numeracy and ICT capabilities as they learn in other areas; rather it means that knowledge and skills associated with those capabilities are actually defined in the corresponding curricula of English, Mathematics and Digital Technologies, though not only taught in them.

DLTV will be actively developing resources and offering professional learning programs, starting this year, to support teachers successfully implement this curriculum. Remember, in the primary years a small allocation of a school's program would focus on Digital Technologies, so while the curriculum may appear daunting for some, it is manageable, not burdensome and exciting! And many of the content descriptions have very close connections with the Mathematics, Science and English curricula at the primary levels.

## VCE: Information Technology

Work began in August 2013, and has continued in 2014, to review the current version of the VCE Information Technology study design. To date the Review Panel have met on seven occasions and we are on the brink of getting a draft study design approved for consultation. From 14 April to 17 May you are invited to provide feedback on this draft curriculum. It will be available on the VCAA website (www.vcaa.vic.edu.au)

together with a questionnaire to capture your opinions. Please don't pass up this opportunity to have your voice heard – consultation feedback resulted in a range of changes during the last review.

If all goes according to plan, the study design will be approved by the VCAA at the end of August 2014, and available online at the end of the year. The study design will only be digital – no more VCAA printed study designs. Next year, of course, will be time to become familiar with the study design, assisted by a VCAA implementation program, as the study does not commence its accreditation period until 2016. During 2015 an Assessment Handbook will be published, and work will be done on preparing either a full sample examination paper for each of the units 3 and 4, or just some sample questions - this decision rests of the final extent of change in these units. Also, DLTV will be preparing resources to support the teachers transform the revised study design into teaching and learning programs.

## VCE: Algorithmics

The VCAA, in partnership with the University of Melbourne and Monash University, are developing a new VCE study (just units 3 and 4) in the area of algorithmics. It will be referred to as a Higher Education Scored study, indicating that it is pitched at first-year university level, rather than year 12. It will attract a study score and contribute to a student's VCE. It will be offered by schools, but the delivery of content (all online) will be in partnership with the universities. This new arrangement brings challenges, but not insurmountable ones! The VCAA and the universities are currently trialling this delivery mode with an extension study program offered by Monash.

The study will have a very strong focus on developing problem-solving skills that have a strong mathematical/computational emphasis. It is envisaged to be attractive to students with mathematics/science interests, and would be a very complementary study to VCE Specialist Mathematics and Mathematics Methods (CAS). It is planned that this study will be available for introduction in 2015, however, as with the Extended Investigation study design, a set of criteria will be employed to assist in determining school-readiness criteria to offer the study.

For any queries please contact Paula Christophersen
Phone: 03 9032 1724
Email: christophersen.paula.p@edumail.vic.gov.au

# ACCE Response to the Government's "Enhancing Online Safety for Children"

Dr Michael Henderson
Monash University, Faculty Of Education

In March 2014 the government called for community consultation on "Enhancing Online Safety for Children". The full consultation/discussion paper can be found at the Australian Government's Department of Communications website [alternatively access it here: http://bit.ly/govcybersafety].

Online safety is a large concern for the teaching profession in three ways. First, teachers are concerned for the welfare of their students while at the same time want their students to make the most of learning opportunities afforded by online technologies. Second, teachers need to know about resources and how to educate their students about online safety. Third, teachers are also at risk and need to be aware of risks as well as support services. As a result the Australian Council for Computers in Education (ACCE) submitted a 10 page response on behalf of DLTV and the other state associations. Here are **extracts** from that submission.

Prepared on behalf of ACCE by

- Dr Michael Henderson, Faculty of Education, Monash University
- Associate Professor Melissa de Zwart, Adelaide Law School, Adelaide University

## Preamble:

The initiative for *Enhancing Online Safety for Children* is a step in the right direction. Children and their educators and caregivers are in serious need with respect to guidance and security when engaging with social media.

ACCE with its close connection to educators (Early Childhood to Tertiary), students, and researchers supports a holistic approach; arguing that change to regulatory frameworks, as well as procedures for rapid removal of harmful materials will be ineffectual unless coupled with education and guidance for the entire community, particularly children, caregivers and educators. ACCE is not only concerned for the welfare of young people who are victims of inappropriate or harmful materials, but also those others who are affected by content posted by young people, including their educators for whom the content could be harmful to their professional and personal identity. We need to bring to bear a concerted and well-funded educational strategy to help young people make effective decisions when living out their lives in the public sphere of social media. This needs to be coupled with effective measures for rapid removal of materials for all individuals and all social media.

In addition, the rapid change of technologies, the constant renewal within schools and curriculum and ultimately the curiosity and creativity of new generations of young people also means that the e-Safety Commissioner needs to be able to respond to the constantly changing environment, including dealing with new technologies and new practices that cannot be predicted. This means that the scope of the Commissioner needs to be broadly defined, have broad discretion on how to respond, while at the same time well-resourced to keep abreast of such changes.

### About ACCE

The Australian Council for Computers in Education (ACCE) is the national professional body for educators (from early childhood to tertiary) as well as researchers involved in the use of digital technology in education. ACCE has representation from all states and territories plus international affiliations in many countries (http://acce.edu.au).

### Members

**ACS** - Australian Computer Society
**DLTV** - Digital Learning and Teaching Victoria
**ECAWA** - The Educational Computing Association of Western Australia (Inc)
**EdTechSA** - The Educational Technology Association of South Australia
**ICTENSW** - ICT Educators of NSW
**INTEACT** - Information Technology Educators ACT
**ITEANT** - Information Technology Educators Association of the Northern Territory
**QSITE** - Queensland Society for Information Technology in Education
**TASITE** - Tasmanian Society for Information Technology in Education Inc.

### Affiliations

**IFIP** - International Federation for Information Processing. **ACCE** is affiliated with IFIP through the relationship with ACS.
**ISTE** - International Society for Technology Education. ACCE is an International affiliate of ISTE.
**NEF** - National Education Forum. ACCE is a member group of the NEF.
**TEFA** - Technology Federation of Australia. ACCE is a member group of TEFA.

## Functions of the commissioner

The establishment of the e-safety Commissioner is important to the welfare of Australian young people. Each state education department as well as many other organisations have developed resources around online safety. However, the volume of resources, variations in quality, currency of the information, and relevance to the particular age group of the students causes considerable confusion for teachers and caregivers. It is not sufficient to simply list a number of websites. Leadership in this area is needed to ensure a coherent, easy to understand, and functionally useful point of contact for guidance and victim advocacy.

It is critically important that the e-safety Commissioner is focussed on a dual role of guidance and advocacy. The guidance role must be also considered in two parts (a) proactive education in schools and in the community, (b) support for those seeking specific advice, information and support. The guidance role in the policy document needs to

be strengthened. It is currently not sufficient to meet the policy goal of improving online safety of young people.

*The scope of complainant: more than just for children*

At the very least, we recommend that the focus of the policy is for young people under the age of 18. We recognise the need to protect young people, and their particular vulnerability. However, the kinds of online safety issues this policy deals with are not limited to young people and at the same time many other users would benefit from a mediatory stage before criminal and civil actions are pursued. The rapid removal of materials, and the establishment of an agency such as the Commissioner that can guide and support this action, would benefit society. It does seem to be a waste of resources to establish a Commissioner whose office develops significant working relations with social media services and has the ability to process complaints and implement the rapid removal of harmful materials and restrict this assistance and support solely to minors.

Within education we do not refer to everyone under the age of 18 as children. It is unlikely a 17 year old or their caregivers are going to immediately realise that "children" applies to them. While the term children may be used in legal or regulatory contexts, it is not appropriate in this context. Consequently, even if the Commissioner was to only work with under 18s it is strongly recommended that the word "children" is not used. This also means that the title of "Children's e-Safety Commissioner" should be changed to something that is appropriate and respectful of the people the office serves.

*Establishing processes of certification and school funding for online safety education*

We support these actions. However, we do not support the generation of an online safety industry, that is, consultancies and others cashing in on the funding programme without themselves being certified as providing high quality service. There are many online resources as well as online safety training programs, but there is a lack of coherence. How will a school decide which program is the best (not simply the most accessible)? The Commissioner needs to either develop core resources including learning activities for such training programmes or will need to develop systems to certify trainers ***and*** their programmes.

A solution is to bring together the excellent but disparate resources and intelligence of the various state government education departments as well as other notable philanthropic organisations (eg. Alannah and Madeline Foundation) and consultants in the field to develop a core set of materials and activities that are regularly updated. These can form the basis of individualised programmes to be delivered in schools (by trainers or school educators themselves) and at the same time accessible by parents and the wider community. This could also serve another important role for the Commissioner, that of an advisory group to assist the Commissioner maintain currency in light of changing technologies and practices.

The impact of any education initiative is significantly lessened unless funding and considerable strategic thinking is invested in education for teachers, administrators, caregivers and the wider community. It is critically important to have the same frame of reference, the same language, the same understanding of what is acceptable and the knowledge of how to deal with problems. The most frequent advice given to young people today is if something makes you feel bad then talk to an adult. The problem is many adults, including educators, are not yet skilled to fully understand the problem, let alone knowledgeable of suitable courses of action.

We recommend that funding be provided to not only develop (and maintain) learning materials for young people, but also their caregivers and educators, and importantly, for pre-service teachers.

*Coherent advice and resources*

The Commissioner has a significant role in bring coherence to the many resources available to young people, caregivers and educators. There are many high quality resources and programmes currently available, but they need to be either amalgamated or integrated in a very clear way. It is not sufficient to simply provide a list of websites / contacts with brief descriptions. This does not help young people, nor does it help educators who are time poor and are already dealing with an overloaded curriculum. In this respect the e-safety commissioner's role is not just focussed on young people. There is an important role to provide a first point of call for all Australian residents.

## 2. Rapid removal of material that is harmful to a child from social media sites

*Defining social media and participating social media services*

Consequently we propose social media is broadly defined, not limited to social network sites which are increasingly becoming less significant than the social experience itself.

These social media services encompass, amongst others, social networking services (eg. Facebook, Google+), blogs (eg. Blogspot), microblogs (eg. twitter), wikis (eg. wiktionary.org), forums (eg. minecraftforum.net), video sharing (eg. YouTube), image sharing (eg. Flickr), virtual worlds (eg. SecondLife), gaming platform with social media features including live chat (eg. Xbox Live), and massive multiplayer online role playing games (eg. World of Warcraft). These services are increasingly platform independent, having presence across devices and operating systems (eg. the same service such as Facebook can be accessed via web browser, mobile phone application, gaming platform such as XBox. In addition, these services are increasingly integrated with other services, such as "social

plugins" that can embed social media profiles data on other websites. These services can also be mashed with other social media services so that the experience is no longer of a single service but rather a social context. Finally, the social media services can be accessed through applications not developed by the social media companies themselves. For instance, there are a variety of Twitter applications for mobile devices created and managed by third party companies that provide a customised experience of the social media, including additional features such as the incorporation of multiple social media services which ultimately provide a qualitatively different social media experience.

Social media is therefore now best characterised by "experience" rather than as a "site".Thus a list of sites becomes less useful as a regulatory or advisory tool. Behaviour can manifest and spread rapidly across a number of platforms.

In addition, the almost seamless integration of social media across devices and websites, and especially the amalgamation of social media services into essentially new social media experiences makes it difficult to identify where offending material resides and who has agency, let alone responsibility over the data. The confusion over where the data is stored, who controls it and how to engage with that service is even greater for younger people and problematically for their caregivers and educators who are not necessarily knowledgeable of the technology or its surrounding youth/digital culture.

For these reasons, the definition of social media needs to be broad, giving the e-Commissioner flexibility in light of changing technologies, social practices and services. One of the responsibilities of the office should be remaining up to date with and identifying relevant services, sites and apps as new uses will emerge daily. The office will need to be able to add to and expand the scheme rapidly to take account of sudden uptake of such social media. The proposed definition is therefore not workable.

*Focussing on "large" as a criterion will result in failure*

In addition the restriction of the government's focus to "large social media sites" is clearly problematic and ultimately unhelpful. As already explained, "sites" is an overly restrictive frame for social media which is better explained as an experience that can transcend a single site or service, incorporating multiple services, some of which may be "large" and small. More importantly, the focus on "large" social media is incongruous with the intent of any online safety initiative or regulatory framework. For instance, the size of the social media service is not relevant in the examples of children suicides cited on page 4 of the discussion document. In these cases the children's social networks are miniscule in comparison to the entire social media network. Considering the rapidly changing technologies it is highly plausible that this same scenario could be played out in a new social media experience that would not fit the criteria of "large".

Focussing on "large social media sites" does not serve the interests of young people, caregivers or educators. The social media experience is not defined by the size of a social media company, its national corporate presence, or other definitions of "large". Scale of users is relevant in considerations of degree of exposure of materials such as pornography or defamation. However, in terms of the young person's 'life world', that is, the people who they know and interact with who essentially define the boundary of their 'world' can be relatively small and yet as seen on page 4 of the discussion document result in tragic outcomes.

The e-Commissioner's remit must not be limited to only "large" social media.

The full ACCE response to the government's consultation document can be accessed by emailing: michael.henderson@monash.edu

# An introduction to Games in Education

Garratt Alexander and Kris Nagy

**M.Teach pre-service teachers,** Faculty of Education, Monash University

We hear it regularly in the media: games are detrimental to the development of children and teenagers. In other circles, we hear the opposite, claims of various benefits gained through playing games – such as critical thinking, logical deduction, and even enhanced manual dexterity. But what about in education?

Games are typically given the stigma of being a form of entertainment, with little educational or real-world value. However, we believe there is a great potential for games (playing games through to programming games) to develop students' thinking and ICT skills, while also integrating content and learning outcomes from across the school curriculum. In the following pages we provide some suggestions of games and programs that can aid in the teaching of game creation.

As a precursor to actual computer games, you may wish to have students do some research into game theory – sometimes referred to as ludology. A suggested unit of work and resources can be found at http://bit.ly/18MhU0R (the site and resources were created by Kris). This may provide a useful overview by investigating board games, and grasping game design theory, and how rules or considerations affect the gameplay – and ultimately, the enjoyment of a game.

## Teaching Programming and Programming Principles.

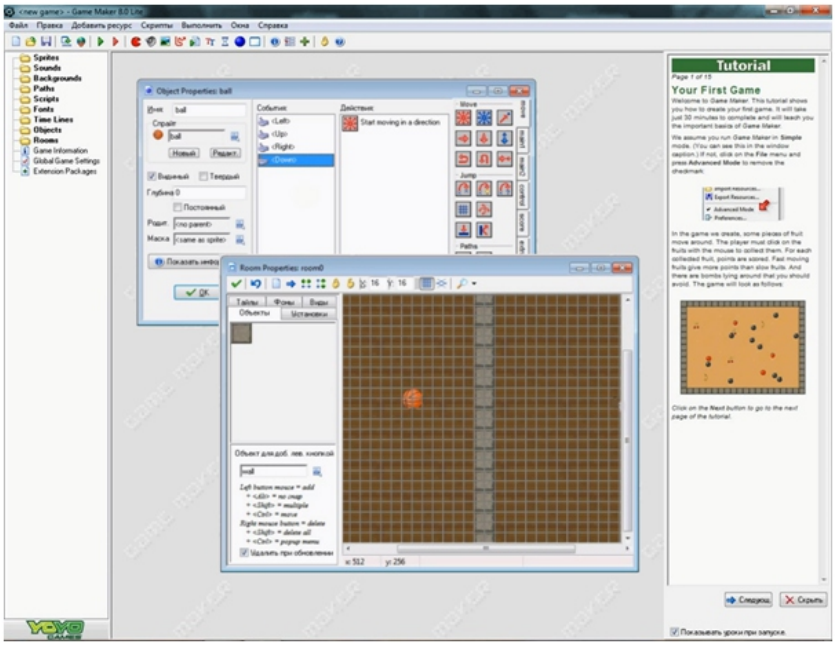
Invariable, at some point the need to teach programming and surrounding skills will be required. When introducing programming and / or programming principles, one of the best (and easiest) ways of doing it is through an integrated development environment, often abbreviated to IDE. One of the biggest challenges is determining which IDE to choose to teach from based on the cohort you are teaching – in terms of skills and capabilities – and also what the resources a school has to invest in software.

When deciding on an IDE to use for teaching, there a few things one should look for that will aid in the teaching and learning process:

- **Console** – Much like your traditional 'command prompt', this is a little window that outputs important information such as why things 'break' when you're trying to compile and run the program or it can just output data that the user specifies so as to confirm their program is running properly. Sometimes referred to as a 'debugging console'.
- **Work Space** – A clearly defined 'working area', where media can be placed and interacted with.
- **Media Library** – pictures, sounds, and movies that can be stored and incorporated into any program that is being created or run.

The remainder of this article is presented in two parts. The first looks at a number of development tools that would suit a variety of learning environments, skill levels, and school resources. The second part presents a review of games with educational value.

## Part 1: A review of game development tools.




1. Game Maker Studio - **http://www.yoyogames.com/studio**

- Platform: Windows, Mac (Currently only the older Game Maker available)
- License: Freemium – the core program is free, you can purchase to unlock features such as the ability to have unlimited resources). Education licenses are available.

Game Maker is an all-in-one integrated development environment that allows you to create a variety of games through a relatively easy-to-use interface. This software

package has been a staple favourite of many school educators in the past, however recent advances in game IDE's highlights some of the limitations of Game Maker, which may become particularly clear when trying to extend the innovative capacities amongst more advanced students. There is a bit of a learning curve with understanding the script and the use of the various game elements / resources, but with its ability to export to a variety of platforms, it could prove very powerful especially if your school is able to fund a class license.


**2. GamePress http://www.gamepressapp.com/**

- Recommended iPad App
- Platform: iPad
- License: Free

Not every school has computer labs or a student laptop program. In fact, it is increasingly popular to equip students with iPads to aid in the learning. As a result, it was felt important to include an application that can help students create games – and GamePress is this very app!

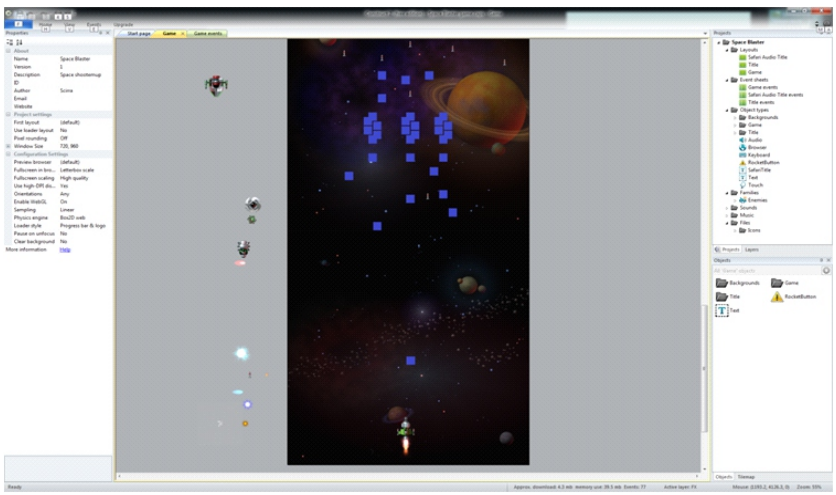
With a comparatively easy-to-use interface, students can create a classic 'platform game' (think the original Mario) or a more classic scrolling arcade game, where the player pilots a ship that stays at the bottom of the screen, while the background scrolls down, and enemies appear that have to be dispatched by the player.

The interface is fairly intuitive and has only a slight learning curve when it comes to some of the more complicated scripts that can be attached to screen elements. Many of the logic controls are done by 'linking' screen elements to each other, for example, collecting a coin will increase the score by a user-defined amount, or another element will allow the characters health to increase by a user-defined amount.


3. Sploder **http://www.sploder.com/**

- Recommended Web-based App
- Platform: Web-based (Adobe Flash)
- License: Freemium (Free registration required to save / publish games)

A great free online flash-based game creator that allows you to create games in a few different formats: Retro Arcade, Platform, Physics Puzzle, or Classic Shooter. With a simple drag-and-drop interface, elements can be quickly and easily added to the desired game with levels also being created easily. The games are stored in the browsers cache (meaning they can easily be wiped), but if students create a free account, their games can be saved, and then published, allowing students to share their creations.



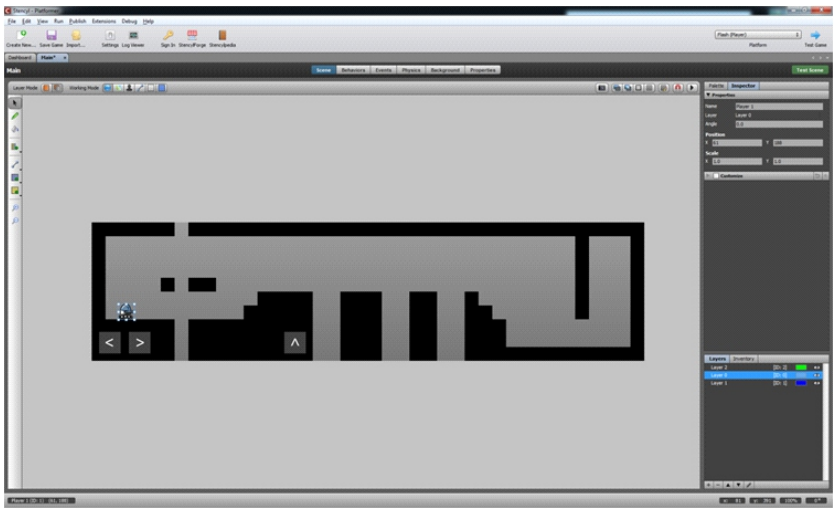
4. Construct 2 **https://www.scirra.com/construct2**

- Platform: Windows
- License: Freemium (Education and individual Licenses available – license required to remove game creation limitations, allow exporting to multiple platforms, and unlocks additional media elements).

Construct 2 is a HTML5 game creation environment, which means that games that have been created will work cross-platform natively. The free version has limitations on the number and types of media elements that can be used, however this may be enough for most students.

It comes with a couple sample games to give an idea of what can potentially be done, and there are a number of tutorials on their website to guide students (and teachers) through the process of familiarising themselves with the Construct 2 environment. All of these will help in understanding the ins and outs of Construct 2.

There is also a handy debugging console when running local tests – which is particularly handy when trying to work out why things are behaving (or not behaving) the way that they were intended to.



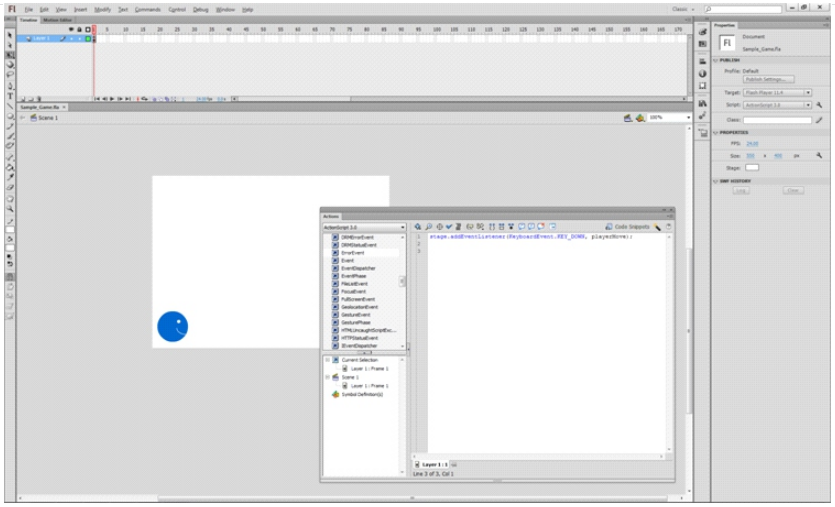
5. Stencyl **http://www.stencyl.com/**

- Recommended Downloadable / installable App
- Platform: Windows, Mac, Linux (Ubuntu)
- License: Freemium (Allows publishing to web with watermark / intro advertisement; paid-for license allows for publishing to a variety of other platforms, including mobile and tablet devices)

Stencyl takes a slightly different approach to game design and creation: It is natively drag-and-drop – and this doesn't just apply to the media elements that are seen on-screen. The coding logic is all block elements that are dropped – with variables defined by the creator.

During testing, a debugging console appears, allowing for quick and easy viewing and rectifying of errors. The basics can be picked up fairly intuitively; however, as an added bonus – there are extensive guides and 'crash courses' available to reference to aid in learning and understanding the tools available.

Further, there are educator guides to aid with planning and integrating into the school curriculum, and there are no limitations with the free version for use within schools.



### 6. Adobe Flash

- Recommended Paid-For App
- Platform: Windows, Mac
- License: Paid-For (Education pricing available)

Although Flash has gotten some bad press in the past few years (notably due to lack of iPad support), the development environment of Flash offers much in the way of allowing teaching concepts and principles to be taught in an interesting and fun way.

Most of the drawing and animation skills can be picked up quickly enough, along with basic scripts being added to create additional functionality. The scripting language used by Flash is ActionScript 3 (AS 3). This is an ECMA complient scripting language – which means that anyone familiar with JavaScript will be able to pick up AS 3 in no time.

Given that Android systems have native Flash support, and that Flash can now export projects to Apple iOS devices (iPod / iPhone / iPad), this is a powerful development environment for students to get to use – not only because there are a large number of developers and animators using it still, but also because it allows for files created in Photoshop and Illustrator to be quickly and easily imported and used in projects.

There is also a huge array of documentation on the ActionScript 3 language, as well as plenty of code examples available that can be quickly and easily found through simple Google searches.

#### 6a. Flash Alternatives

Here are a few 'flash alternatives' – all of which, when put together, can actually allow for flash-based games to be developed without Adobe Flash being installed.

FlashDevelop is your 'coding environment', Flixel and Flash Punk are libraries designed especially for flash-based game development, allowing for a variety of functionality that isn't natively found in the ActionScript code used in Flash.

Note: Both libraries can also be used within Adobe's Flash, they just have to be imported into the main program class.

- FlashDevelop (Coding Environment) - http://www.flashdevelop.org
- Flash Punk (AS3 Library) – http://useflashpunk.net
- Flixel (AS3 Library) – http://flixel.org

### 7. Some other approaches to consider:

Sometimes you may want to have students think more about the content, and the creative process rather than the nuts-and-bolts of programming, perhaps as a lead into the programming principles. If so, you may like to consider using the following software with these suggested activities:

- PowerPoint, or variations (PC – CrossPlatform, iPad, Paid and free versions available)

Choose your own adventure type 'game' can be created quickly and effectively, allowing students to consider the story element of games, and to make them think of how to 'branch' their games based on decisions.

- Inform7 (PC – Cross Platform, Free) http://inform7.com/

Classic 'text-adventure' type games can be created using this free application. Potentially useful as an extension from the PowerPoint, choose your own adventure style game. Inform 7 can allow students greater focus on the writing and the story than in PowerPoint and therefore could be used as a cross-curricular integration with English classes. The site also provides resources for teachers.

## Part 2: A review of games with educational value

### 1. World of Warcraft

A Massive Multiplayer Online Role Playing Game, typically abbreviated to MMORPG, World of Warcraft (WoW) is a fantasy world in which players create characters and interact with each other and the environment through the use of an avatar (an electronic representation of themselves). A player begins by creating a character (avatar); they will choose a race and a class. The class that is chosen has a set of unique skills that will dictate on how the character solves challenges in the game and confirms what role they will play in a group situation. For example a "healer" class restores health to characters that are damaged, while a "tank" class is suited to absorbing damage and directing the flow of combat. Characters of different classes will have to work in synergy to overcome the biggest challenges. WoW offers an array of different activities to participate in. You can slay monsters and dragons and with the help of your team mates take on the most technical fights which in turn grant the best rewards. There is an in game economy present in WoW which incorporates an auction house. Players interact with the market by posting up items they which to sell and other players choose to bid or buy using in game currency. Quests are dotted around the worlds which offer item rewards and experience from non-playing characters (NPC's). Experience is granted to a player by gauging how difficult a quest is. You receive experience for defeating enemy monsters and players as well. Experience allows a character to level up and become stronger and gain access to new abilities. The acquisition of items supplements a character's abilities granting bonuses to a player's statistics. The best items come from defeating difficult challenges and from crafting. Players have a choice of professions to choose from and allow players to craft and harvest materials. For example a player my choose to be a miner and a blacksmith, allowing the player to gather stone and minerals and then use a forge and anvil to craft armour and weapons. Overall the game has a high level of usability and takes you by the hand as it introduces the game to you step by step.

There are still over seven million subscribers as of July 2013 for this 10 year old game. Teachers need to be aware that when entering WoW that there will be many players in the game other than themselves. So a vigilant eye is needed, while there are blizzard employees monitoring public chats and unsavoury behaviour in game, players have the opportunity to privately chat amongst themselves. Edurealms.com have devised a full years language arts curriculum based on and in WoW and the book "The Hobbit".

### 2. Minecraft

Minecraft is a sandbox game, it allows the player creative freedom to explore, build and demolish. The game world is populated by different cubes which are randomly generated at the beginning of the game. These cubes are varied in appearance and are represented as dirt, stone, various ores, water, trees and other various resources. The game revolves around breaking different blocks that make up the world with implements that are crafted from the player such as pickaxes. Players craft different quality implements and tools from

different resources. For example an axe can be made wood and stone which is effective at chopping down trees but a stronger axe would be made from better materials. Blocks have different properties and require advanced tools to be gathered and when are placed down again interact with each other in different ways. Players have made roller coasters out of mine carts, entire cities and ancient civilizations.

Players are promoted to explore their world, gather resources, craft new items out of other items, and defend themselves in combat. The game has the ability for Complex systems to be built by using electrical circuits, and logic gates which are built with an in-game material known as redstone. http://minecraftedu.com provides a service for teachers that helps facilitate, organize and focus on the educational benefits of Minecraft

### 1. Kerbal Space Program

This is a rocket launching, space exploration and navigation simulator. This game begins with players constructing a rocket with the purpose of being launching it into space. To begin with Players have a selection of parts to choose from including different types of fuel, engines and struts. Parts snap together the parts in an intuitive manner, players need to be conscious that additional piece's add extra weight and will add to drag in flight and that these pieces all have properties that will affect the rocket. Players can construct their rockets in stages. They can choose when their rocket will detach from spent fuel and engines mid-flight to minimise drag. Most importantly the Rockets are affected by a Newtonian dynamics simulation so if a vehicle is not constructed wisely it can be torn apart by forces of excessive thrust and explode on its way into orbit.

Once players have reached space, players ships will be affected by the home planets properties and be pulled back down to earth unless they can achieve orbit. All the planets present in the game have different atmospheres and gravitational forces. From orbit pilots can direct their ships into orbit around a different planet if they have enough fuel to align themselves on the correct trajectory. Players can construct space ships and add to them launch by launch to create a lander to explore other worlds.

Players will find themselves over confident in this game at the beginning only to see their rockets explode or overshoot their rockets and drift aimlessly into the nether.

This game requires forward planning, intelligent design, an understanding of physics and forces and above all patience.

### 2. SimCity

SimCity is a single player city building simulation game. In SimCity, the player creates a city from the ground up, whilst managing a stable budget and keeping the citizens happy and safe. To be successful a player must provide utilities to their city whilst expanding and provide services to keep the population happy. Such services included education, health and leisure buildings. If the player doesn't fulfil these requirements the population can strike and riot. The player advances by collecting income from taxes. A balance must be stuck so the people do not revolt. There have been many versions of SimCity and other sim games such as Sim hospital, Sim Park all of these games focus on a synergy of elements, resource management and time allocation.

### 3. Word A Day Visuals and Audios by VocabAhead

This app presents to the user a selected "word of the day" which is accompanied by a 2d image of the word, a brief definition, a list of synonyms and antonyms (which can assist students to connect the word to existing vocabulary knowledge) and a short paragraph using the word in context per day. The choice is available for a user to skip ahead to see the next three days' worth of words and a limited number of previous days' words. This can assist with revision or and with students who wish to advance. This app includes an audio definition of each word to assist with pronunciation and paragraph as well as a timed quiz for users. The app provides elements that can assist in expanding vocabulary.

The app doesn't provide anyway to modify their learning, so student can't use the app to creating their own images or sentences. A small warning about the app, the sentences that accompany the word can be a bit strange and misleading.

### 4. Algebra Touch

This app is designed to advance a student's understanding of algebra by practicing problems in a drag and drop manner. This is achieved by students manipulating the terms of an equation from one side to the other they can then tap to factor or solve. There are more than 20 different lessons such as variables, basic equations, negatives, and more. A downfall of algebra touch is that the app lacks detailed instructions for students beginning to study algebra or extension opportunities for more advanced students.

### 5. Procreate

Procreate contains all the tools and quality performance you would expect from any professional digital app. The app includes an arsenal of digital tools and different brushes with the added ability to create custom brushes, or buy additional brushes. Similar to Photoshop the software works in layers with the option to choose the canvas size and shape. Students click and drag on the screen to draw with the selected brush and further manipulate the software. Procreate comes with the ability to work up to 16 megapixels which is very generous size. Additionally students can import files from Dropbox or a camera work on the image and then can export their creations to Dropbox, iTunes, or as Photoshop PSD files; then share creations via social media such as Facebook.

On the down side there are no tutorials included, students learn through exploring the tool and creating as they go.

However any tutorials on Photoshop would translate sufficiently. Ideally this is most suited for students who have some knowledge on

6. Anno 2070

**Please note:** this game has an ESRB Rating: T (for Teens, ages 13 and over); animated violence

Anno 2070 takes strategy gaming to a new level. It incorporates environmental and political elements, along with the standard economical and building elements of a real-time strategy game, in order to make the player decide the best strategy for building and expanding the society they've been tasked with overseeing. There are three major factions – those that are more environmentally focussed, those that are more industrially focussed, and one who supports both via technologically advancements. Both factions rely on mining and extracting natural resources in order to advance civilisation stages, and unlocking 'building options' – so it isn't just a game of 'good' and 'bad'. Rather, it gets the player to consider the impact of their choice – regardless of the path they take.

The game has a variety of play styles – from short campaign missions, to open-world styles, even multi-player (so that students can work together) in order to explore, grow and develop their worlds and communities. Along with helpful cues throughout the game, this helps in training players to the game style and how to effectively forward plan their communities.

Many strategy games focus on the need to acquire resources, and build up their communities or armies in order to take over the map, and 'win'.

Anno does it slightly differently – the islands that you inhabit have different resources, which allow the player to unlock certain production capabilities. It may seem intuitive at first to try take over the map – that is, inhabit all the islands – but there are other computer controlled players throughout the map – each one controlling a single island to begin with. If the player controls too many islands, this upsets the geopolitical balance – since it prevents other factions from being able to expand.

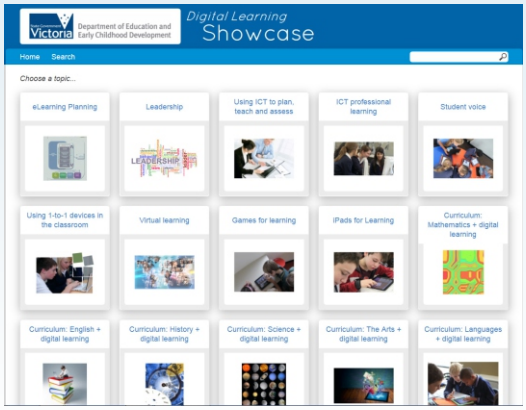
Overall, the game allows students to learn the consequences of their chosen actions from a variety of perspectives, thereby making them think how one seemingly straightforward decision could cause a variety of issues.

# GAME CREATION AND VIRTUAL WORLDS WITH DEECD DIGITAL LEARNING

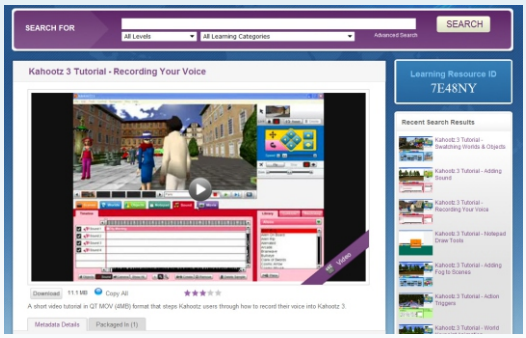
Digital Learning Branch Team, Department of Education and Early Childhood

Game playing and game creation have been long recognised as important parts of childhood development. An integral part of the work of DEECD's Digital Learning Branch as part of Early Childhood and School Education Group (ECSEG) has been to collate a wide variety of applications and resources that support both game design and game playing.


FUSE **www.education.vic.gov.au/fuse** as the main DEECD portal for learning resources and through the three main pages; primary, secondary and teacher allows public users' access to thousands of high quality websites including game focused ones such as *BBC games* and the game pages of *ABC Splash*. DEECD teachers can login to FUSE and gain access to additional resources.

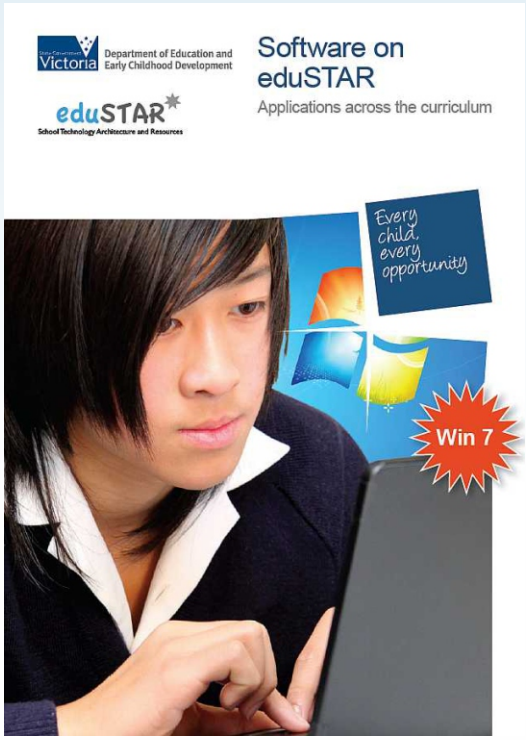



Linked from the FUSE teacher page is the Digital learning Showcase: **http://epotential.education.vic.gov.au/showcase/** which provides examples of current practice in the use of ICT and includes a separate section called Games for Learning. School stories from DEECD schools in the successful integration of games into their curriculum can be found here in both video and text form.



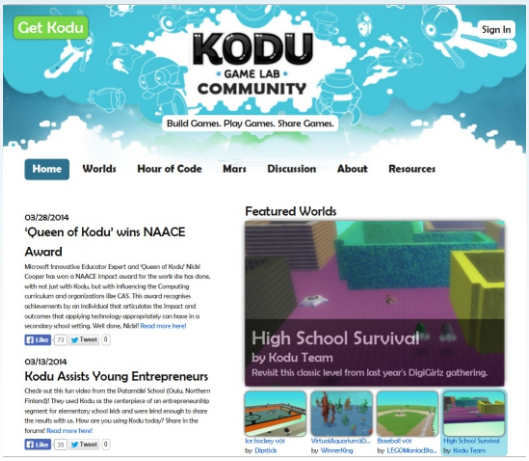

In addition the Digital Learning Showcase provides other key gaming resources. Video tutorials supporting game creation applications including Game Maker and Kahootz can be found here. Kahootz 3 is an intuitive virtual world application that can be used across many curriculum areas. Basic game interactivity can be programmed into Kahootz projects while "fly through" movies can be created and exported, potentially into other game applications as content.


*Scratch* remains among the best freeware game creation applications and has a large online community where *Scratch* practitioners show their work and provide hints and advice.
As users are able to see the immediate results of their game or simulation they are able to rapidly formulate input to optimise or radically change the scenario or game play.




Both *Scratch* and *Kahootz* are integral parts of DEECD's eduSTAR software image which is available to all DEECD Schools in several versions including Mac and Windows 8.1


*Game Maker* is also part of the eduSTAR software image which is now available for Windows 8.1 as well as Mac OSX. Game Maker provides a simple platform for platform game creation.




With this recent update the eduSTAR image now provides access to Microsoft's Kodu visual programming environment. *Kodu* is a drag and drop virtual world that was trialled by Ideas Lab's Richard Olsen across 29 Victorian Schools. The website for this exploration is **http://media.planetkodu.com/workshop/resources.html** and includes sample worlds and manuals on game design with Kodu. DEECD games based learning research can be found at **http://www.education.vic.gov.au/school/teachers/support/Pages/gamesbasedlearn.aspx** and includes reports on virtual worlds, serious games and links to the schools initially involved in the research.


The Digital Learning Branch has recently completed its *Digital Deck* project which provides double sided A5 cards featuring aspects of ICT and including links and classroom ideas. The key game creation applications such as *Scratch* are included in this set which can be downloaded as PDFs.


The Digital Learning Branch is looking for DEECD schools that are interested in exploring the gaming functionality of the new generation of consoles and in particular the X Box One with its Kinect interface.

The digital learning branch team can be contacted at:
**digital.learning@edumail.vic.gov.au**

# GAMES, PROBLEM BASED LEARNING AND MINECRAFT


## Kynan Robinson

Kynan currently works for New Era as the manager of the PD department, his work focuses on the use of ICT in education and specifically its relationship to new pedagogies.

This article is presented in three sections: first an introduction to the possible role of digital games in education. Second, a brief overview of project based learning and finally a 'lived' example of how these two areas of focus can be combined in a unit of work in a primary school context.

## Digital Games in Education: An introduction

Our students' experiences of society and culture are increasingly digital and their futures will involve digital workplaces. Their everyday lives are characterised by digital play and online interaction and their futures will involve digital workplaces, regardless of the career paths they follow. Beavis et al. (2014) argue that students have a right to learning opportunities that account for this reality but also allow them to develop the knowledge, skills and dispositions towards digital culture that will enable them to effectively and actively participate in diverse futures. Through their digital experiences, young Australians increasingly experience what Jenkins (2006) calls a participatory culture in which students are producers, not mere users, of digital culture. This has similarities to Lave and Wenger's (1998) notion of active participation which underpins the concept of communities of practice and online networks. Each student has the right to a rich connected ICT experience. In fact many would argue that depriving students from this experience or more specifically limiting a child's ability to connect to the Internet, is in fact depriving them of a basic human right. It is important that all schools embrace this new learning space, understand it and evolve and adapt their pedagogical approaches to reflect the change in learning. Digital games are one of the tools in this new space.

There is a rise in the use of digital gaming in educational settings and there has been a huge increase in the creation and development of digital games for learning. However, in many instances the games developed are merely replications for the type of teaching already occurring in non-digital classrooms. The digitising of them merely means that they are now available to be used on a device. They demonstrate little to no consideration for the new learning styles of modern children and once again attempt to replicate a method of reductionist information transferral, or to use another phrase, memorisation of fact and formulas. Most of them are closed form 'skill and drill' games rather than open exploratory games that allow for manipulation, reflection and other aspects of self directed or self managed learning. As Beavis et al. (2014) indicate, it is important that we move from seeing games as simply a way to promote smarter transmission of information to exploring how games might promote deep learning in the discipline areas, teach critical reflective competence with new literacies, and promote imagination and creativity, through play, production, analysis and use.

Much of the research into digital games and learning has presented their findings within one of two frames. Either the frame of direct transfer of skills, which demonstrates how simulation games can teach skills and therefore impart knowledge (for example, see: Bowman 1982, Malone 1980, Prensky, 2000), or through the frame of theories of situated learning which shows how games provide new investments in learning and provides epistemic frames for creating new ways of knowing (for example, see: Barab & Duffy, 2000, Jenkins and Squire 2003, Shaffer 2006). Many online digital games also have powerful dynamic networks existing around the games. These networks are places where knowledge is stored and where new knowledge is co-created, providing powerful learning environments for students. Gee (2007) refers to the places that exist within the game itself but also around the game such as the network built up online around the game, usually existing online as affinity spaces. Hayes and Gee (2010) go on to define affinity spaces as "well designed spaces that resource and mentor learners, old and new, beginners and masters alike. They are the learning system built around a popular culture" (p.188) like playing a game. This is a continuation of the network established in the game playing itself outside the direct parameters of the games structure, much like the wiki was being used in this unit, which I will discuss later.

The game Minecraft would place itself in the second frame, the frame of situated learning. Minecraft is not a simulation skills based game. Minecraft is Massive Multiplayer Online Game (MMO) and is also referred to as an open 'sandpit' game, which is played online. The term "sandpit" refers to the style of game. It has little predetermined narrative. The game plays out mostly dependent on the collective imagination of the players involved. It is essentially a building game with noticeable similarities to Lego- a digital Lego perhaps. One enters the world and begins building. The way it was used at North Fitzroy Primary School was to establish a community of practice or a network within the game - the participating 136 children - nest that network within already existing networks and to observe that complex system.

## Problem Based Learning: Providing an overview of our project.

In my time at North Fitzroy Primary School we were a school very focussed on gaming in education (using digital games to teach). In 2012 we were awarded a Schools Specialisation Grant to focus in the area and as part of that we partnered with Deakin University to conduct research into the area. A portion of the research focussed on this Minecraft Unit.

Other games we used included Civilisation and Sim City to teach term long units on government and history. We have also done entire term projects on game making which included students looking at programming skills plus narrative development in grades 3/4 area. We used programs such as Scratch, Atmospfir, Sploder and Game Salad to do this. We also use a lot of games on mobile devices in the junior levels to enhance the numeracy and literacy program.

However, a major focus for our research was a Minecraft project that we constructed. Our use of Minecraft was situated within a term long project (10 weeks) comprising 136 grade 5 and grade 6 students over five classes. There were five individual teachers involved and I operated as a guiding coach and project facilitator. The unit's major area of focus was Science, specifically looking at areas including sustainability and biospheres. However, it did also involve content and curriculum from subjects including Geography, Design and Technology and Communication. It is also important to note that the unit was set within a Project Based Learning (PBL) framework. The PBL framework allows:

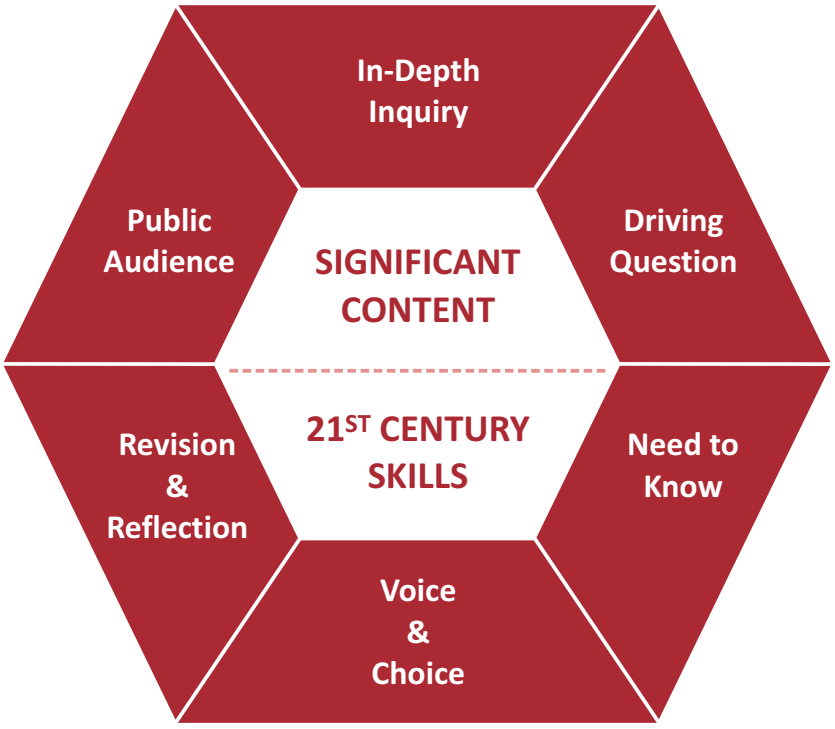
students [to] go through an extended process of inquiry in response to a complex question, problem, or challenge. While allowing for some degree of student "voice and choice," rigorous projects are carefully planned, managed, and assessed to help students learn key academic content, practice 21st Century Skills (such as collaboration, communication & critical thinking), and create high-quality, authentic products & presentations. (Buck Institute of Education, 2013)

PBL was chosen as it displays a number of the key criteria set out by complexity theory (I will also speak of this later in this article), including openness and non linearity. Below is an image demonstrating what is considered the essential elements of a PBL project.

The 'driving question' is a key aspect of PBL and its aim is to be open enough to allow for flexibility and choice of direction within the project but focused enough that if participants are getting lost or unsure of relevancy they can constantly refer back to it with participants including both the students and the teachers.

Our unit of work centred on the driving question 'How do we sustain life on another planet?' To further focus the unit, the teaching team The driving question (which can be seen in the planning document below) for our Minecraft unit was 'How do we sustain life on another planet?' The introduction and project overview have provided a brief introduction to the context in which Minecraft was used in our school.

The final section of this paper begins with an over view of the initial planning document that was collectively written at the start of the term and was designed as a guiding document for the teachers to ensure that students and classes remained on track. The document was considered a dynamic artefact which meant that changes could be made at any stage dependent on where the learning was heading.



## PROJECT OVERVIEW

| | |
|---|---|
| **Name of Project:** Mission Terraforma | **Duration:** 10 weeks |
| **Subject/Course:** Rich Learning Project | **Grade Level:** Level 4 |

**Other subject areas to be included, if any:** Science (Food Chains, Ecosystems, Biospheres), Geography, Design and Technology, Communication

**Project Idea:**
Summary of the issue, challenge, investigation, scenario, or problem:

It is the Year 2385 and the planet Earth is in chaos...

Climate Change has ravaged the land with food and drinking water now in short supply. Civil unrest, extreme poverty and disease are rampant, as global warming has caused disease, famine and a 5000% increase in the occurrence of natural disasters. Fossil fuels are all but gone as crises talks are held by the New World Order.

The New World Order has given you the last of its available resources so that you may attempt to terraform the planet MX73 - the closest planet with atmosphere composition similar to Earth. You land on MX73 and equipped with the creative tools at your disposal, your mission is to: Terraform Aurora 56Z and create a colony for the human race. Initially you are to create marketing material for prospective colonists. Good luck! The future of the human race is in your hands.

**Driving Question:** How do we sustain life on another planet?

### PROJECT MILESTONES

| WEEK 2 | WEEK 3 | WEEK 4 | WEEK 5 |
|---|---|---|---|
| Planet Dying | Where to Go? | A New Home | Destination Planet MX73 |
| • Introduce project idea and driving question<br>• Examine why we are leaving earth? Explore issues of climate change, sustainability, fossil fuels | • Examine and compare the known planets in our solar system. Is life sustainable on these planets?<br>• New planet is discovered. What is it like? These are the atmospheric conditions of the planet – launch WIkispaces<br>• Minecraft & Google Sketchup P.D. | • What will we need to take to our new planet? Make decisions about what we will take.<br>• Spaceship design<br>• Develop council groups<br>• Minecraft & Google Sketchup P.D. | • What will we need to take to our new planet? Make decisions about what we will take.<br>• Begin spaceship design<br>• Develop council groups<br>• Rocket launch<br>• Minecraft & Google Sketch up P.D. |

| WEEK 6 | WEEK 7 | WEEK 8 | WEEK 9 | WEEK 10 |
|---|---|---|---|---|
| Landed | Terraforming | Where to Next? | What have we done? | Will we Survive? |
| • Terraforming our new planet<br>• Initial Council Meeting: Agriculture, Culture, Industry, Suburbia | • Terraforming our new planet<br>• Council Reports on Wikispaces. Agriculture, culture, Industry, Suburbia | • Council reviews the work of another council and provides feedback and suggestions | • Council Meeting: determine presentation material and mode | • Share as a level, each council presents their work<br>• Expert panel evaluates the success of the planet |

**Content and Skills Standards**
to be addressed:

**SCIENCE – Progression Point 4.5**

Knowledge of factors which have impacted on the development of scientific ideas over time within chemical, physical, biological, earth and/or space science contexts

**ICT – For Visual Thinking**

Students begin to work in a collaborative global environment. At Level 4, students apply ICT tools and techniques to represent and explore processes, patterns and cause-and-effect relationships. Students use ICT tools and techniques that support the organisation and analysis of concepts, issues and ideas that allow relationships to be identified and inferences drawn from them.

**Thinking Processes – Reasoning, Processing and Inquiry**

At Level 4, students develop their own questions for investigation, collect relevant information from a range of sources and make judgments about their worth. They distinguish between fact and opinion. They use the information they collect to develop concepts, solve problems or inform decision-making. They develop reasoned arguments using supporting evidence.

**Thinking Processes – Creativity**

At Level 4, students use creative thinking strategies to generate imaginative solutions when solving problems. They demonstrate creativity in their thinking in a range of contexts and test the possibilities of concrete and abstract ideas generated by themselves and others.

**Thinking Processes – Reflection, Evaluation and Metacognition**

At Level 4, students use a broad range of thinking processes and tools and reflect on and evaluate their effectiveness. They articulate their thinking processes. They document changes in their ideas and beliefs over time.

| | | T&A | E | | T&A | E |
|---|---|---|---|---|---|---|
| **21st Century Skills**<br>to be explicitly *taught and assessed* (T+A) or that will be *encouraged* (E) by project work, but not taught or assessed: | Collaboration<br>• Students collaborate across Level 4 to build and develop the new biosphere<br>• Students collaborate with their council group to plan and organise their area of the biosphere | Y<br>Y | | Organisation<br>• Students plan the project management that is required and develop an effective action plan for the biosphere<br>• Students allocate roles to ensure the tasks are completed appropriately<br>• Students ensure they have appropriate services for the community and are able to articulate these at the expert panel session | Y<br><br>Y | <br>Y<br> |
| | Creativity & Design<br>• Students create and design their space shuttle and terraform their part of the planet | Y | | Communication<br>• Students will be required to effectively communicate with other students to ensure they meet the needs of their population<br>• Students will need to articulate their designs and achievements to the expert panel<br>• Students will promote and create marketing material for the planet | <br><br>Y | Y<br><br>Y<br> |
| | Technology<br>• Students will use Minecraft to terraform and build the planet<br>• Students will use WIkispaces to record and reflect their progress with the project | Y<br>Y | | | | |

| | | | PRESENTATION | |
|---|---|---|---|---|
| **Culminating Products and Performances** | **Group & Individual:** | Each council will present their work to an expert panel, which will evaluate the success of the planet and the potential for its long-term survival? | Class: | Y |
| | | | School: | Y |
| | | | Community: | |
| | | | Experts: | Y |
| | | | Web: | Y |
| | | | Other: | |

## PROJECT OVERVIEW

**Entry event** to launch inquiry, engage students:

**It is the Year 2385 and the planet Earth is in chaos...**

Climate Change has ravaged the land with food and drinking water now in short supply. Civil unrest, extreme poverty and disease are rampant, as global warming has caused disease, famine and a 5000% increase in the occurrence of natural disasters. Fossil fuels are all but gone as crises talks are held by the New World Order…

| | | | | | |
|---|---|---|---|---|---|
| **Assessments** | **Formative Assessments (During Project)** | Peer Evaluation<br>Councils peer evaluate each others district and the developments they have made. They provide feedback and suggestions to one another. | Y | Preliminary Plans/Outlines/ Prototypes<br>Students will plan the terraforming of the planet and also the design for their space shuttle. | Y |
| | **Summative Assessments (End of Project)** | | | Self-Evaluation<br>Students will self evaluate their additions to the planet. | |

| | | |
|---|---|---|
| **Resources Needed** | **On-site people, facilities:** | Minecraft Server |
| | **Equipment:** | Laptops |
| | **Online Resources:** | Minecraft www.minecraft.net |

| | | | | | |
|---|---|---|---|---|---|
| **Reflection Methods** | **(Individual, Group, and/or Whole Class)** | Reflection 1: Initial<br>Reflection 2: Mid term<br>Reflection 3: Final | Y | Whole-Class Discussion | Y |

## Project Idea: a context for the use of Minecraft

*It is the year 2385 and the planet Earth is in chaos….. Climate Change has ravaged the land with food and drinking water now in short supply. Civil unrest, extreme poverty and disease are rampant as global warming has caused disease, famine and a 5000% increase in the occurrence of natural disasters. Fossil fuels are all but gone as crises talks are held by the New World Order. The New World Order has given you the last of its available resources so that you may attempt to terraform the planet Aurora 56Z - the closest planet with atmosphere composition similar to Earth. You land on MX73 and equipped with the creative tools at your disposal, your mission is: to Terraform Aurora 56Z and create a colony for the human race. Additionally you are to create marketing material for prospective colonists. Good luck! The future of the human race is in your hands.*

So began a 10 week unit of inquiry at North Fitzroy Primary School in term four 2012. North Fitzroy Primary School is an inner city primary school in Melbourne, Australia. I had been working at the school for approximately 10 years. The unit's major area of focus was science, specifically centred on sustainability and biospheres. Most of the unit was taught through the game Minecraft and the premise of the unit was "our world is ending due to unsustainable practices. We are moving to a new planet, Aurora 56 Z. We need to rebuild a new and smarter civilisation. Our new planet exists within the game Minecraft."

136 students, five individual teachers and I were involved. My role was as facilitator and guide. While I did not have my own class I worked with the teachers to plan the unit and help deliver it. I also worked as a mentor to the teachers, offering advice when needed. My position at the time of the research was that of Leading Teacher in the school, with a focus on ICT (Information Communication and Technology), creativity and innovative learning and teaching. This role had peaked my interest in digital gaming in education.


As the name Minecraft implies players need to mine for resources in order to build. The first task most players do is use the given axe to chop down a tree in order to collect wood. That wood is used to build a house. As one progresses in the game, stronger resources and subsequent abilities become available, for example, the ability to collect or mine stone, red stone (a system of electronics enabling a player to turn switches on and off), diamonds and other materials. Each progression allows the player to build stronger and more elaborate structures. The initial world one enters has all the properties of an unsettled land including water, trees, natural resources and terrain such as hills and mountains. What one does inside the world is almost entirely dependent on one's imagination.

As the world we currently lived in was rapidly disintegrating, the cohort was now moving to a completely undeveloped, newly discovered planet and was required to settle in it. The settlement and development and building process was to display evidence of learning around the key content areas (biospheres and sustainable practices). Everything that was built on our new planet had to represent learning and research that the children were doing in the areas of sustainable biospheres.

Obviously this project involved a high degree of role-playing. The imaginary planet, titled Aurora 56Z, that humanity was now to inhabit, was built within the Minecraft game. The use of the game Minecraft was an extension of the role-playing. It is an example of using games to provide experiences that could not have previously been possible. The building of this planet would encompass all the learning that the students were doing

about sustainability and biospheres. Examples of structures that were built within the game included

- Wind farms
- Farms based on sustainable farming techniques
- Research Centres for Education
- Parks
- Drainage systems
- Space station for further discovery of other planets
- Art works
- Desalination plants
- Seed Pods
- Libraries, Universities and Schools
- Recycling Centres

As part of the unit a Wiki was also used (http://aurora56z.wikispaces.com/). A wiki is a web site, which allows users to upload content, comment on each other's content, modify content and collaborate. In this instance the Wiki was a place for the students to reflect on their learning. All the students' research, discoveries, reflections on learning and ideas were presented in the Wiki. Each child had its own page. The Wiki was public, meaning it was viewable by everybody. This meant that all involved in the unit (teachers and students) could see each other's reflections, (a visible representation of the learning process), provide feedback on each other's work and find appropriate people with whom to collaborate and form working groups.

The unit aimed to draw on much of the literature written on complexity thinking and education. Complexity theory indicates that when you have a collection of interacting agents that can communicate within a complex system and the system is fighting for a limited resource and there is no centralising 'god-like' figure controlling the system a thing called emergent phenomenon will arise out of the system. Emergent phenomenon is phenomenon cannot be predicted by prior knowledge of the individual agents – it arises like magic out of the system. Levels of the emergent phenomenon plus the survival of the system is dependent on feedback provided to the system, feedback from prior memories and the ability within the system for communication. The system is open, always changing dynamic, flexible evolving and adaptive and there is a balance of order and disorder. This theory was used extensively in our approach to the Minecraft project. As mentioned earlier in our Minecraft project we had 136 students building a new world in a MMO (Massive Multiplayer Online Game). They were all in there building at the same time. I would describe this as a complex system and the observance of the emergent phenomenon was eye opening.

## Observations from the unit

Two key themes emerged as significant when we reflected on our observations from this unit: self-directed learning and feedback.

## Self directed learning

One of the initial discoveries we can observe when reviewing this project was in regards to the intended learning outcomes, based on VELS (Victorian Essential Learning Standards, Victorian Department of Education, 2012). These were covered in approximately two weeks. From that moment on the project was almost entirely driven by the students. The learning became much more 'personalised' and self directed (existentially realised by the participants). Below is a brief narrative example from one of the teachers, which supports this claim:

> Energy was needed to fuel our new planet and a decision was required on what type of energy to use. The students had decided that collectively they would research and report before any major construction could occur within the Minecraft world. This was to create order within their new world. Initially, people were chaotically building anything anywhere.
>
> Once the decision on what to build had been collectively decided, the students could then start building the required infrastructure on our new planet – Aurora 56Z. The decision around a suitable energy source was charged to students working within the Industry District. Based on the student led research being done around sustainable energy sources, most members of the district decided to build wind farms to create energy. However one child was anti-wind farms. He was insistent that nuclear power was the correct decision. His argument was based on solid research he had done on his own.
>
> He had researched nuclear power versus wind farms. He had begun researching the potential consequences and benefits of using either one as a primary energy source. He began investigations in what nuclear power actually was (splitting an atom), the need for rapid energy (wind farms would take too long )and could not provide sufficient base power capacity.
>
> This child was researching areas of science, that we as teachers hadn't initially considered teaching. The student was pushing into areas of personal interest. His learning was becoming self-directed. That child then vehemently argued his case through interactions within the Minecraft environment, the Wiki and in face-to-face discussions. In the process this provided additional learning for all about nuclear energy and the science which supported it. He still failed to convince the group. So wind farms were built.

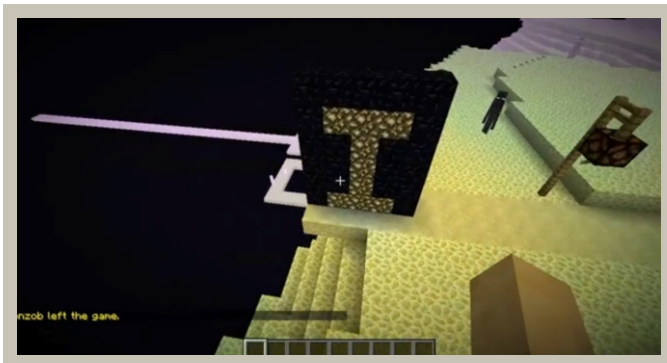
Wind farms were chosen as the source of energy and subsequently built in the game.

## Feedback – within the game and through a Wiki.

The game Minecraft and the server that the participants inhabited also acted as a complex system within our project. Initially it had very poor internal communication and feedback systems built into it. The students were 'building on top of each other'. For a system to evolve, the agents within the system must be able to communicate. Feedback is a requirement for adaptation. The way this system developed its own methods of improving communication and the ability to feedback to itself was very interesting. Initially the students demanded that a bureaucracy be brought into place and the system to be internally managed. Districts were invented and each student aligned himself or herself to a district of interest. That district was responsible for researching and self-educating around points of need for our new planet. It was also responsible for building within the Minecraft server, dependent on the learning and finally it was responsible to feedback the learning and progress to all the other districts. The chosen districts were:

- Agriculture
- Industry
- City and Culture
- Recreation
- Discovery and Education

Communication of this student devised bureaucratic structure and subsequent structures were done through all participant meetings held on a weekly basis, through emails, online chat and communication methods within the game. Below are a couple of examples of communication within the game, including the chat function situated in the bottom left corner of the screen and in built communication methods devised by the students themselves.

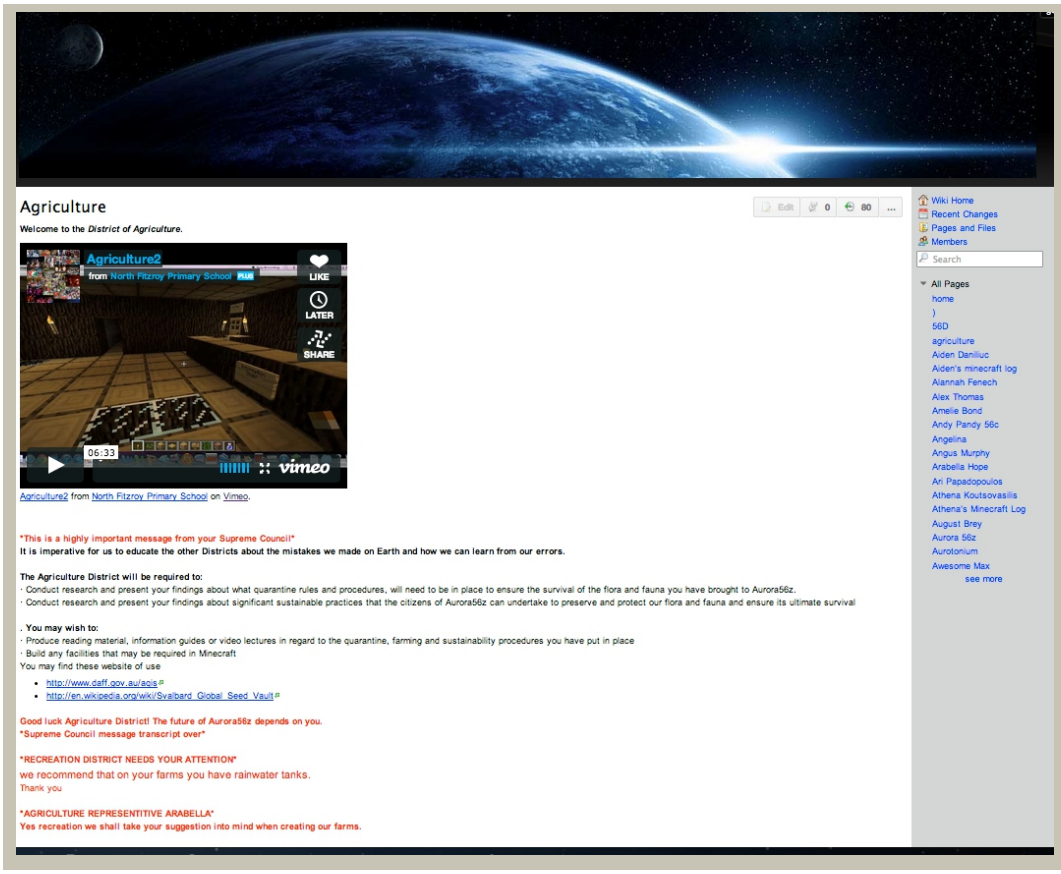



The large "I" was a communication symbol designed by the students. It represented the Industry District and was used to help in the demarcation of land to build on.

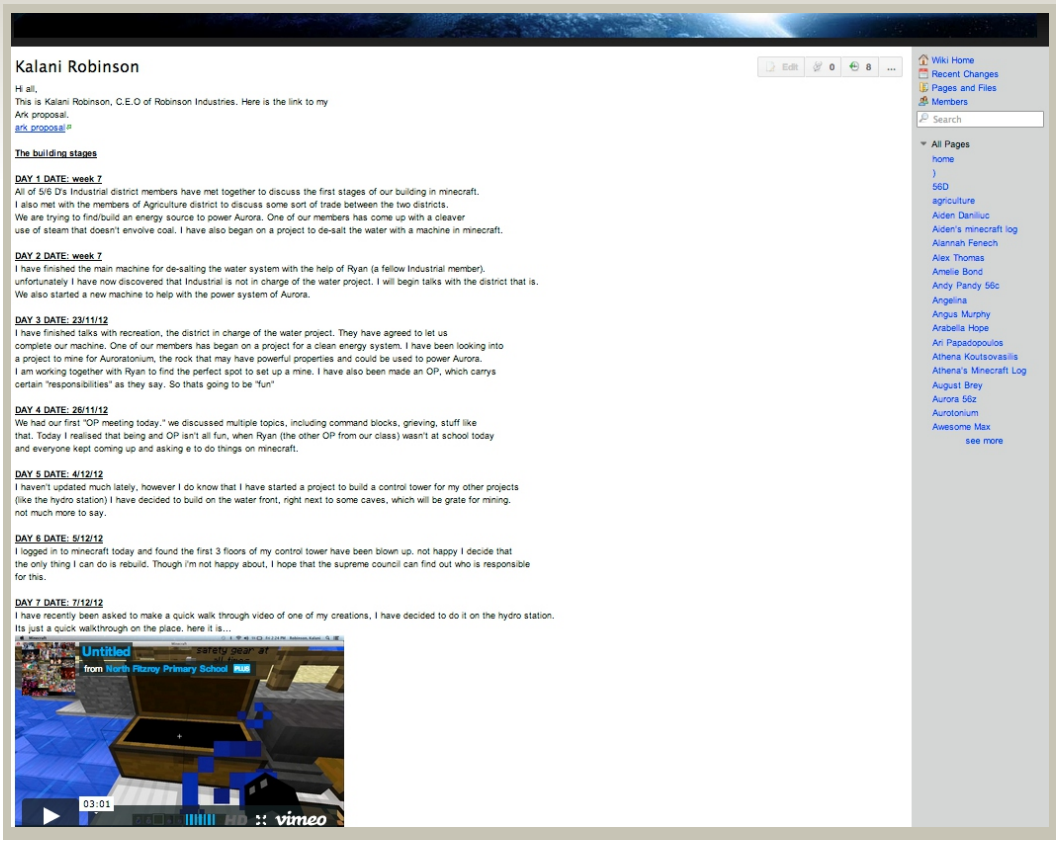

A further example of internal communication – rules were created by the students and posted to sites within the game.

The final communication device used was the development of the WIKI.
The WIKI was constructed in the following way:


Front page with guiding question and project idea. This also had hyperlinks to the district pages. All the student pages are listed on the right hand side of every page within the wiki.

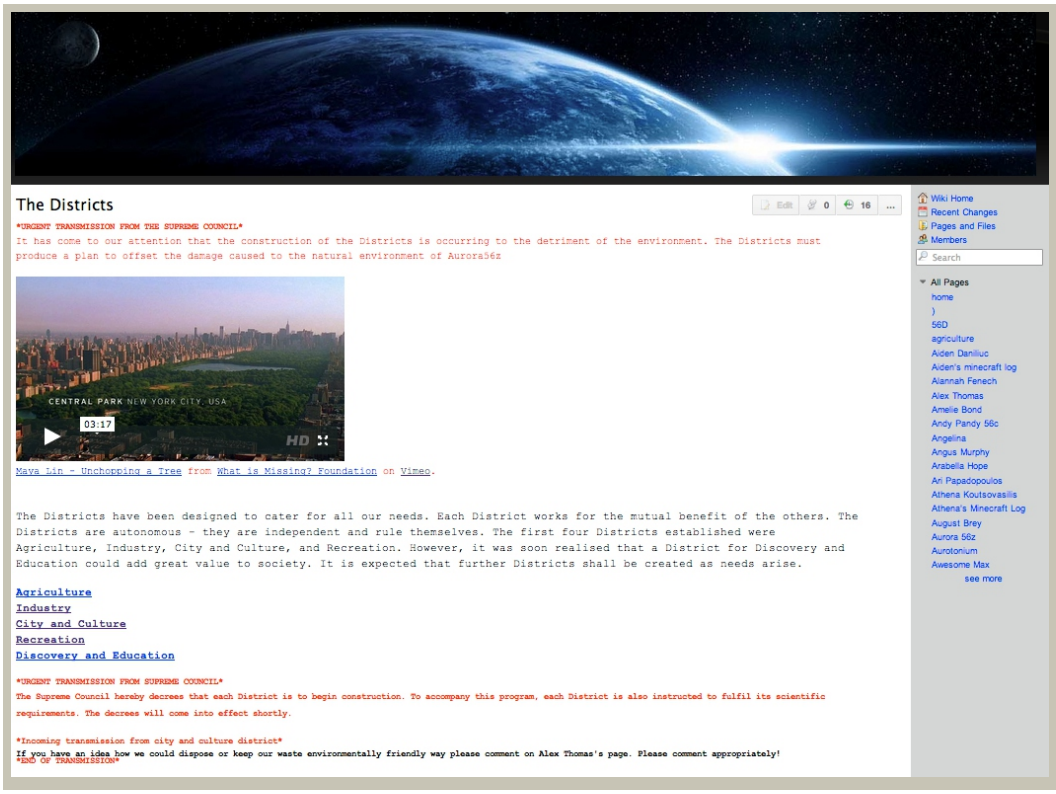



District pages – to be used to demonstrate thinking, learning and argue cases for further development/building in the Minecraft world




Individual students pages - to be used to demonstrate thinking, learning and argue cases for further development/building in the Minecraft world. As is evident in the above screen shot, reflection of learning occurred in the wiki space using a variety of media including text, video and images.

As everybody could visibly see everybody else's page, the Wiki was also a place that the students provided feedback to each other through the comment section. Teachers also used this section to provide feedback to every child.

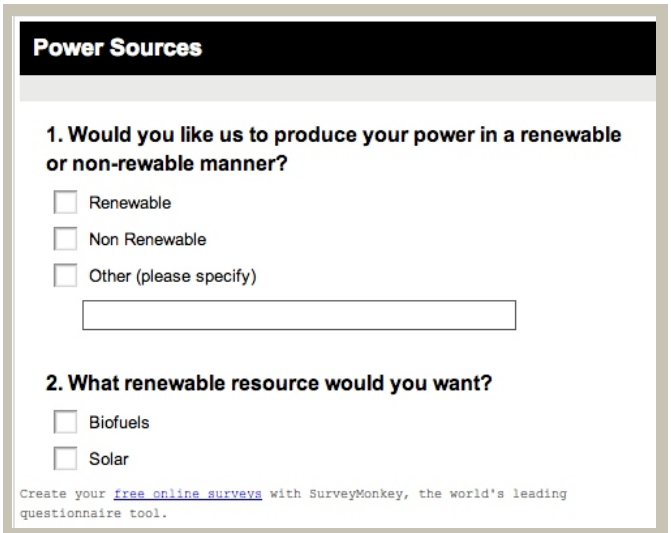


The teachers would often ask questions within the wiki space. These questions were attempts to influence the learning and to keep the project "on track". The teachers' comments were written in red for two reasons:

1. By altering the colour from the standard black it was a point of difference. The students became aware that when red text appeared they were to refer to it and decide on how to proceed.
2. It was felt that by making it red, it fit with the role-playing theme of an "urgent transmission" coming through to the inhabitants of our new planet.

Minecraft
1: We have been constructing a farm and a barn for animals. So far, so good, although animals have been escaping into other areas. We have fixed that problem though. The barn is going nicely, a nice building that will easily be able to keep chickens if need be. The point of this is to have animals and barns for storage. We decided to build right near trees for that extra, environmental boost.
2. I have created a plant house, made out of glass, the plant house will provide sunshine for it's contents. We will be watering them ourselves from the purified water that we collect from 5/6D industrial's water dam. The point of this is to have plants and crops for use. Food and water.
3. Isaac and I have been creating an underwter water source. Its purpose is to "water" our plants and farm stuff from underneath.
4. Okay supreme council...
4.1 I said that the trees give the boost, though shade is a good bonus for animals to keep coll.
4.2 I made the plant house with glass so that I can see their progress and so the sun above is amplified.
4.3 The underground water source is for plant growth and animal coolness. We made it underground because both the animals and plants are covered by things.
++++++++++++++++Transmission from Supreme Council++++++++++++++++++++++++++++++++++++++++++
Ben, please answer the following in further detail:
1. Why does the shade give the farm an "extra environmental boost?"
2. Why does the plant house require to be made out of glass? Glass is very expensive? What is the benefit of this?
3. What is the purpose of your underwater water source? Why not above ground?
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Example of an internal transmission (in red) used to guide the learning.




An example of student generated surveys created and embedded into the wiki to assist with communication.

Finally as part of the process involving public audience, a panel day was created in which the students as organised districts, had to share their learning and take questions from a panel to justify their decisions on what they had built. The panel consisted of local experts including a professional scientist, a science lecturer, a representative from the Department of Education, the head of ABC Education and the principal of the school. Typically after each district had presented, a panel member would quiz them on their construction and its relationship to sustainable practices; for example, "Why did you build a desalination plant and can you explain the process of desalination?"

For me as an educator and researcher, this project example demonstrates what makes contemporary education, with its strong links to the digital world, so exciting. No longer are students locked in to the reductionist methods of education prevalent in much of our education systems. Rather, there is a diversified world within which students can navigate, collaborate, co-create and communicate.

How is ICT changing the way we learn? How can we best utilise this to enhance creativity and innovation in students?

For me, the above questions are essential and link to some of the primary aspects of human creativity. Through the incredible creativity that is evident in all life, our biosphere has constantly adapted and evolved. This creativity is "ceaseless in the natural universe, biosphere and human culture." (Kauffman 2010, p.xi) and this creativity emerges naturally from the self-organising, non-linear process that is life. How can we enable an education system that acknowledges and embraces the complexity of life, in contrast to the reductionist system so prevalent in most western education? How can we create learning environments that supports emergent creativity and which better reflects the new scientific thought that is complexity theory?


A desalination plant was built to supply the colony with water.

An aerial shot of a farm built by the Agriculture District using sustainable farming techniques.

A space station was deemed necessary in case this planet proved unsuccessful and further exploration was required.

## References


Beavis, C, Dezuanni, M, O'Mara, J, Prescott, S, Rowan, L, Wyatt-Smith, C, Zagami, J, Yam San Chee 2011 - 2014, *Serious play: using digital games in school to promote literacy and learning in the twenty-first century*, Australian Research Council Linkage Project LP 110200309.

Bowman, R. (1982). A pac-man theory of motivation. Tactical implications for classroom instruction', *Educational Technology*. 22, (9) 7-14

Gee, J.P. (2003). *What video games have to teach us about learning and literacy*. New York: Palgrave Macmillan.

Gee, J.P. (2004). *Situated language and learning: a critique of traditional schooling*. London: Routledge.

*Gee, J.P. (2007) Good video games and good learning: collected essays on video games, learning and literacy.* New York: Peter Lang.

Gough, N. (2012). Complexity, complexity reduction and 'methodological borrowing' in educational inquiry. *Complicity: An International Journal of Complexity and Education. 9*, (1), 41-56.

Hayes, E and Gee, J (2010) Design Resources and Affinity Spaces. In *Handbook of Public Pedagogy: Education and Learning Beyond Schooling*. Sandlin, J. A., Schultz, B. D., & Burdick, J. (Eds.) New York, Routledge, pp185-193.

Buck Institute for Education (2013). *Project based learning*, retrieved October10, 2013, from: http://www.bie.org/about/what_is_pbl

Kauffman, S. (1995). *At home in the universe*. New York: Oxford University Press.

Kauffman, S. (2010). *Reinventing the sacred: a new view of science, reason, and religion*. Basic Books.

Lave, J., & Wenger, E. (1991). *Situated learning: legitimate peripheral participation*. Cambridge: University Press.

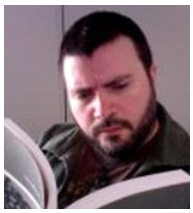
Wenger, E. (1998). *Communities of Practice. Learning, meaning and identity*. Cambridge: Cambridge University Press.

Malone, T. (1981). 'What makes things fun to learn? A study of intrinsically motivating computer games', *Pipeline*, 6 (2),50-51.

Prensky, M. (2000). *Digital game based learning*. New York: McGraw-Hill.

Shaffer, D. (200) *How computer games help children learn*, Macmillan.

# A Model for Critical Games Literacy



Tom Apperley
University of Melbourne, Australia

Catherine Beavis
Griffith University, Australia

## ABSTRACT

This article outlines a model for teaching both computer games and videogames in the classroom for teachers. The model illustrates the connections between in-game actions and youth gaming culture. The article explains how the out-of-school knowledge building, creation and collaboration that occurs in gaming and gaming culture has an impact on students.' understanding of their own lifeworlds. The authors demonstrate how the development of curricula around and with games and gaming cultures can incorporate and capitalise on approaches to learning and collaboration, design and identity that students have developed in their own gaming practices.

## INTRODUCTION

The centrality of new media and digitally mediated communication in young people's lives is an increasingly important concern for teaching practitioners in English and

literacy education. Previous research into young people's out-of-school digital engagements and literacy practices highlights the role of digital texts as multimodal forms of meaning making, and the role of digital culture in formations of values, identity and community (e.g. Jewett, 2008). The scholarly research that has endorsed the importance of digital texts has been accompanied by a more general recognition of the centrality of digital technological competence to economic and social wellbeing at both individual and national levels (OECD/CERI, 2009; Westbrook, 2011). Consequently, media literacy education has been embraced in many jurisdictions, including the USA, where media literacy was highlighted as one of three '21st century competencies' in the US National Education Technology Plan (Office of Educational Technology, 2010, p. 13). This recognition underlines the need for English and literacy curricula and pedagogies to actively incorporate the use and analysis of digital texts, knowledge and practices in the classroom.

Donna Alvermann poses the question at the heart of much research and practice bringing together young people in and out of school literacies: 'why bother theorizing adolescents' online literacies for classroom practice and research?' (Alvermann, 2008). While '"a healthy skepticism that theorizing adolescents' online literacies, alone, is sufficient to the task of improving learning in subject matter classrooms" (p. 17), she called for 'a pedagogy of critical literacies as a starting point for analyzing both online and offline texts' (p. 17). In this article, we present a model for exploring digital literacies and games in the classroom context. Developed in the course of a nationally funded three-year research project working with English teachers in the Australian state of Victoria (see Beavis et al, 2009), the model provides both a map for observing and analysing games and gameplay, and a template for curriculum planning and pedagogy concerned with critical games literacy, digital games and multimodal twenty-first-century literacies.

## Why Digital Games and Literacy?

The premise of this focus of media --- particularly digital --- literacies is the need to prepare students to be active, literate participants in the rapidly changing world beyond school. Understanding the literacy practices involved in playing digital games and reconceptualising curricula to support the learning affordances offered by digital games have great potential to build strong bridges between students' out-of-school life-worlds and twenty-first-century curricula. This article presents a model for use in developing English and literacy curricula with digital games that will allow teachers and practitioners to capitalise on this connection. This article focuses on *gaming literacy* --- the literacies required to analyse, design, and play digital games. Previous research has solidly established this connection between digital games and digital literacy (Buckingham & Burn, 2007; Salen, 2007, 2008; Zimmerman, 2009; Gee & Hayes, 2010; Hayes & Gee 2010; Hsu & Wang, 2010), particularly how they "recruit important literacy practices", through both play and participation in online gaming communities (Steinkuehler, 2010, p. 63).

While in many respects the literacy practices developed through digital games are similar to those required for any other digital media, we argue that digital games are different because they are *enacted* by the player. Thus, we definite gaming literacy to include:

1. 'textual' literacy --- the 'new literacies' associated with digital iterations of 'reading' (or playing) and 'writing' (or producing) in combination and in multimodal forms (e.g. New London Group, 1996); and

2. 'literacies' specifically linked to the *action*-based processes of digital gameplay (e.g. Atkins, 2006; Galloway, 2006).

The model of game literacy we present in this article draws on the insight of games scholars *and* literacy theorists to both emphasise the distinctiveness of digital games as cultural phenomena and situate this uniqueness against contemporary understandings of literacy and multimodal literacy practices.

This definition of gaming literacy underscores how digital games – including games played on computers, consoles, and mobile and handheld devices – present a complex challenge for researchers and practitioners of education. Digital games deserve a central place in an expanded repertoire of texts brought into the curriculum for study, but *they cannot be understood simply on textual terms* – successfully capitalising on digital games in the classroom requires an understanding of students' out-of-school gaming practices on their own terms. While the 'meanings' of digital games are negotiated and produced in the interaction between 'text' and reader (as is the case with any text), we believe it is important that the model also demonstrates how digital games are enacted and instantiated through *action* (Apperley & Beavis, 2011).

This is why the model is presented as two interlocking layers: games-as-action (Figure 1) and games-as-text (Figure 2). The games-as-action layer is presented first; it addresses the experience of gameplay by examining the virtual worlds of digital games and the dynamic interplay between game and player. This layer looks inwards to the virtual world of the game in order to focus on and understand gameplay on its own terms, and uncover the constellation of literacy practices involved in digital gameplay. Second, the games-as-text layer is outlined; this layer examines the connection between the digital game and the lifeworld of the player, where the game play is embedded, enacted and given meaning. By looking outwards to the experience of the player, this layer provides scope for connecting gameplay to literacy outcomes, and events in the world more generally. Finally, we discuss how these two layers can by fruitfully combined (Figure 3). The boundary between the layers is permeable and overlapping, and this section endeavours to mark useful segues between games-as-action and games-as-text layers to demonstrate how the model operates holistically.

## Games as Action

The notion of "ergodic" (Aarseth, 1997, p. 1) is the crucial concept from game studies that marks the importance of understanding digital games as action. The term emphasises the physical actions ('labour') of the player in the configuration of the final game 'text'. The notion conceptualises the relationship between the final text --- or output --- of a digital game and the process of textual production --- the interactions between the digital game software, the hardware and the player – that produces the text (see Bogost, 2007; Wardrup-Fruin, 2009; Walsh, 2010). Three crucial factors inform the ergodic process: *action*; *design*; and *situation*; alone and in combination, these factors constitute the games-as-action layer of the model (Figure 1).

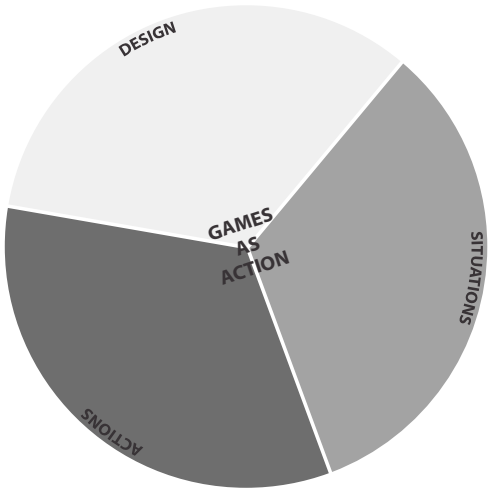



**Figure 1.** Games as action

### *Actions*

Digital games are enacted on two levels: by the players, and by the console or computer that enacts the games' software. Actions refer to *interactions* --- the reciprocal configuration and re-configuration of the game software --- performed both by the player and by the hardware (Galloway, 2006). This distinction allows practitioners to understand distinctive actions within what might otherwise be perceived --- based on purely visual observations --- as an amorphous, homogeneous, and unspecific session of game play.

Action underscores the complex, contradictory relationship between the player and the digital game. Players will often – even within the same game – alternate between playing *against* and playing *with* the digital game. The game software takes on an ambiguous position as an opponent, referee and arbiter, who sometime provides the conflict, but always determines and enforces its outcome. In many cases the game software is responsible for the actions of all opponents and hazards, which will act only according to their designed remit. In such cases the players' actions are often informed by how well they observe and understand the actions that the software undertakes as their opponent. In multiplayer games this challenge is provided by other players, making the strategies involved considerably more complex. In these cases the software arbitrates the interactions between the parties, and the physics of the virtual world. Software and players also play cooperatively in single-player digital games centred on building and management. For example, in the *SimCity* series (Maxis, 1990-), the player and software cooperate to build/design a virtual city, the player makes the decisions and the software runs the simulation according to set rules, whilst notifying the player of areas needing particular attention (deforestation, pollution etc.).

Digital games are defined by action. Actions determine *how* players will use their avatars, the virtual game space(s), and the objects in it; as Gee (2008b, p. 259) points out: 'in a game, the virtual character's powers and limitations mesh with the way in which the virtual world is designed in quite specific ways'. Players must deploy their knowledge – from previous gaming experience, or from some other intertextual signal – in order to recognise actions available to an avatar. *Assassin's Creed II* (Ubisoft Montreal, 2009) illustrates this point; the fact that Ezio can climb makes Florence a different kind of city to explore. Of course, this is revealed right away in the game's tutorial, along with other basic actions, but *Assassin's Creed II* constantly introduces new techniques as the player proceeds through the game. These are explained when Ezio comes to a new area or must perform a new challenge in order to proceed in the game. It is the introduction of the action by the game

and its mastery by the player that allows the game to proceed.

### *Designs*

The concept distinguishes between two crucial forms of action: those that follow the rules of the game, and those that shape the rules of the game. It is necessary to understand design in these two closely related --- and sometimes virtually indistinct --- ways. First, design includes the element of production within digital games that players encounter and with which they interact during the course of play. For example, in the Nintendo DS game *Lock's Quest* (5th Cell, 2008), to successfully play the game the player must design and upkeep protective fortifications. Second, previous research suggests that literacies are also developed through participation in online communities (Steinkuehler, 2010), by the re-presenting and recontextualising of information from digital games in the creation of paratexts (Walsh & Apperley, 2008, 2009; Gutierrez & Beavis, 2010), and the process of designing and redesigning games (Buckingham & Burn, 2007; Peppler & Kafai, 2007;

Salen, 2007; Hayes & Games, 2008; Zimmerman, 2009). The first form of design literacy is connected to action, while the

second emphasises multimodal meaning-making and design.

Many recent and contemporary digital games allow players a degree of control over elements of design. Control takes place on two levels: the appearance of the game, and the game system. Aesthetic design choices – for example, the lengthy and detailed avatar design found in recent digital games like *Fallout: New Vegas* (Obsidian Entertainment, 2010) and *Mass Effect 2* (BioWare, 2010) – have no impact on the rules of the game or how the game is played. Even in games like *Grand Theft Auto IV* (Rockstar North, 2008), in which players have no choice over their avatars, forms of player customisation of the avatar are possible because of the availability of clothing and accessory stores. *Grand Theft Auto: San Andreas* (Rockstar North, 2004), with barbershops, gyms, and junk food, is exemplary of this form of player customisation.

Other design decisions act on the game system, and thus may have an impact on the processes and outcomes of digital game play. This is apparent in games – for example, *Grand Theft Auto IV* (Rockstar North, 2008), *Heavy Rain* (Quantic Dream, 2010), *Star Wars: Knights of the Old Republic* (BioWare, 2003) – that are designed to have different narrative outcomes that are based on the actions of the player. For example, in *Dragon Age: Origins* (BioWare, 2009) particular choices taken during the avatar design phase – specifically, the selection of the avatar's race and class, rather than the size of the avatar's chin and nose, which does not change the game system – unlock different subplots within the overarching narrative.

Many digital games allow players to customise areas of the game-world. While activity is central to some popular digital games, like *Minecraft* (Mojang, 2010), *The Sims* (Maxis, 2000-) series, and *WarioWare D.I.Y.* (Intelligent Systems/Nintendo, 2010), it is more commonly included as an optional feature. Often design parameters are limited on consoles (and hand-held devices) in comparison with computers because digital rights are more strictly controlled. Usually, this results in the console game exerting strong and inflexible control over the games' design features (see Sotamaa, 2010b). For example, the Wii game *Boom Blox* (Amblin Entertainment, 2008) allows players to design and distribute maps, but only through the Wii, to other players that also own *Boom Blox*. Computers offer more opportunities for thorough engagement with game design, using software like *Game Star Mechanic* and *Game Maker* (Games & Squire, 2008; Richards & O'Mara, 2012), although similar software, *Microsoft XNA*, is also available on the Xbox live service. Game design is informally learnt/taught through these platforms through a combination of trial and error, the use of paratexts, and the unofficial 'mentorship' of online interest groups.

### *Situations*

The situation of play refers primarily to its context. While emphasis is often given to the virtual elements of play, it is also important to conceptualise the spaces in which digital games are embedded and enacted (Flynn 2003; Taylor, 2006; Stevens et al, 2008). Examining the situation of game play foregrounds the learning and sociality that take place, and how digital gaming is connected with --- and a part of --- other mundane daily activities (Pargman & Jakobsson, 2008; Pelletier, 2008; Apperley, 2010; Gosling & Crawford, 2011). The concept provides scope for practitioners to focus on how pupils' out-of-school literacies are developed through digital gaming without excluding other environmental factors.

When digital games are played, people and technologies are aggregated in many different ways (Apperley, 2010; Steinkuehler, 2006; Taylor, 2009). Accounting for people in this aggregation is not as simple as it seems; while some people are clearly playing, other people are often also – directly or indirectly – involved. Other players may be playing from different locations over a network, as is common with Massive Multiplayer Online Games like *World of Warcraft* (Blizzard Software, 2004); or in the same room, as is more common with console-based multiplayer games like *Mario Kart Wii* (Nintendo, 2008). In other cases a group of people will play, with players taking turns to play and watch the others play while they wait – the *Mario Party* (Nintendo, 1998) series, for example, encourages this type of play (see Newman, 2004).

While many multiplayer games have a strong competitive focus, there is also considerable cooperation between players that can be understood only in the context of the situation. For example, in multiplayer games knowledge and information is shared between players in the process of play through observation – and experience – of new tactics. Similar information can be 'researched' using digital game paratexts and online communities. This knowledge exchange may be facilitated by cooperation, one player looking up instructions on an online FAQ, while giving instructions to another who manipulates the controller; or it may involve a more direct mentorship, as a more experienced player leads another through a difficult part of the game. The process by which players learn from one another is described as the exchange of 'gaming capital' (Consalvo, 2007; Walsh & Apperley, 2008, 2009; Sotamaa, 2010a).

It is from the situated perspective that the ergodic (games-as-action) and textual (games-as text) modes of engagement intertwine and feedback into each other. The three dimensions – action, design and situation – that organise the games-as-action layer of the model intersect with, overlap, and mutually constitute each other.

## Games-as-Text

Bringing a textual approach to bear provides a mode of connecting digital games, and the actions players take within them, to the wider world. Hayes and Gee (2010, p. 67, emphasis added) observe, 'Game literacy is itself multiple, embedded in different practices and fully *socioculturally*

*situated*. Game literacy does not have one effect, but gives rise to different skills, values, and attitudes in different contexts.' The role of the games-as-text layer of the model is to situate digital games in wider contexts: the classroom, students' out-of-school experiences, even world events. The games-as-text layer also fleshes out a spectrum of literacy and learning outcomes that are intimately related to context. Steinkuehler (2006, 2007, 2010) for example, demonstrates how ingame play in massively multiplayer online games develops and relies on a 'constellation' of literacy practices. However, a quite different constellation is required in playing first-person shooter games like *Counter-strike* (Valve, 2000) in an Internet café (Beavis & Charles, 2007) or fantasy sports games such as *AFL Supercoach* (Gutierrez & Beavis, 2010) or fantasy baseball (Halverson & Halverson, 2008). Furthermore, following the New Literacies Studies tradition (e.g. Coiro et al, 2008), this layer of the model explores the role of the multi-modal meaning-making taking place in the digital game text in the formation of values, identity and community.

In order to connect new literacies frameworks for understanding digital and out-of-school literacies with conventional iterations of literacy as presented in state and national curriculum documents, the games-as-text layer maps four foci for study in relation to the model of game play outlined in the games-as-action layer. The games-as-text layer also calls upon and presupposes a '3D' view of literacy (Green, 1999; Durrant & Green, 2000) which 'thinks together' literacy and technology (Green 1999, pp. 42-43) and requires attention to 'cultural', 'critical' and 'operational' dimensions of language use (Green, 1999, p. 43-44) in relation to digital games and game play. The four foci addressed in this layer are:

- Knowledge about games
- The world around the game
- Me' as s game player
- Learning through games.

Each focus traces a trajectory from the immediacy of game play to the world outside the game, providing teachers and practitioners with different segues between the unofficial knowledges of out-of-school literacy practices and the demands of the literacy curriculum. The four foci act as lenses or vectors that reciprocally illuminate --- and are illuminated by --- the model of game play presented in the games-as-action layer. The active experience of play, described in the games-as action layer, is in the model's centre.

## *Knowledge about Games*

While attending to and historicising narrative and aesthetic aspects of digital game play, the key role of the 'knowledge about games' focus is to bring critical literacy perspectives to bear on digital games and game play; to consider digital games as cultural artefacts, and to also consider the aesthetic and technological forms that have emerged. This requires a balanced approach that recognises that digital games are not simply 'remediated' versions of related forms --- film, literature or television --- while still acknowledging the 'family resemblances' between digital games and previous media forms. Crucially, digital games draw on intertextual knowledge to build narratives across forms and platforms; not simply a matter of branding, digital games also pioneered transmedia storytelling --- using more than one medium to deliver a narrative --- as in, for example, *The Matrix* film series and the *Enter the Matrix* (Shiny Entertainment, 2003) digital game (see Jenkins, 2006).

For example, a curriculum that focused on a digital game's narrative structures and features might trace the relation between the game and narratives from other 'texts'; for example, the narrative of the novel *Lord of the Rings* could be compared with the narrative presented in the film trilogy, or in the series of games that accompanied the films *The Fellowship of the Ring*, *The Two Towers*, and *Return of the King*. Using digital games in curriculum in this manner calls on and develops students' multimodal understanding of the characteristics and features of the relevant genre – in this case, fantasy – by examining at how those generic features are used, and to what effect across different mediums. Burn (2005), for example, describes how the 'same' scene from the Harry Potter book, film and digital game – Harry's encounter with the giant spider Aragog – changes across genres, and he discusses children's commentary on the differences they found. He explores such questions as how a particular image or narrative moment 'translates' across different media, what 'character' means in the context of a game, and how the 'verb' differs in the interactive medium of the digital game.

## *'Me' as Game Player*

This focus encourages reflexivity about oneself as a games player, and includes attention to issues of value, ideology and identity, and how players are positioned by the game. Bradford (2010) notes, "When young people play video games they do so as embodied subjects whose identities are shaped by the cultures in which they are situated, the circumstances of their lived experience, and the particularities of their dispositions, abilities and interests" (p.54). This focus centres exploration on students' own involvement with digital games as players, creators and 'readers', with the goal of critical reflection about practices of play. This consideration of play with known and unknown others can springboard into an examination of representations of self and others, of how these representations are constructed and interpreted, through visual means but also through values, voice and competencies as revealed through play.

Topics for exploration include analysis of how the player is positioned by the game, the ways texts seek to draw players into implied subject positions, and how they take up or resist that positioning. Curriculum dealing with this focus asks students to think through how they are positioned in digital

games: how do games like the *Sid Meier's Civilization* (Microprose

Software/Frixais Games, 1990-) series position expansion and development? How is race and gender represented in the game? How are relations with other players framed by the ways that the game allows them to interact? Bradford (2010), for example, describes a ambiguous relationship with her avatar in *World of Warcraft*, characterised by a mix of identification - invited through the second-person form of address with which she is greeted - and pragmatism - given her novice status and relative lack of skill within the game - with which she views her avatar.

*The World around the Game*

The primary concern of this focus is with the broader local and global contexts where game play takes place, and how the world around the game influences play. Areas for study include the exploration of a range of contexts for play, including physical and virtual spaces; public and private settings; settings shared with others or experienced alone; differences in geographic locations and time zones in online gaming; and how context shapes relationships, interactions and play. This focus also underscores contexts and influences such as marketing and globalisation; the place and effect of advertising; and convergence and participatory culture (Jenkins, 2006). Debates with students about media panics --- addiction, 'mind change' (see Metherall, 2011), violence --- can be undertaken within this focus, allowing the exploration of the terms and assumptions underlying much reportage and an evaluation of the basis and evidence for these claims.

Paratexts have a particular bearing in this focus, and may provide practitioners with a useful starting point for curriculum development. Consalvo's (2007; see also Newman, 2008) account of how the players' use of paratexts shapes game play, and how the paratexts designed – or otherwise contributed to – by players themselves reciprocally contribute to other players' experience of the game. Paratexts demonstrate the collaborative processes that take place in game play, and by cataloguing the routes, combinations and tactics available to the players, the complexity and detail of the digital game 'text'.

*Learning through Games*

Studies in this focus are qualitatively different from those in the other three foci, although like all four foci, this focus overlaps with others, with curriculum and pedagogy likely to be spread across a number of areas. This focus is particularly concerned with the capacity of games to teach or impart information through what Bogost (2007) describes as 'procedural rhetoric'. It includes game supported learning in curriculum areas, both through digital games specifically designed for education, and through the use of commercial, off-the-shelf digital games. Attention here is both on the specific curricular knowledge and understandings fostered through particular games, and on developing players' increased awareness of meta-cognitive strategies and processes. An important dimension here is the development of critical perspectives on both games and the social issues and problems they illuminate. Much of the 'serious games' literature and research addresses this area, raising questions about the nature of curricular knowledge; the design features of games that enable specific kinds of understandings; the role of the teacher and the place of reflection in the spaces around games; constructions of learning and the learner; and the learners' relationship with the game.

Curriculum addressing this focus might trace rhetorical strategies across a number of digital games; first, with serious games that put forward a specific agenda, then – building on the recognition that digital games can have agendas – examine the ideological assumptions of commercial off-the-self digital games. Teachers and practitioners could also highlight the different knowledges that quasi-educational games like the *Sid Meier's Civilization* series allow players to engage with. On one level the games provide basic encyclopedia / Wikipedia style entries on various aspects of history from aqueducts to Leonardo's Workshop. However, this is not the only literacy practice being developed, because the game also requires that the players develop a through understanding of the operation of its algorithm. It is in the latter area that teachers and practitioners can make the most useful intervention, as the utility of these literacies is not readily apparent to students, unlike the encyclopedia entries, which can be more readily accommodated into official forms of knowledge, yet are peripheral to the literacies involved in playing –and succeeding in – *Sid Meier's Civilization* series.

## The Model in Combination

In thinking together games and literacy in the way we propose, it is clear that significant commonalities, links and overlaps exist between the two layers of the model. However, each layer also works individually: in both layers the constituent elements or foci are integrally related to each other, so that both within and between the layers the categories we introduce need to be conceived as mutually influential. In any given iteration of the model, foci within and across both layers will interact in varying ways.

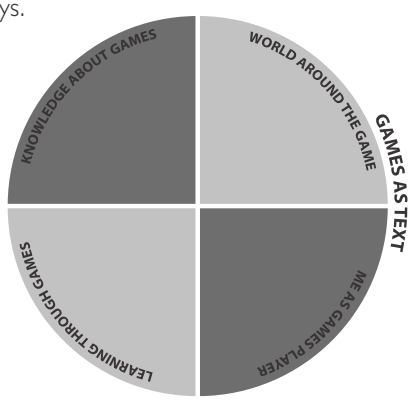



**Figure 2.** Games as text

The model is intended to provide a framework for planning games-based curriculum and pedagogy, and arises from a mapping of characteristic features of digital games and game play. A number of elements are held in common. Key concepts across both layers are context, situatedness, and design. The importance of *context* and purpose in language learning and the role of context in shaping the construction of meaning have long been central tenets of English and literacy curriculum theory, with the view of literacy as socially situated practice well established in New Literacies scholarship, both with respect to older forms of literacy --- reading, speaking, listening and writing --- and in new media and digital culture, including digital games (Gee 2003; Lankshear & Knobel, 2007).

Situatedness also bridges the layers. Gee (2008a) notes that game play, like literacy itself, is primarily a *situated* form of knowledge. When developing literacy practices, students respond to the variance and demands of the particular situation, and situated factors such as their peer group, access to equipment, classroom, and teacher will shape the experience of learning as much as the material which is being learnt. Digital gaming parallels this: the virtual experience of game play is always enacted in a physically situated location that may be characterised by affordances just as much as it is by constraints.

*Design* is a familiar term in the theorisation of multimodal literacy (New London Group, 1996; Kress, 2003). In the proposed model, design embraces several crucial and related meanings and bridges across both levels, related to digital games conceived primarily both in terms of text, and in terms of action. The synthesis provided by Gee (2003, p. 49) between literacy and digital games foregrounds the centrality of design in both fields: '[in playing games,] learning about and coming to appreciate design and design principles is core to the learning experience'. As a term, 'design' is both noun and verb; it describes the relationship between meaning making elements on a screen or page, and action – the process of designing as a creative activity, with multimodal literacy reconceptualised as 'design'.

Yet there are important differences too. Key amongst them is the recognition, in layer one, of those aspects outside a player's control and the active role that is played by the machine, the algorithms and other elements of game play. The games-as-action layer maps the interrelationships in how digital games are played. This guide for developing curriculum mirrors students' out-of school experiences of game play: the games-as-action layer insists strongly that digital games should not be conceived in primarily textual ways; the games-as-text layer differs in its text-based take on digital games, and acts as a template for curriculum planning and pedagogy with digital games within contemporary curriculum guidelines.

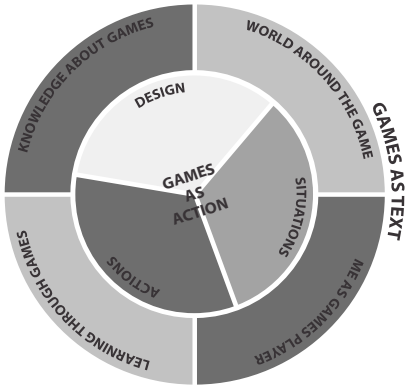



**Figure 3.** The model in combination

It is our view that both layers are essential, and that they speak to each other in multiple ways. Different contexts, classrooms, students and curriculum mandates will result in the model being used to produce classroom activities that both respect those parameters and reflect young people's out-of-school experiences of digital games and game play.

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## References

Aarseth, E. (1997) *Cybertext: perspectives in ergodic literature*. Baltimore, MD: Johns Hopkins University Press.

Alvermann, D. (2008) Why Bother Theorising Adolescents' Online literacies for Classroom Practice and Research?, *Journal of Adolescent and Adult Literacy*, 52(1), 8-19. http://dx.doi.org/10.1598/JAAL.52.1.2

Apperley, T. (2010) *Gaming Rhythms: play and counterplay from the situated to the global*. Amsterdam: Institute of Network Cultures.

Apperley, T. & Beavis, C. (2011) Literacy into Action: digital games as action and text in the English and literacy classroom, *Pedagogies*, 5(2), 130-143.

Atkins, B. (2006) What are We Really Looking at? The Future-orientation of Video Game Play, *Games and Culture*, 1(2), 127-140. http://dx.doi.org/10.1177/1555412006286687

Beavis, C., Apperley, T., Bradford, C., O'Mara, J. & Walsh, C. (2009) Literacy in the Digital Age: learning from computer games, *English in Education*, 43(2), 162-175. http://dx.doi.org/10.1111/j.1754-8845.2009.01035.x

Beavis, C. & Charles, C. (2007) Would the 'Real' Girl Gamer Please Stand up? Gender, LAN Cafes and the Reformulation of the 'Girl' Gamer, *Gender and Education*, 19(6), 691-705. http://dx.doi.org/10.1080/09540250701650615

Bogost, I. (2007) *Persuasive Games: the expressive power of videogames*. Cambridge, MA: MIT Press.

Bradford, C. (2010) Looking for My Corpse: video games and player positioning, *Australian Journal of Language and Literacy*, 33(1), 54-64.

Buckingham, D. & Burn, A. (2007) Game Literacy in Theory and Practice, *Journal of Educational Multimedia and Hypermedia*, 18(3), 323-349.

Burn, A. (2005) Potter-literacy – from Book to Game and Back Again: literature, film, game and cross-media literacy, *Papers: explorations into children's literature*, 14(3), 5-17.

Centre for Educational Research and Innovation (CERI) & Directorate for Education, Organisation for

Economic Co-operation and Development (OECD) (2009) *The New Millennium Learners: main findings*. Paris: CERI/OECD.

Consalvo, M. (2007) *Cheating: gaining advantage in videogames*. Cambridge, MA: MIT Press.

Coiro, J., Knobel, M., Lankshear, C. & Leu, D.J. (2008) Central Issues in New Literacies and New Literacies Research, in J. Coiro, M. Knobel, C. Lankshear & D.J. Leu (Eds) *Handbook Of New Literacies Research*, pp. 1-22. New York: Lawrence Erlbaum Associates.

Durrant, C. & Green, B. (2000) Literacy and the New Technologies in School Education: meeting the l(it)eracy challenge? *Australian Journal of Language and Literacy*, 23(2), 89-108.

Flynn, B. (2003) Geographies of the Digital Hearth, *Information, Communication and Society*, 6(4), 551-576. http://dx.doi.org/10.1080/1369118032000163259

Galloway, A. (2006) *Gaming: essays in algorithmic culture*. Minneapolis: University of Minnesota Press.

Games, I. & Squire, K. (2008) Design Thinking in Gamestar Mechanic: the role of gamer experience on the appropriation of the discourse practices of game designers, *Proceedings of the 8th International Conference for the Learning Sciences*, 257-264. Utrecht: International Society of the Learning Sciences.

Gee, J.P. (2003) *What Video Games Have to Teach Us about Learning and Literacy*. New York: Palgrave Macmillan.

Gee, J.P. (2008a) Learning and Games, in K. Salen (Ed.) *The Ecology of Games: reconnecting youth, games and learning*, pp. 21-40. Cambridge, MA: MIT Press.

Gee, J.P. (2008b) Video Games and Embodiment, *Games and Culture*, 3(3-4), 253-263.Gee, J.P. & Hayes, E.R. (2010) *Women and Gaming: the Sims and 21st century learning.* New York: Palgrave Macmillan. http://dx.doi.org/10.1057/9780230106734

Green, B. (1999) The New Literacy Challenge? *Literacy Learning: secondary thoughts*, 7(1), 36-46.

Gosling, V.K. & Crawford, G. (2011) Game Scenes: theorizing digital game audiences, *Games and Culture*, 6(2), 135-154. http://dx.doi.org/10.1177/1555412010364979

Gutierrez, A. & Beavis, C. (2010) 'Experts on the Field': redefining literacy boundaries, in D. Alvermann (Ed.) *Adolescents' Online Literacies: connecting classrooms, digital media and popular culture*, pp. 145-162. New York: Peter Lang.

Halverson, E. & Halverson, R. (2008) Fantasy Baseball: the case for competitive fandom, *Games and Culture*, 3(3-4), 286-308.

Hayes, E. & Games, I. (2008) Making Computer Games and Design Thinking, *Games and Culture*, 3(3-4), 309-322.

Hayes, E. & Gee, J.P. (2010) No Selling the Genie Lamp: a game-literacy practice in the Sims, *E–Learning and Digital Media*, 7(1), 67-78. http://dx.doi.org/10.2304/elea.2010.7.1.67

Hsu, H. & Wang, S. (2010) Using Gaming Literacies to Cultivate New Literacies, *Simulation & Gaming*, 41(3), 400-417. http://dx.doi.org/10.1177/1046878109355361

Jenkins, H. (2006) *Convergence Culture: where old and new media collide*. New York: New York University Press.

Jewett, C. (2008) Multimodality and Literacy in School Classrooms, *Review of Research in Education*, 32(1), 241-267. http://dx.doi.org/10.3102/0091732X07310586

Kress, G. (2003) *Literacy in the New Media Age*. London: Routledge. http://dx.doi.org/10.4324/9780203164754

Lankshear, C. & Knobel, M. (2007) *A New Literacies Sampler*. New York: Peter Lang.

Metherall, M. (2011) Web Weaves Its Effect on Young Brains, *The Age*, 14 July. http://www.theage.com.au/technology/technology-news/web-weaves-its-effect-on-young-brains-20110713-1hdx9.html (accessed 14 July 2011).

New London Group (1996) A Pedagogy of Multiliteracies: designing social futures, *Harvard Educational Review*, 66(1). http://wwwstatic.kern.org/filer/blogWrite44ManilaWebsite/paul/articles/A_Pedagogy_of_Multiliteracies_Designing_Social_Futures.htm (accessed 25 May 2011).

Newman, J. (2004) *Videogames*. London: Routledge.

Newman, J. (2008) *Playing with Videogames*. London: Routledge.

Office of Educational Technology (2010) *Transforming American Education: learning powered by technology*. Washington, DC: US Department of Education.

Pargman, D. & Jakobsson, P. (2008) Do You Believe in Magic? Computer Games in Everyday Life, *European Journal of Cultural Studies*, 11(2), 225-244. http://dx.doi.org/10.1177/1367549407088335

Pelletier, C. (2008) Gaming in Context: how young people construct their gendered identities in playing and making games, in Y.B. Kafai, C. Heeter, J. Denner & J.Y. Sun (Eds) *Beyond Barbie and Mortal Kombat: new perspectives on gender and gaming*, pp. 145-159. Cambridge, MA: MIT Press.

Peppler, K. & Kafai, Y.B. (2007) What Video Game Making Can Teach Us about Learning and Literacy: alternative pathways into participatory culture, in A. Baba (Ed.) *Situated Play: proceedings of the Third International Conference of the Digital Games Research Association*, pp. 369-376. Tokyo: University of Tokyo.

Richards, J. & O'Mara, J. (2012) A Blank Slate: using game maker to create computer games, in C. Beavis, L. McNeice & J. O'Mara (Eds) *Digital Games: literacy in action*, pp. 57-64. Adelaide: Wakefield Press.

Salen, K. (2007) Gaming Literacies: a game design study in action, *Journal of Educational Multimedia and Hypermedia*, 16(3), 301-322.

Salen, K. (2008) Towards an Ecology of Gaming, in K. Salen (Ed.) *The Ecology of Games: reconnecting youth, games and learning*, pp. 1-17. Cambridge, MA: MIT Press.

Sotamaa, O. (2010a) Achievement Unlocked: rethinking gaming capital, in O. Sotamaa & T. Karppi (Eds) *Gaming as Services: final report*, pp. 73-81. Tampere: University of Tampere.

Sotamaa, O. (2010b) Play, Create, Share? Console Gaming, Player Production and Agency, *Fibreculture Journal*, 16. http://sixteen.fibreculturejournal.org/Play-Create-Share-Console-Gaming-Player-Production-And-agency/ (accessed 2 August 2011).

Steinkuehler, C. (2006) The Mangle of Play, *Games and Culture*, 1(3), 199-213. http://dx.doi.org/10.1177/1555412006290440

Steinkuehler, C. (2007) Massive Multiplayer Online Gaming as a Constellation of Literacy Practices, *eLearning*, 4(3), 297-318. http://dx.doi.org/10.2304/elea.2007.4.3.297

Steinkuehler, C. (2010) Video Games and Digital Literacies. *Journal of Adolescent & Adult Literacy*, 54(1), 61-63. http://dx.doi.org/10.1598/JAAL.54.1.7

Stevens, R., Satwicz, T. & McCarthy, L. (2008) In-game, In-room, In-world: reconnecting videogames to the rest of kids' lives, in K. Salen (Ed.) *The Ecology of Games: reconnecting youth, games and learning*, pp. 41-66. Cambridge, MA: MIT Press.

Taylor, T.L. (2006) *Play Between Worlds: exploring online game culture*. Cambridge, MA: MIT Press.

Taylor, T.L. (2009) The Assemblage of Play, *Games and Culture*, 4(4), 331-339. http://dx.doi.org/10.1177/1555412009343576

Walsh, C.S. (2010) Systems-based Literacy Practices: digital games research, gameplay and design, *Australian Journal of Language and Literacy*, 33(1), 24-40.

Walsh, C. & Apperley, T. (2008) Researching Digital Game Players: gameplay and gaming capital, in Y. Xiao & E. Ten Thij (Eds) *Proceedings of IADIS International Conference Gaming 2008: design for engaging experience and social interaction*, pp. 99-102. Amsterdam: IADIS.

Walsh, C. & Apperley, T. (2009) Gaming Capital: rethinking literacy, in P. Jeffrey (Ed.) *Changing Climates: education for sustainable futures. Proceedings of the 2008 AARE*. Coldstream, Victoria: Australian Association for Research in Education (AARE).

Wardrup-Fruin, N. (2009) Expressive Processing: digital fictions, computer games, and software studies. Cambridge, MA: MIT Press.

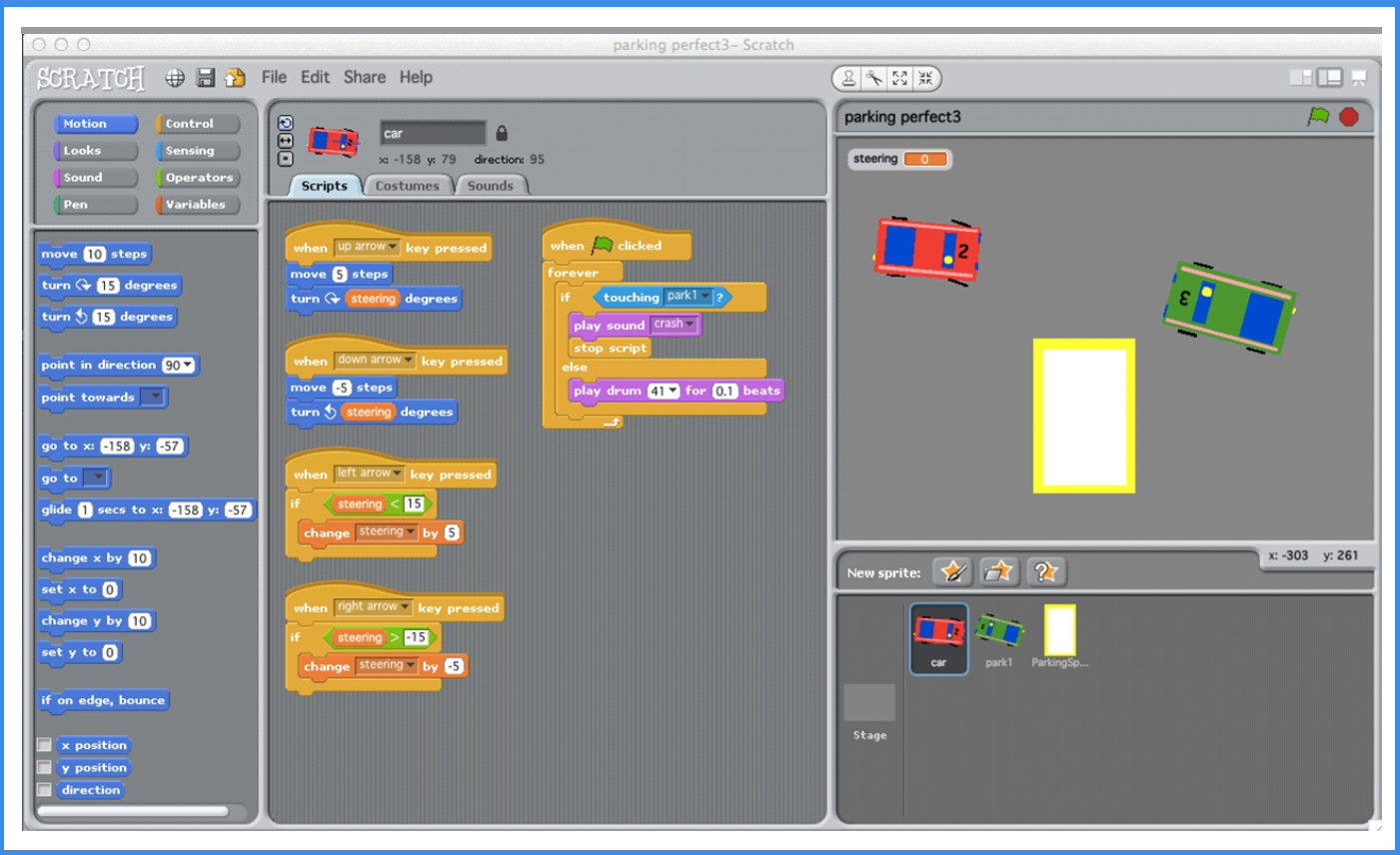
Westbrook, N. (2011) Media Literacy Pedagogy: critical and new/twenty-first-century literacies instruction, *e-Learning and Digital Media*, 8(2), 154-164.

Zimmerman, E. (2009) Gaming Literacy: game design as a model for literacy in the 21st century, in B. Perron & M.J.P. Wolf (Eds) *The Video Game Theory Reader 2*, pp. 23-31. New York: Routledge.

TOM APPERLEY* is a researcher of digital media technologies. His previous writing has covered digital games, mobile phones, digital literacies and pedagogies, and the digital divide. Dr Apperley is currently a research fellow at the University of Melbourne, Australia. He is the editor of the peer reviewed journal *Digital Culture and Education*; his book *Gaming Rhythms: play and counterplay from the situated to the global* was published by the Institute of Network Cultures in 2010. *Correspondence*: thomas.apperley@gmail.com

CATHERINE BEAVIS is Professor of Education at Griffith University. Catherine's research expertise centres on the changing nature of text and the implications for literacy, education and schooling of young people's engagement with digital culture and the online world. She researches in the areas of English curriculum, pedagogy and assessment; digital culture and computer games; digital literacy and new literacies and games-based learning. *Correspondence*: c.beavis@griffith.edu.au

*Contact author




# Programming in Scratch

Roland Gesthuizen
Keysborough College

The journal editors contacted me to provide some programming code. They wanted to pay homage to a bygone era of programming magazines that connected early computer users in Victoria. They were a great source of inspiration with pages of free programming code that teachers or students could use to enter, experiment and learn from. The mysterious lines of code were patiently entered line by line in at home into a treasured TRS-80, ZX81, Atari or similar computer. It was then dutifully debugged until it had successfully executed. For me, this triggered many happy memories of entering machine level programs onto an Apple ][e to build a morse code generator hacked onto a cassette deck whilst using Visical and Wordstar. At the DLTV launch, I shared some wonderful early programming stories and laughs with Maggie Iaquinto, an inspiring fellow teacher and ICT pioneer.

An introduction to teaching of programming concepts can now be covered using just a visual drag and drop interface with programs like scratch. This does not replace the need to engage with cool text based programming languages such as Python, but it does present very young students with an opportunity to engage with concepts such as loops and variables.

Therefore, as a modern twist on sharing some raw code, here is a Scratch program. I use the screenshot at the top of page 55 to kickstart my students thinking after I have challenged them to program a perfect car parking game, deconstruct the code (understand it) and then experiment with it. To recreate this program you will need to download scratch, draw some car objects and assemble the programming elements by dragging and snapping them into place. It isn't intuitive but it is HOT (Higher Order Thinking) fun.

I don't explain what is happening, give them this solution or reveal the need for a loop or variable. Instead I prompt everybody through the activity with questions such as "How does a car behave when you turn a steering wheel?" or later "Why is there an orange steering variable in the forward or backward movement script?".

When they finally understand the script I present them with some new challenges such as how could you modify this program to include:

- a "collision" event with a green car.
- a "win" when it has successfully parked onto the target square.
- different levels and new challenges.

When they are pleased with their solution, encourage your students to document their learning and share the love by publishing the source code online. Invite them to try the Hour of Code or Grok challenges. We salute those days of past and look forward to the next. After all, it was this culture of collaboration and learning that helped to build the world we live in today.

**Links**

http://code.org
Http://scratch.mit.edu.au
http://technologizer.com/2008/11/20/the-twelve-greatest-defunct-tech-magazines-ever

# Introduction to the educational gamification market

Thomas Bierly
MEd student, Monash University, Australia

The number of products promising improved learning outcomes through the use of gamification or game mechanics is increasing at a significant rate. Despite the rapid market growth, the demand still exceeds the supply. As the gamification market matures, many products available today will not survive. Learning professionals need to arm themselves with a means of evaluating the potential gamification products. This paper aims to explore common concepts of gamification in an attempt to introduce and enhance educators understanding so that effective education solutions are selected.

## The gamification market

Digital gaming is quickly becoming a quintessential part of Australian life. In 2012, Australians spent over $1.161 billion on retail games (Curry, 2013). Add to that staggering amount another $620 million in digital game subscriptions; a figure that is expected to grow to $730 million in 2013 (Curry, 2013). It is estimated the gaming industry will see global revenues grow to $70.4 billion in 2013, up 6% from 2012 (Warman, 2013). While the main goal of these games is entertainment, people are finding their functions applicable in every day life. Digital games are quickly becoming a pervasive force, impacting many industries such as: defence, science, health care, emergency management, city planning, engineering, and politics; certainly, education is no exception (Muntean, 2011).

Jane McGonigal (2011) argues that by the time students are 21 years old, they will have spent over 10,000 hours playing games, which is comparable to the same amount of time they will have spent in school. To engage and motivate this new generation of students, educators will need to gamify their instruction. The effective use of games to educate students on traditional subjects such as math, literacy, and science, is a plausible theory as they are all bound by rules and set structures (Gee, 2007). Mastering a digital game is a learning process in and of itself. The players are faced with challenges that require them to increase in skill level and knowledge as they progress through the storyline towards achieving their goals (Gee, 2007; Prensky, 2002).

This application of game mechanics outside of traditional game boundaries is often referred to as 'gamification', though the explicit definition of this term is highly debated in academic circles (Deterding, Dixon, Khaled, & Nacke, 2011; Deterding, Khaled, Nacke, & Dixon, 2011). In an attempt to further define the word, many scholars draw a dichotomous distinction between serious, or educational, games and gamification (Groh, 2012). Though such distinctions have their merits, it may only serve to obfuscate potential uses of gamification for educators new to the concept and unintentionally lead to less effective learning outcomes (Kapp, 2012). For the purposes of this article, Karl Kapp's definition of gamification will be used. Kapp (2012, pp. 15-16) defines gamification as "a careful and considered application of game thinking to solving problems and encouraging learning using all the elements of games that are appropriate."

Despite the infancy of the concept, gamification has spread like wildfire; educators are scrambling to adopt gamification within their respective institutions. As a result, market demand for gamification rocketed from 155% in 2011 to 197% in 2012 (Rauch, 2013). Gartner's hype cycle shows gamification at the peak of inflated expectations, see Figure 1 (Rivera & Meulen, 2013). This position on the hype cycle denotes a number of high profile publications alluding to success stories while often overshadowing many less successful attempts. As Gamification travels along the hype cycle into the trough of disillusionment many products, and companies, will fail to survive in the market. As these success factors of the remaining products become more concrete and better understood, gamification will climb through the slope of enlightenment and into the plateau of productivity. Typically, products have to evolve many times so only second and third generation products survive to see the end of the hype cycle.

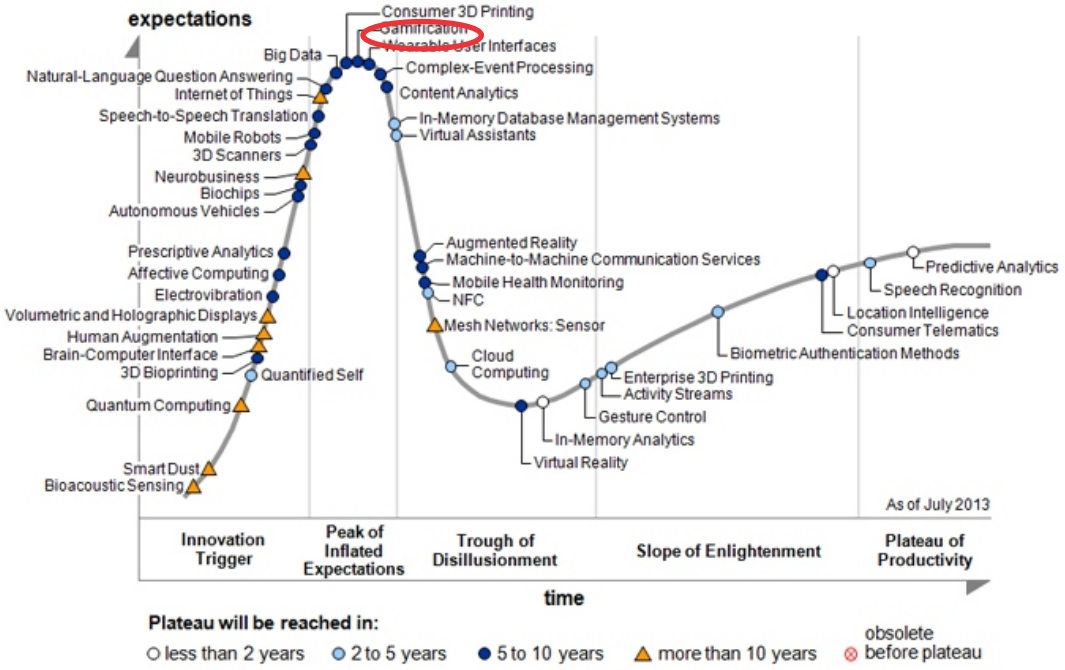



*Figure 1*. Gamification at the peak of inflated expectations on the *Gartner Hype Cycle for Emerging Technologies*, 2013. Adapted from "Gartner's 2013 Hype Cycle for Emerging Technologies Maps Out Evolving Relationship Between Humans and Machines," by J. Rivera, and R. Meulen, 2013. Copyright Gartner, Inc. Retrieved 22 Aug, 2013, from http://www.gartner.com/newsroom/id/2575515.

The fusillade of demand has led to an onslaught of educational products claiming to gamify a plethora of activities (Duggan & Shoup, 2013; Rauch, 2013). Companies are increasingly seeking to profit from the new gamification market. Many products are sold that simply tally points and award badges. Though these characteristics are included in most games, they are not what make them so successful; they are merely the cheapest and easiest elements to include.

## Education Is Already Gamified

Lee and Hammer (2011) made an interesting point when they suggested badges are already an intrinsic component of our classrooms. Teachers award points for completing assignments; over the course of the semester these points add up and get converted into badges (commonly referred to as grades); at the end of the academic year students who collected the right badges get to level up. By awarding these points educators attempt to extrinsically motivate students to perform. Unfortunately, the standardised testing mechanics often used to award points requires strict adherence to assessment criteria, often only allowing one opportunity to acquire the needed points to progress. This, according to Bartels (2013), dissuades students from engaging in critical consideration, enquiry, and experimentation. In an area purposed to expand knowledge and encourage innovation, little opportunity to do so is presented. Gamified learning environments, on the other hand, are tolerant of failure and, often times, allow for repeated failure. After each failure, students are able to learn something new and try again. This reframes the role of failure in education from a negative experience, presenting it instead as a valuable, positive, and perhaps even necessary experience.

## Enhancing Gamification in Education

The goal of gamification is not just too extrinsically motivate students by bribing them with badges, but to immerse the students in an authentic learning experience. Quality products will engage students with rich and authentic storylines, challenge the participant, encourage the learner to explore their curiosity, empower them to make decisions and feel a sense of accomplishment.

Skinner and Belmont (1993) propose engaged learners are very motivated as they, "select tasks at the border of their competencies, initiate action when given the opportunity, and exert intense effort and concentration in the implementation of learning tasks; they show generally positive emotions during ongoing action, including enthusiasm, optimism, curiosity, and interest." These characteristics are in essence what many educators wish to see from their students. Gamification provides the necessary motivation to engage students in their learning (Muntean, 2011).

Many scholars have characterised criterion of various gamified initiatives which have proven to be successful. Perhaps two of the most influential studies on motivation, pertaining to the study of gamification today, are Malone and Lepper's (1987) intrinsic motivation taxonomy and Csikszentmihalyi's (1979) flow framework. Malone and Lepper's (1987) intrinsic motivation taxonomy outlined seven key components of learner engagement: challenge, curiosity, fantasy, control, recognition, competition, and cooperation. Csikszentmihalyi (1979) defined flow as a process, "so gratifying that people are willing to do it for its own sake, with little concern for what they will get out of it, even when it is difficult or dangerous." Sweetser and Wyeth (2005) built upon the flow framework, developing what they referred to as the Game Flow model. Their model contains eight components for player engagement: control, concentration, challenge, clear goals, feedback, immersion, mechanics, and social interaction.

Of course, many other notable scholars have contributed lists of gamification characteristics as well (Garris, Ahlers, & Driskell, 2002; Yee, 2006). Bostan (2009) attempted to review some of them and found a general lack of consensus and expressed concern for the proliferation of terms and resulting complexity stemming from similar, overlapping, or alternative definitions.

A framework for understanding components of gamification

When Charles, Bustard, and Black (2011) reviewed the literature, they noted forty commonly cited characteristics. They systematically worked through the list to reduce that number to 18 key characteristics, which they grouped to create six components of gamification. Charles et al. (2011) referred to the groupings as the Game-Enhanced Learning (GEL) framework, see Figure 2. It should be noted that there are other frameworks which may prove more valuable depending on one's specific contexts and narrow objectives. However, as someone new to the concept of gamification or in instances where contextual specificity is not known or is deemed too limiting, this generalist framework should prove useful in evaluating or developing a gamified product.

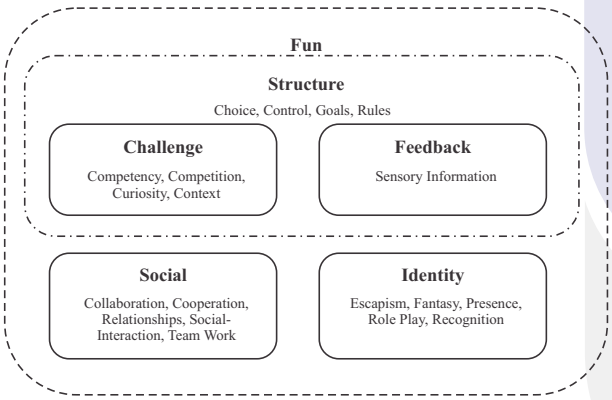



*Figure 1*. Gamification at the peak of inflated expectations on the *Gartner Hype Cycle for Emerging Technologies*, 2013. Adapted from "Gartner's 2013 Hype Cycle for Emerging Technologies Maps Out Evolving Relationship Between Humans and Machines," by J. Rivera, and R. Meulen, 2013. Copyright Gartner, Inc. Retrieved 22 Aug, 2013, from http://www.gartner.com/newsroom/id/ 2575515.

The first and arguably the most important component of the GEL framework is ***fun***. Bisson and Luckner (1996) cite several studies and conclude there is a strong correlation between fun and learning. Though definitions for 'fun' are varied and often contradictory (Prensky, 2002), Bisson and Luckner argue that in order for learning to be fun it must be relative, situational, voluntary, and natural. In part, to be fun, the learner must opt into the experience with no perceived negative impacts resulting from their participation, as opposed to being forced to partake. Bisson and Luckner (1996, pp. 109-110) write, "Enjoyment and fun as part of the learning process are important when learning new tools since the learner is relaxed and motivated and therefore more willing to learn… The role that fun plays with regard to intrinsic motivation in education is twofold. First, intrinsic motivation promotes the desire for recurrence of the experience… Secondly, fun can motivate learners to engage themselves in activities with which they have little or no previous experience."

The products ***structure*** provides the scaffolding through which points can be acquired. It sets clear and understandable rules for participants to follow. Achievable goals are established, and participants are given choices regarding which actions to take and control over their progression of the game. Within the gamified structure participants are presented a ***challenge*** through various activities with varying degrees of difficulty. These challenges should spark the students' curiosity and provide an authentic context for the learning to occur in. In order for participants to endure and overcome the challenges, timely and actionable ***feedback*** is required. Challenge and feedback are paired sub-components of structure; that is, without one the other will not achieve its goals (Charles et al., 2011). Without adequate challenges, participants may struggle to maintain engagement; but if the challenge should prove to be too great without feedback to assist the participant, their engagement will likewise suffer and they may not successfully complete the experience.

Ideally, ***social*** components should encourage students of differing abilities to cooperate and collaborate to achieve their individual and collective goals. Creating an individual or team ***identity*** enables the participants to explore their personal development and imagine a better or different future state through fantasy or role play. Landers and Callan (2011) argue that when identity is paired with the social component, for example badges publicly displayed on a social network, it can result in educational mechanisms to assist, encourage, recognise, and reward participants for their efforts. This may also simultaneously create a degree of competitiveness amongst participants as they rank themselves against one another, which may further contribute to their engagement. To reiterate an earlier theme in this article regarding the over emphasis of badges in gamification, Charles et al. (2011, p. 428) state that social and identity are, "not main factors in gameplay" but insist they do have a place in learning.

## Conclusion

The gaming industry is growing at a rapid rate, with new forays into the education arena. Though games have long been considered a source of entertainment, through the lens of gamification they can now be seen as a means of engaging students to acquire and develop a deeper understanding of academic subjects. The market, at this moment, is turbulent and fraught with products and companies making claims and promises that will not likely pan out in the long run. Through the use of the Game-Enhanced Learning framework, educators can better evaluate the plethora of products at their disposal. By engaging students with a fun and authentic experience, that challenges the participant to take control and explore their understandings, while providing meaningful feedback to aid the learning process, in a social and collaborative way, educators will see students excited and motivated to learn.

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## References

Bartels, D. M. (2013). What is your question? Cultivating critical thinking skills in informal learning environments. *Scientific American, 308*(3), 12.

Bisson, C., & Luckner, J. (1996). Fun in Learning: The Pedagogical Role of Fun in Adventure Education. Perspectives. Journal of Experiential Education, 19(2), 108-120.

Bostan, B. (2009). Player motivations: A psychological perspective. Computers in Entertainment, 7(2), 22.

Charles, T., Bustard, D., & Black, M. (2011). Experiences of promoting student engagement through game-enhanced learning Serious Games and Edutainment Applications (pp. 425-445). London: Springer.

Csikszentmihalyi, M., & Nakamura, J. (1979). The concept of flow. Play and learning, 257-274.

Curry, R. (2013, 13 Feb). Australian video games industry records $1.161 billion sales in 2012. Retrieved 22 Aug, 2013, from http://www.igea.net/2013/02/australian-video-games-industry-records-1-161-billion-sales-in-2012/

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining "gamification". Paper presented at the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, Tampere, Finland.

Deterding, S., Khaled, R., Nacke, L. E., & Dixon, D. (2011). Gamification: Toward a definition. Paper presented at the CHI 2011 Gamification Workshop.

Duggan, K., & Shoup, K. (2013). Business Gamification for Dummies. Hoboken, NJ: John Wiley & Sons, Inc.

Garris, R., Ahlers, R., & Driskell, J. (2002). Games, motivation, and learning: A research and practice model. Simulation & gaming, 33(4), 441-467.

Gee, J. (2007). Good Video Games Plus Good Learning. New York: Peter Lang Publishing.

Groh, F. (2012). Gamification: State of the art definition and utilization. Paper presented at the 4th Seminar on Research Trends in Media Informatics.

Kapp, K. M. (2012). The gamification of learning and instruction game-based methods and strategies for training and education. San Francisco: Pfeiffer.

Landers, R., & Callan, R. (2011). Casual social games as serious games: The psychology of gamification in undergraduate education and employee training Serious Games and Edutainment Applications (pp. 399-423). London: Springer.

Lee, J. J., & Hammer, J. (2011). Gamification in education: What, how, why bother? Academic Exchange Quarterly, 15(2), 146.

Malone, T., & Lepper, M. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. Aptitude, learning, and instruction, 3, 223-253.

McGonigal, J. (2011). Reality is broken : why games make us better and how they can change the world. New York, NY: Penguin Press.

Muntean, C. I. (2011). Raising engagement in e-learning through gamification. Paper presented at the Proc. 6th International Conference on Virtual Learning.

Prensky, M. (2002). The motivation of gameplay: The real twenty-first century learning revolution. On the horizon, 10(1), 5-11.

Rauch, M. (2013). Best Practices for Using Enterprise Gamification to Engage Employees and Customers. Paper presented at the 15th International Conference on Human-Computer Interaction, Las Vegas, NV.

Rivera, J., & Meulen, R. (2013). Gartner's 2013 Hype Cycle for Emerging Technologies Maps Out Evolving Relationship Between Humans and Machines. Retrieved 22 Aug, 2013, from http://www.gartner.com/newsroom/id/2575515

Skinner, E., & Belmont, M. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. Journal of educational psychology, 85(4), 571.

Sweetser, P., & Wyeth, P. (2005). GameFlow: a model for evaluating player enjoyment in games. Computers in Entertainment, 3(3).

Warman, P. (2013). Newzoo Announces New Report: Global Games Market to Grow 6% to $70.4bn in 2013. Retrieved 22 Aug, 2013, from http://www.newzoo.com/press-releases/newzoo-announces-new-report-and-projects-global-games-market-to-grow-6-to-70-4bn-in-2013/

Yee, N. (2006). Motivations for play in online games. CyberPsychology & Behavior, 9(6), 772-775.

# Game-Based Learning and the Australian Curriculum

Luke Skehan
MEd student, Monash University, Australia

Game-based learning (GBL) is a method of learning and teaching that is currently in the process of development and implementation in educational contexts across the world. It combines the readiness to utilise games, either educational or commercial in nature, in the classroom, with a developing theory of learning drawing upon the work of educational psychologists, most notably Csikszentmihalyi and his idea of Flow Theory. While the use of games or play in education has been acknowledged and promoted for some time (Piaget, 1962; Vygotsky, 1978), the value of GBL in formal secondary school and Higher Education settings has only recently emerged (Johnson, Smith, Willis, Levin, & Haywood, 2011).

## GBL in Theory: Towards an Educational Model

The last decade has produced a wealth of research and writing in the field of GBL (for example, see: Chee, 2001, 2007; Gee, 2008, 2009; Gee and Morgridge, 2007; Klopfer, Osterwell, & Salen, 2009 ; Squire, 2005, 2006; Steinkuehler, 2008). One of the main preoccupations of GBL academic literature is with meta-cognitive opportunities presented by quality games, and in the development of an educational model that supports experiential, knowledge rich learning environments (Chee, 2007).

*Immersive Engagement & Ideal Learning Experiences*

A strength of GBL is that it is an engaging and fun way for the creation of learning environments and experiences (Whitton, 2011). The work of psychologist Csikszentmihalyi (1992), in particular his work on Flow Theory is used to explain the success GBL has in engaging individuals in meaningful learning experiences. According to Csikszentmihalyi (1992) the factors contributing to flow include:

1. a challenge that requires skill to achieve, with an attainable goal and known rules
2. complete absorption in the activity
3. clear goals
4. immediate feedback
5. concentration on the task at hand
6. a sense of control, lacking the sense of worry about losing control
7. loss of self-consciousness
8. transformation of time

Academics investigating GBL have, with certain reservations, adopted this list as a useful way of explaining GBL processes (Gee & Morgridge, 2007; Whitton, 2011). The factors contributing to 'Flow' are recognisable components of many

video games of different genres, be they role playing games (RPGs), first person shoot 'em ups, sports simulations or strategy games. The links between 'Flow' theory and gaming has led to interest among educationalists looking to engage so-called 'millenials', for whom games are the medium of choice (Squire & Steinkuehler, 2005).

*The Nature of Knowledge in GBL*

Knowledge that is provided 'just in time' or 'on demand' is a feature of GBL (Gee & Morgridge, 2007). This allows for the principal of 'performance before competence', a game version of doing as learning. Knowledge essential to the playing of the game, or understanding of the game's logic, is presented to players in context, rather than as disembodied information. Through linking the acquisition of knowledge to experience, a core component of constructivist educational theory, students are able to value knowledge according to its use in achieving goals, rather than just for the sake of knowledge.

*Identity Construction*

Chee (2007) argues that identity construction is co-constitutive with academic, content based learning. This supports the view that knowledge creates identity, and informs the student of his/her place in the world. When dealing with online gaming environments, Chee (2001) finds the experiential world of gaming as conducive to collaborative learning whereby the individual is forced to consider identity as singular and plural in nature. GBL, through providing students with various positions to come to terms with, whether in opposition to or adoptive of, situates the acquisition of knowledge as an identity shaping process.

## GBL in Practice

While theoretical and pedagogical support exists for GBL, practical barriers to the adoption of GBL within the classroom must be acknowledged. This section will look at these barriers, along with two GBL case studies that highlight the need for further consideration of practical concerns in introducing GBL into Australian secondary classrooms.

*Barriers to Adoption*

The report 'Moving Learning Games Forward: Obstacles, Opportunities & Openness' seeks to establish what GBL best practice might look like (Klopfer, Osterwell, & Salen, 2009). The three barriers Klopfer et al. (2009) raises with a direct bearing on this paper are:

1. Curriculum Requirements
2. Scope for Standardised Assessment
3. Limited Pedagogical Paradigms

Educational games are limited to delivering and assessing subject specific content, and are constructed with little regard to the pedagogical possibilities of GBL, while commercial off the shelf (COTS) games produce learning rich environments without the academic rigour demanded by curriculum and assessment authorities (Klopfer et al., 2009). While GBL theory claims that meaningful learning can and does occur within games, the type of learning (meta-thematic rather than subject content specific), and the measurement of student knowledge and skill achievement (game goal based rather than through traditional methods of test, assignment, etc.) leaves GBL seemingly at odds with prevailing educational assessment practice.

## Contextualising GBL: *Sid Meier's Civilizations V* and the Australian Curriculum

*Sid Meier's Civilizations V* is the latest title in the popular Civilization franchise ("Sid Meier's Civilizations V," 2010). It is a turn-based strategy game, where the gamer takes control of a civilization (there are eighteen to choose from, from Egyptian to Ottoman to Mongolian) in an attempt to win the game by creating the most successful civilization over a period reflecting 7,500 years of history.

A player may achieve victory in one of four ways; through a scientific victory, signified by being the first civilization to launch a rocket into space; a cultural victory, achieved by building the UN and gaining a winning number of votes from fellow civilizations and city-states; a military victory, achieved through defeating all other players and controlling their territories; or by having the most amount of points when the end of the game, set at the year 2050, is reached and no one civilization has achieved victory through other means.

This section explores ways to use *Sid Meier's Civilizations V* within an Australian secondary classroom. It proposes that computer games be used as a text for learning and, using the Australian Curriculum for History as a curriculum and assessment guide, suggests three ways in which the text *Sid Meier's Civilizations V* can be used for, of and as assessment.

*Overview of the Australian Curriculum for History: Year 7 and Year 8*

The Australian Curriculum, created by the Australian Curriculum, Assessment and Reporting Authority (ACARA), is the first attempt to unify the educational goals of Australian students, regardless of which state they live in. This paper is limited to a view of the Australian Curriculum at Year 7 and Year 8 levels. These levels were chosen as the most appropriate content wise, and also to focus the assessment task.

The Australian Curriculum for History provides broad inquiry questions at each level. For Year 7 the broad inquiry questions are:

- what is history?
- what are the defining characteristics of societies?
- how did people live in other times and other places?
- who should rule in a society?

For Year 8 the broad inquiry questions are:

- how do beliefs and values influence people's way of life?
- how do societies interact?
- why do societies change?

During these two years the areas of study cover the ancient and medieval worlds, from 60,000 BCE to 1750 CE. The Content Descriptors in History are divided between Knowledge and Understanding, and Skills. The Knowledge and Understanding descriptors at both Year 7 and Year 8 levels make explicit the need to address the nature of History, and the need to provide a chronological overview of key events and eras.

The Skills descriptors at both year levels are grouped in four categories; historical questions and research, analysis and use of sources, perspectives and interpretations, and comprehension and communication.

For a full overview of the descriptors for History at a Year 7 and Year 8 level, please see:

http://www.australiancurriculum.edu.au/History/curriculum/F-10

*Game as Text*

Non-academic texts, such as novels, plays, music, graphic novels, and other cultural artifacts, have come to occupy a legitimate space in formal school curriculum through the use and consensus of teaching professionals. An important step in the adoption of games as a legitimate learning resource is to view it as text. Once this conceptual leap is made, stakeholder anxiety is manageable, and community attitudes towards GBL can abandon uninformed rhetoric as the resource is normalized. It is important to note that in the Australian Curriculum documents published thus far, no prescriptions or limitations, nor even suggestions, on the media of texts is made. Therefore, the use of a strategy game such as *Sid Meier's Civilizations V* as a document through which to explore historical concepts is wholly within the guidelines and spirit of the Australian Curriculum. As the document states, "students' interest and enjoyment of history should be enhanced through a range of different approaches" ("The Australian Curriculum: History Foundation to Year 10 Curriculum,").

Clearly, at a textual level *Sid Meier's Civilizations V* has links with content covered by the Australian Curriculum. The game spans the entirety of human history, uses historical terms such as Medieval, Renaissance and Industrial Age to segment time, uses a dynamic relationship between city and countryside, and highlights the importance of political, social, technological and cultural factors for change and continuity within civilizations.

Possible assessment tasks using *Sid Meier's Civilizations V* as a textual resource include *playing* the game, *discoursing* the game, and *modding* the game. By using summative and formative assessment teachers are better able to create an enriched learning environment for the student. The following GBL tasks do not supersede the academic essay, or student presentation, as the sole, or major, assessment of learning. For those teachers unfamiliar with GBL, it may be instructive to use the following tasks as assessment for learning, as a reflective process contributing to the development of student skills, knowledge and understanding, supplemented by traditional methods of assessment. In designing GBL tasks, it is important to keep these thoughts in mind.

*Playing the Game*

In *Sid Meier's Civilizations V* a host of advisors, addressing economic, military, foreign and science concerns, provide players with 'just in time' knowledge to help navigate new players through early and key decision making processes, without disrupting the flow of the game with verbose direction. It is worth noting, that the advice given need not be followed, unlike traditional understandings of teacher direction in the classroom (Klopfer et al., 2009). *Sid Meier's Civilizations V* cannot claim to be an historians game, in that it does not require the gamer to demonstrate a historian's skill set or expertise in order to achieve victory. What it does do, however, is situate knowledge within a historical narrative. As Gee and Morgridge (2007) observe, "*Know* … is a verb before it is a noun, as in *knowledge*". Through gameplay, students come to understand basic historical concepts, such as how technological advancement may lead to increased economic productivity, or provide a military edge over less technologically advanced opponents. In this, gaming aligns with the Australian Curriculum guidelines that "historical narrative should be used so that students experience the 'story' in the history" ("The Australian Curriculum: History Foundation to Year 10 Curriculum,").

Gee and Morgridge (2007) note that "games encourage players to think about relationships—not isolated events—facts, and skills" (p.1029). In *Sid Meier's Civilizations V*, the player must interact with a number of other civilizations and city-states in relationships that fluctuate between friendly, neutral, guarded and at war. The nature of these relationships are determined by a composite of factors, including competition for land and resources, respective military strength, fear of a third party, or the 'personality' of the computer controlled civilizations. A consequence of this design is that player choices on social policy, technological advancement, the location of cities, the style of victory being pursued, even the choice of unit production, must take domestic concerns as well as international relations into account. In doing so, students refer to other, traditional media, such as maps, historical primary and secondary sources, and Civilization's own Civilopedia, to inform their gameplay. When it comes to bringing knowledge to bear in gameplay, students "don't memorize facts; they mobilize information to solve game-related problems" (Squire & Jenkins, 2003, p.14).

Playing the game *Sid Meier's Civilizations V*, much like reading a class novel, or watching a film, is an opportunity for informal

assessment. Students at this stage are engaging with the text, and the teacher can impose imbedded tasks (establish three cities, wage war, enter into diplomatic relations with another civilization, enter the Medieval period) which players must achieve, and/or ask students to make more academic responses, as covered in the next section, 'Discoursing the Game'.

*Discoursing the Game*

Gee (2008) has written of the cultural production surrounding games, labelling the project one of creating Discourse. There are various portals for Discourse for the Civilizations series of games, from official fan sites hosted by Firaxis and Aspire, the creators of the series ("Sid Meier's Civilization V,"), to fan sites created, hosted and curatored by fans ("Civilization Fanatics Center,"). These sites serve numerous functions, including providing reviews, mods, FAQs, game information and forums. These 'Affinity Spaces' are environments where learning is enabled and knowledge is demonstrated, where individuals collaborate on a shared object of interest. Unlike a traditional classroom environment, participants are not compelled to attend the space, and are free to produce, amend, respond to, or access knowledge as they see fit. Gee (2009) has identified 11 key attributes of 'Affinity Spaces' that foster learning in a non-traditional way.[1]

For the teacher, implementing 'Affinity Spaces' within the class can be an attractive yet daunting idea. Certain parallels can be drawn between 'Affinity Spaces' and the developing practice of class blogs, whereby a culture of student collaboration, publication and reflection is cultivated. In asking students to use *Sid Meier's Civilizations V* to contribute to a digital portfolio, or as part of a collaborative or reflective piece on the nature of history or civilization, teachers are able to fuse new pedagogy with mandated curriculum and assessment. Closed questions (What constitutes each historical Age? What constitutes each Social Policy? What are the particular strengths and weaknesses of different civilizations? ) and higher order questions (How does *Sid Meier's Civilizations V* create a narrative of History? Does *Sid Meier's Civilizations V* define what a good or bad society might look like? Would you like to live in your civilization and why?) can be used to engage students.

*Modding the Game*

Modding computer programs, creating what is known as Mods, occurs when a gamer modifies the files of a COTS game, creating new levels, characters, weapons, or introducing new material into an established game. Mods may entail minor adjustments to COTS games, or the creation of entirely new games. Mods may be seen as the artistic and technical realisation of an "open source, code sharing culture, where the urge to access, create and share information is both the means and the end to cultural capital (Morris, 2003, p.2). While first and predominately an amateur pursuit, Mods are increasingly seen by commercial game developers as a legitimate and worthy source of creativity and capital (Park, 2007). Mods for *Sid Meier's Civilizations V* published on the Steam site include an Australian civilization, a Cold War scenario, a mod that creates a zombie apocalypse, and a Nazi German.[2]

The existence of Mods for *Sid Meier's Civilizations V* provide students with several valuable lessons, supported by the ideology of the Australian Curriculum. Firstly, history is an interpretive practice, encompassing many differing viewpoints. Mods exist as a critique of the 'official' history narrative presented by *Sid Meier's Civilizations V*. For example, Mods call into question the idea of which historical civilizations are worthy of representation, and, through modifications to unit and building specifications, challenge the value of different elements in determining society. Secondly, history is a social practice. Mods are created for consumption by the gaming community in the same manner that historians create histories for a mass audience. Both practices construct artefacts providing meaning and narrative for cultural consumption.

In addition to using Mods as a tool for constructing knowledge, they can also be used for summative assessment. Assessment of student created Mods will vary, however the criteria does not have to differ from a traditional project demonstrating knowledge of a particular place, time, peoples or event. Creating a mod engages in the GBL practice of Identity Construction (Chee, 2007), and mastery of New Literacies (Steinkuehler, 2008), along with content proscribed by the Australian Curriculum (See Appendix D: Student Mods and the Australian Curriculum.)

As well as exploring other Mods, and commenting on their meaning as a response to an historical text, *Sid Meier's Civilizations V*,[3] there is also the opportunity for students to create their own mods. The feasibility of such a project depends on a number of factors, including but not limited to:

- time and resources
- student familiarity with *Sid Meier's Civilizations V*
- student familiarity with the process and goals of modding

Mods created by students can take form in any number of ways.

[1]These attributes are; Common endeavor, not race, class, gender, or disability, is primary; Newbies and masters and everyone else share common space; Some portals are strong generators; Content organization is transformed by interactional organization; Encourages intensive and extensive knowledge; Encourages individual and distributed knowledge; Encourages dispersed knowledge; Uses and honors tacit knowledge; Many different forms and routes to participation; Lots of different routes to status, and; Leadership is porous and leaders are resources (Gee, 2009).

[2]For a discussion on the morality of adopting a criminal point of view in gaming, see Gee and Morgridge's discussion of the game Full Spectrum Warrior in 'Being a Soldier and Being a Lion: Learning and Games' (2007, p.1036).

[3]In Mod culture, the official version of a game is referred to as 'vanilla', as in a base flavour that has not been tampered with. It also implies that the original game is boring, and needs flavouring, ie through modding.

Possible mods include:

- create story boards for new civilizations and new scenarios
- creating new civilization, for example Australia, Victoria, the school, or other society of interest
- adjusting an existing civilization
- creating scenarios (for example, the colonisation of Australia, the Crusades, a world where the polar ice-caps have melted)

## Conclusion

GBL has a place within Australian secondary History classrooms, and through incremental exposure to the use of games as texts, teachers and education institutions will be willing and able to pursue GBL in accordance with curriculum and assessment guidelines. Educational professionals must commit themselves to creating best practice learning environments, where students are encouraged to learn in a variety of ways, and demonstrate their knowledge through summative and formative assessment. Leading teachers and academics have an important role to play in providing teachers and educational institutions with theory addressing the link between GBL and curriculum and assessment requirements, in order to promote best practice learning, and to legitimise GBL in the eyes of educational institutions and society at large.

## References


Anderson, T., Varnhagen, S., & Campbell, K. (1998). Faculty Adoption of Teaching and Learning Technologies: Constrating Earlier Adopters and Mainstream Faculty. *The Canadian Journal of Higher Education, 28*(2,3), 71 - 98.

*The Australian Curriculum: History Foundation to Year 10 Curriculum*. Retrieved 20 Spetember 2012, from http://www.australiancurriculum.edu.au/History/Curriculum/F-10

Chee, Y. S. (2007). Embodiment, Embeddedness, and Experience: Game-based Learning and the Construction of Identity. *Research and Practice in Technology Enhanced Learning, 2*(1), 3-30.

*Civilization Fanatics Center* . Retrieved 20 September 2012, from http://www.civfanatics.com/

Gardner, H. (1987). The theory of multiple intelligences. *Annals of Dyslexia, 37*(1), 19-35. doi: 10.1007/bf02648057

Gee, J. P. (2006). Why Game Studies Now? Video Games: A New Art Form. *Games & Culture, 1*(1), 1-4.

Gee, J. P. (2009). Affinity Spaces: From Age of Mythology to Today's Schools.

Gee, J. P., & Morgridge, T. (2007). Being a Lion and Being a Soldier.

*Global Conflicts*. (2012) Retrieved 21 September 2012, from http://www.globalconflicts.eu/teachermaterial

Johnson, L., Smith, R., Willis, H., Levin, A., & Haywood, K. (2011). The 2011 Horizon Report. Austin, Texas.

Klopfer, E., Osterwell, S., & Salen, K. (2009). Moving Learning Games Forward: Obstacles, Opportunities & Openness. Massachusetts: Education Arcade.

Morris, S. (2003). WADs, Bots and Mods: Multiplayer FPS Games as Co-creative Media: University of Queensland.

Park, A. (2007). Sid Meier's Civilizations IV: Beyond the Sword Review, *Gamespot*. Retrieved from http://www.gamespot.com/sid-meiers-civilization-iv-beyond-the-sword/reviews/civilization-iv-beyond-the-sword-review-6175647/

Piaget, J. (1962). *Play, dreams and imitation in childhood*. New York: Norton.

*Serious Games Initiative*. (2012) Retrieved 21 September 2012, from http://www.seriousgames.org/

*Sid Meier's Civilization V*. Retrieved 20 September 2012, from http://www.civilization5.com/

*Sid Meier's Civilizations V*. (2010): 2K Games.

Squire, K. (2005). Changing the Game: What Happens When Video Games Enter the Classroom? *Innovate, 1*(6), 20.

Squire, K., & Jenkins, H. (2003). Harnessing the Power of Games in Education. *Insight, 3*, 1-33.

Squire, K., & Steinkuehler, C. A. (2005). Meet the Gamers. *Library Journal*. Retrieved from http://www.libraryjournal.com/article/ca516033.html

Steinkuehler, C. A. (2008). Cognition and Literacy in Massively Multiplayer Online Games *Handbook of Research on New Literacies* (pp. 611-634). Mahwah, New Jersey: Erlbaum.

Vygotsky, L. (1978). *Mind in society: The development of higher psychologicalprocesses*. Cambridge, Massechussets: Harvard University Press.

Whitton, N. (2011). Game Engagement Theory and Adult Learning. *Simulation Gaming, 42*, 596-610.

# Using ABC's Science game

# Z O O M

# as stimulus for inquiry learning


Sally Parker

Moriah College, Bondi Junction, Sydney, NSW
Science, Biology, Philosophy and Enrichment teacher.

University of Sydney, Faculty of Education and Social Work

## Part 1 - Introducing the game ZOOM

*ZOOM, the game used as the basis for this article can be accessed at: http://splash.abc.net.au/home*

### Overview of ZOOM

Imagine being able to really see what's going on inside objects. The ability to zoom in on things from the more familiar to the less familiar to see how they work has very wide appeal across all ages.

ZOOM is an inquiry-based game for science students and anyone else who wants to explore physical matter to levels not visible to the naked eye. The journey is undertaken without overt educational signals in order to have appeal beyond the science classroom and into the wider community.

### General aims and objectives

ZOOM's readymade and accurate conceptual framework will give students the visual tools to imagine and question the microscopic and nanoscopic workings of everyday objects in their real world. The creators of ZOOM outline several general objectives:

- To create a journey that is visually beautiful, scientifically accurate and satisfies our curiosity about what's going on inside living things and gadgets we use every day.
- To show the link between our macro world, the micro- and nano-scale worlds of classical physics and chemistry, and the quantum world by delving to smaller and smaller scales.
- To feed our innate curiosity about how things work without traditional stumbling blocks like equations, graphs and technical jargon.
- To give us a visual vocabulary that we can apply when we try to imagine other aspects of the world at a scale that we can never see.
- To let us discover as much or as little of this world as we like, at our own pace.

### Game narrative

The game is set in outer space and the Player is given the core challenge of investigating a disabled spacecraft. To find out what has happened, at particular stages of the game the Player is required to 'zoom' into the atomic-level of an object and engage with a 'mini-game' that is based on a specific scientific principle.

Image 1 - The disabled Space Ship *Polaris* where the ZOOM journey takes place

In order to get to the magnification levels required to play these mini-games the Player "zooms" into the appropriate level using a NanoZoom tool, which they have collected as part of their inventory as they explore the ship.

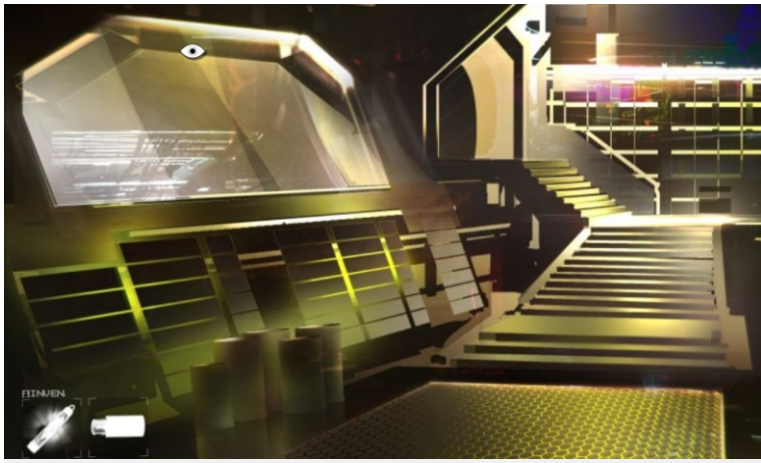


Image 2 – The Player collects a set of tools for later use and stores them in their inventory at the bottom left of the screen. All tools are brightly high-lighted in order to stand out from the background design.

The NanoZoom allows the Player to activate the zoom control to drive their entry into the atomic world, pausing at stages of magnification if desired. Once at the atomic world the Player can interact with cells, molecules, atoms and photons to help solve a problem or find a clue that will allow them to explore further and solve the mysteries within the space ship, including reviving the ship's captain – the cyborg Alexis8.

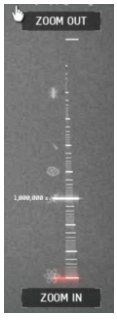



Image 3 – The zoom control (used to access the mini-games) is activated by the NanoZoom tool

Image 4 – Graphic of Alexis8 held in suspended animation and awaiting reanimation at the cellular level by the Player

Two other cyborgs, Amber and Quaan, who are trapped in one part of the ship, assist the Player as they make their way through the ship.

## Game design

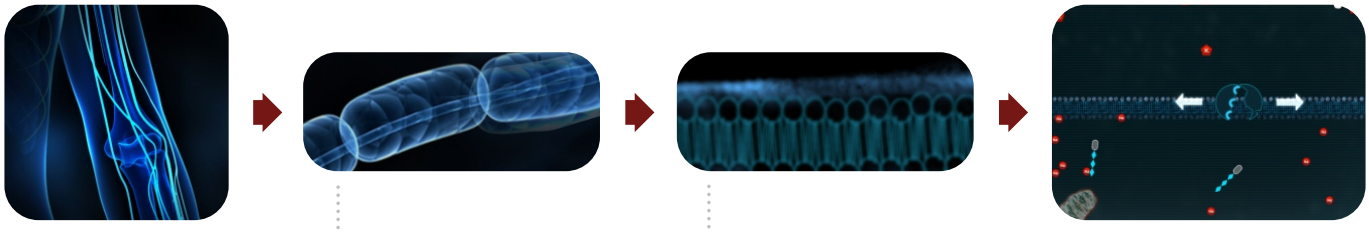
Based on 'graphic novel' illustration, ZOOM has been developed as a series of still images with graphic novel, as well as the sci-fi game genre, as the starting point. The visual treatment aims to encourage exploration, uses dark to light as a positive motivation, to be welcoming, entice curiosity, and retain an element of 'soul' in the environment (as opposed to a cold, hard, distant feeling).

Mini-game visual treatment aims to give the Player a sense of 'being there', using 2D graphics rendered in a 3D stying when appropriate, enhancing the immersive nature of the zoom function. The mini-games engage using arcade-style challenges which are based on science principles. The Player shoots at targets, or moves and collects items to solve a puzzle that will have an impact in the real (zoomed out) world. When a mini-game is completed successfully at the atomic level, the Player will see its impact in the 1x zoom world.

## The Science in ZOOM

The science behind the game is rigorous, due to collaboration with university experts in each field of science represented in the mini-games. Each mini-game has been vetted by a subject matter expert, with scientific principles clarified by research-active scientific advisors.

The mini-games include; activating a laser, matching wave patterns in the electromagnetic spectrum, splitting light beams with prisms, stimulating cells in the retina to restore sight, using a sodium-potassium pump to fire an electrochemical message along a neuron.



Players zoom from a nerve in the arm…

…to an individual neuron…

…to the molecules in the cell membrane of the neuron…

…to the mini-game itself where the player manipulates a sodium-

Image 5 – This series of images shows the levels of magnification as the Player zooms in from a nerve in an arm to a sodium-potassium cell membrane pump where the action potential takes place.

## Part 2 - Pedagogy and classroom logistics

### Educational objectives

The creators of ZOOM outline three major educational objectives:

- To create a user-driven learning experience that explores the link between our macro world, the micro- and nano-scale worlds of classical physics and chemistry, and the quantum world by delving to smaller and smaller scales.
- To create a visual vocabulary for abstract concepts like energy, waves, particles and fields that gives students a foundation on which to build their own conceptual frameworks.
- To encourage enthusiasm for understanding the fundamental nature and workings of matter and energy – the building blocks of the universe.

### Classroom support material

Each of the mini-games has a supporting video of the zooming in journey and mini-game as it is played. A voice-over describes the level of magnification during the zooming as well as the science behind what the Player experiences during the game. The core logic behind these learning resource videos are enabling viewers to understand the science behind the game which is not always that obvious. It also provides a way to categorise the science content on the ABC's Splash website where the game is hosted, as searchable items with particular associated keywords.

There are additional supporting videos that explain and extend on the science animations in the games in more detail.

In Part 3 of this paper, classroom activities to reflect on the ZOOM experience and enhance learning outcomes, will be presented.

### Teaching flexibility

ZOOM as a learning tool can support the teacher in their classroom via a number of pedagogical approaches:

- Can be used as a cross-discipline experience in science or by focusing in on particular zoom games to support the unit of work currently being studied.
- Provides flexibility of use – can be played in the classroom or at home in a flipped-classroom model
- Engages students more deeply with scientific concepts through experiential game-based learning
- Enriches current scientific understanding of already motivated students
- Supports inquiry learning as students are encouraged find answers themselves

### Educational Frameworks

In addition to the above more general approaches to classroom teaching, ZOOM addresses the following educational frameworks:

- Differentiation

  A differentiated classroom is one where teachers acknowledge that students have different learning needs and organise their lessons to cater to this. Experiential games such as ZOOM, that gives both access to all and challenges all types and levels of learners will be of benefit in the classroom. Students can work at their own pace and take on board more or less of the science along the way depending on the specific educational targets at the time.

- Freedom of choice

  Secondary school students require non-linear learning patterns where they can make choices and test their own ideas in order to learn from them. They enjoy and benefit from having the freedom to explore at their own pace. This supports the idea of a differentiated classroom. ZOOM provides this opportunity as students are free to explore the abandoned ship Polaris at their own pace. They can backtrack or move forward to find the appropriate tools to carry out the challenges presented in the mini-games.

- Visual literacy

  Students respond well to visually stimulating images. The value of an enhanced visually stimulating activity should not be underestimated. There is tremendous value for students to observe complex and abstract processes rather than be told about them. While playing each of the mini-games in ZOOM students are adding to their visual vocabulary as they engage with models of cells, waves, photons and other scientific phenomenon.

- Interactivity

  Student can enjoy the interactivity with ZOOM due to the feedback of each mini-game being immediate. Once each challenge is solved the Player progresses through the virtual spacecraft.

- help students construct their own knowledge as they are guided through the small challenges within the mini-games

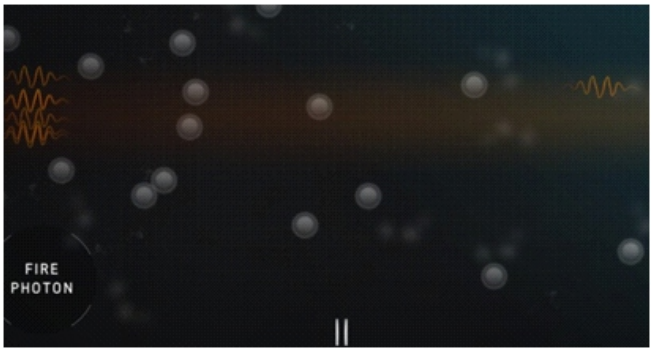
rather than be fed information. It can help them connect their ideas to other areas of their life.

- Problem based learning

  Students need to be able to struggle a little and not get things right straight away, not so much by getting it wrong, but by finding ways to do it better. When playing the mini-games students won't necessarily have the knowledge, experience, or expertise as adult scientists but they can be clever, innovative, capable, inquiring and creative in order to solve the challenges in the mini-games.

## General classroom logistics

Zoom takes between 15-20 minutes to complete. It is anticipated that this length will work well in a typical high-school science class time period of 40-60 minutes where it can be used as stimulus material for discussion, or as a fun example to support content delivery.




Teachers may use the game in its entirety or focus on specific mini-games in order to fit into pre-existing teacher programs. The videos of each zooming-in experience will help support this approach.

The video animations could also be utilised as teaching resources in the classroom without having to play the mini-game. These animations demonstrate core science concepts and can be used by teachers to extend learning beyond the game.

Australian Curriculum links

Because ZOOM is showing us what's happening without maths, graphs or equations it's an eye-opening entrée to the micro and nano worlds for anyone with any interest in how things really work. ZOOM can be played at home by students directly from the ABC's Flash website or used in the classroom due to its inherent link with the high school science curriculum.

Regardless of its audience, ZOOM is first and foremost a science education project, and it directly addresses the Science Understanding strand from the following Learning Areas of the Australian Curriculum:

Year 8

- Cells are the basic units of living things and have specialised structures and functions (ACSSU149)
  - Distinguishing plant cells from animal or fungal cells
  - Identifying structures within cells and describing their function
  - Recognising that some organisms consist of a single cell
- Multi-cellular organisms contain systems of organs that carry out specialised functions that enable them to survive and reproduce (ACSSU150)
  - examining the specialised cells and tissues involved in structure and function of particular organs
  - describing the structure of each organ in a system and relating its function to the overall function of the system
- The properties of the different states of matter can be explained in terms of the motion and arrangement of the particles (ACSSU151)

Year 9

- All matter is made of atoms which are composed of protons, neutrons and electrons; natural radioactivity arises from the decay of nuclei in atoms (ACSSU177)
  - Describing and modelling the structure of atoms in terms of the nucleus, protons, neutrons and electrons
  - Comparing the mass and charge of protons, neutrons and electrons
- Energy transfer through different mediums can be explained using wave and particle models (ACSSU182)
  - exploring the properties of waves, and situations where energy is transferred in the form of waves, such as sound and light

Year 10

- Energy conservation in a system can be explained by describing energy transfers and transformations (ACSSU190)
  - using models to describe how energy is transferred and transformed within systems

## Part 3 – ZOOM and the Inquiry Pathway

### Virtual worlds as learning opportunities

Scenario or narrative-based virtual worlds where students take on the role of a character so that they can interact with elements of the story using game-based elements are proving to be an effective means of attracting and gaining student's attention and have been noted to be one of the technologies to watch over the next few years (Australia-New Zealand Horizon Report, 2009).

Games provide the opportunity of a meaningful framework for offering problem-solving inquiry learning opportunities to students. In this context a problem can be defined as anything that impedes the progress of the Player. All of the problem-based challenges in ZOOM are examples of well-constructed problems (Hong 1998 in Killi 2005), that have clear goals (for example; stimulating the rod and cone cells in the retina to restore vision) rather than the more challenging and real life-like problems of goals of ill-structured problems.

### The inquiry pathway

Guided-inquiry learning is a framework developed to provide an effective approach to science education (Sabourin et.al., 2011). Various sequential steps are required to make up the inquiry pathway and although there are numerous variations of the steps required for inquiry, the following summary includes the more common aspects of inquiry learning. (See Image 6)

**Inquiry pathway**

Step 1. Engagement with stimulus or topic material.

↓

Step 2. Questions are formulated to help understand, probe or challenge the stimulus or restore understanding.

↓

Step 3. Information is gathered relating to one or more of the questions.

↓

Step 4. Information is analysed through discussion, collaboration and reflection. Possible solutions are suggested, new ideas are generated, hypothesis are proposed.

↓

Step 5. Information is evaluated in relation to original stimulus material. A hypothesis is tested.

↓

Step 6. Conclusions are drawn, strategies are adapted, plans are executed.

Image 6 – A general step by step process representing the inquiry pathway

Students may require previous experience or explicit guidance during the inquiry pathway in order to gain the most from the experience or avoid becoming lost along the way.

### Using a mini-game to drive the inquiry process

Although the mini-games provide inquiry opportunity to the Player, these opportunities are incomplete if we are to compare them to the full inquiry process shown in Image 6. There are 3 main reasons for this:

- If a player approaches the challenge within each mini-game as an action-based drill and practice, for example when using rapid trial and error actions rather than reflecting on the outcomes of their actions. This casts aside the reflective nature of inquiry and learning is not enhanced (Killi 2005).
- Being a single Player game, there is also no opportunity for collaboration between players within the game itself. This is one reason why teachers may prefer students to play the game in the classroom where they can be motivated by seeing other students' progress and, where necessary, collaborate by sharing ideas about how to progress through the game.
- The mini-games provide a limited (well-constructed) challenge that has one well-defined goal, where as the inquiry process outlined in Image 6 is more suitable for an ill-constructed problem that does not have well defined goals. To conclude this paper I would like to suggest an inquiry teaching approach where one of the mini-games itself can become the stimulus (step 1) for a deeper inquiry process similar to the one shown in Image 6.

The following classroom activities allow for reflection, collaboration, and application of knowledge and experience gained when playing ZOOM. The following activities for playing a ZOOM mini-game and using it to extend student scientific knowledge in the classroom is matched to the inquiry pathway suggested in Image 6.

### Other suggested classroom activities to accompany ZOOM

1. Scale concept game

Student can work in groups to place a series of cards in order of size along a scale. This can be carried out as an activity to engage students thinking around scale prior to playing ZOOM, or after one or more of the mini-games have been played. Images to include: eukaryotic cell, molecule, atom, cell organelle, bacteria, virus, pollen grain, golf ball, water molecule, hormone.

### ZOOM mini-game inquiry pathway

Step 1. Students apply the NanoZoom tool to zoom in to a mini-game of choice (theirs or the teachers). Students experience the game by playing it in full until the goal is achieved.

Step 2. Students repeat the play but this time identify as many questions as they can generate related to the game. Questions can be generated individually, in pairs, small groups or as a whole class. Sample questions include: How does the game relate to reality? What are the consequences in real life if this process ceases to function properly? What did X represent in the mini-game?

Step 3. Students choose which questions they could research and carry out that research.

Step 4. Students communicate, analyse and reflect on the information they have gathered. They can present material back to the class related to their discoveries or enter into a teacher driven discussion about the relevant science content.

Step 5. Students replay the game with their new knowledge and assess it for accuracy, scientific rigour.

Step 6. Student can reflect on the educational value of the game by identifying its strengths and limitations.

2. Design own zoom experience

Students can use a microscope and electron micrographs to examine specialized tissue and cells to draw up a scale or story board of images that zoom in on a particular cellular function. A further challenge would be to create their own mini-game where an action at the molecular or cellular level affects a change at the macro level.

## References


Cam, P. (2006). Dewey, Lipman and the Tradition of Reflective Education *Pragmatism, education, and children: International philosophical perspectives*. Amsterdam and New York: Editions Rodopi.

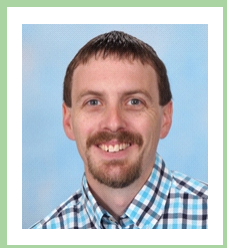
Johnson, L Levine, A, Smith, R Smyth, T and Stone, S (2009) Horizon Report: 2009 Australia- New Zealand Edition. Austin, Tx.

Kennedy-Clark, S., Galstaun, V., & Anderson, K. (2011). *Using game-based inquiry learning to meet the changing directions of science education*. Paper presented at the ASCILITE-Australian Society for Computers in Learning in Tertiary Education Annual Conference.

Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. *The internet and higher education, 8*(1), 13-24.

San Chee, Y., & Tan, K. C. D. (2012). Becoming Chemists through Game-based Inquiry Learning: The Case of Legends of Alkhimia. *Electronic Journal of e-Learning, 10*(2).

# Minecrafting My Classroom



Stephen Elford
Numurkah Secondary College

Since November 2011 I have been incorporating games into my classroom to engage students, enhance my teaching and make my classroom a more enjoyable space. While I have used quite a few games, the major contributing force is definitely Minecraft. As a secondary Science and Maths teacher, I have a hard time just letting students play games without some real purpose, the curriculum, assessment and reporting structures in place just do not support the "play and learn" approach, regardless of how useful I feel that approach may be. So it is always my goal to link tightly to curriculum when using Minecraft in my classes.

My first attempt introducing Minecraft Into my teaching was very simple in terms of complexity and visual appeal compared to some of the projects I have created since; however, it definitely opened my eyes to the educational possibilities of this game. Having played Minecraft for a couple of years prior to bringing it into my classes I knew a fair bit about the mechanics of the game, and that when used with my lesson planning helped me to create a very simple lesson where students were able to explore how neurotransmitters work when crossing the synapse by being the neurotransmitter molecules.

demonstration. From that day on I was hooked, the feedback from the students was very positive and I wanted to keep providing these kinds of opportunities to my students.

Unfortunately, my first use of Minecraft in my classes was quite late in the year so I did not get to use it a great deal despite my desire to push my teaching practice into these areas that were new to me. I did get to do one experiment with my junior Science students as we were discussing reaction times. Instead of dropping rulers in class, which is how I had done reaction time experiments for the previous years, I decided wouldn't it be way more fun to drop students in a virtual world. This proved to not only be more fun, but it provided students with a very neat visual representation of the experiment and a great discussion prompt (to see a video of this experiment please go to MinecraftEdu Class - Reaction Times). While I was originally disappointed that I began using Minecraft so late in the year, I found that having some time over the Christmas break to really sink my teeth into building a project that would engage my students was hugely beneficial.

I began work on a massive 3-dimensional animal cell model,


I had a few demonstrations in mind and spent approximately 10 minutes creating the learning space in the game. The demonstrations went for about 15 minutes and the students were engaged the entire time, they listened, they completed the tasks and we discussed them. What really amazed me was the scope of discussions that could come from such a small

including modifying the graphics in the game to 'fit' my requirements and it took many, many hours to create. One of my core goals of using MinecraftEdu in my classes were to give students opportunities to learn in a virtual space that they had not before, and while the virtual cell was a great achievement, I began to see opportunities in a much wider ranging area of

subjects. I was, for one semester, required to teach Year 7 Humanities. Minecraft has huge potential in this area particularly when studying History: by creating ancient civilisations to the exploration of other students creations or even students creating their own civilisation and exploring trade or laws has much to offer. However I was not trying to teach History, but Geography. More specifically at one point over the semester I was to teach contour maps. Now remembering back to my schooling days, I knew that contour maps were very abstract and I struggled to 'see' how they worked until much later on in my schooling when dealing with higher level mathematics.

To enable my students to 'see' how contour maps work I set about creating a map that would allow students not only to walk a mountain in the game, but also create a contour map of that mountain. My students live on a flood plain in central Victoria, which means there are no hills to explore nearby. Minecraft allowed my students to explore a virtual mountain and collaboratively create a contour map as a class all within a 45 minute lesson. To see our contour map class please go to MinecraftEdu Class - Contours. What was most rewarding for me as a teacher was to see the skills of reading contour maps transferred out of the virtual world into the real world. The next lesson I drew a contour map on the board and asked students which way they would climb to the top. Every student could justify their chosen path based on the inclination or distance travelled, something I never could have done at their age.

MinecraftEdu was starting to gain a lot of momentum in my classes, and yet more opportunities arose. As a science teacher I saw some potential for teaching students how to perform scientific experiments. I gathered a group of senior students who were interested in helping me build a lesson and we set about putting not only the map together but a complete backstory so that students could role play and be 'real scientists' in the virtual world.

We were studying forces, and what better force to explore than the unique properties of Minecraft gravity. The map GravityLab was born, but perhaps the biggest step in this particular lesson plan or idea was the introductory video, the students and I built, scripted and recorded something as corny as we could possibly make it to make the students laugh and give them a reason to complete the task and present their findings. You can see the video at GravityIntro.

After recording our introduction, the students were required to travel to 6 different stations dotted around the virtual world, each with 3 different heights to test. I honestly felt that the students would be able to perform at least half of the 18 experiments that were available to them in the time allocated. Boy was I wrong, the students found it a lot more time consuming to complete the activities in the virtual world; however, as the students all started at different station as a class we got all the experiments done.

After the in-game sessions we discussed the results, compared them to real life gravity and then even got to talk about the scientific method, and why students had to repeat experiments. All in all I felt this was a very successful project, meeting more learning outcomes than just the exploration of forces.

So from very humble beginnings the journey of MinecraftEdu in my classroom has been an amazing one, and still continues to this day. Over time my teaching practice has been altered significantly, my thinking about games in education has been changed for good and my ability to see learning opportunities from games in general and Minecraft specifically has evolved hugely.

So one last thing, if you are thinking of bringing games into your classroom, or even if you have already dabbled, MinecraftEdu is a robust, easy to set up and amazingly flexible game to start with. I can, with confidence, highly recommend this as an excellent educational tool for classrooms. If you are interested, MinecraftEdu can be purchased from http://minecraftedu.com, there are many tutorial videos and classroom videos of my classes on http://youtube.com/eduelfie and I also write, very honestly, and normally in great depth on my projects at http://minecrafteduelfie.blogspot.com.au. I would also recommend you join the Minecraft Teachers Google Group https://groups.google.com/forum/#!categories/minecraft-teachers, it is an amazing resource full of teachers who are using this in their classes now and who are also willing to help out.

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# Creating a Mathematics game using Construct 2

Drew Thomas

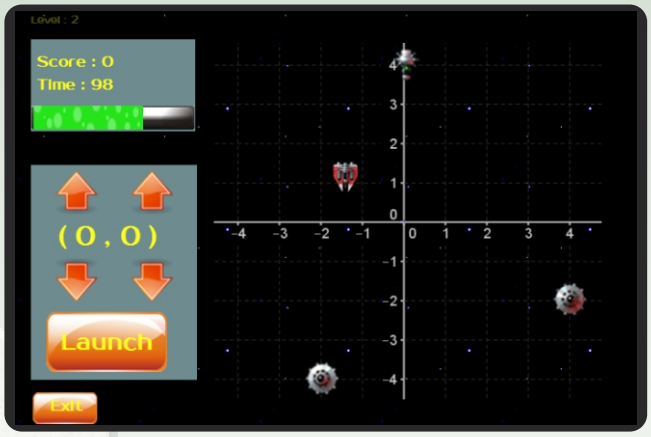
Games are something I have always been drawn to as a teacher. Whether as a pen and paper exercise, or utilising new technologies, the ability to make a game out of learning can add a level of engagement. When teaching mathematics, I have found it common to see struggle getting their heads around Cartesian coordinates. In an attempt to remedy this confusion, I created a web based game which I called 'Cartesian Blaster'. Cartesian Blaster is a space-themed game in the Battleship mould.

The program that I used to create Cartesian Blaster was Construct 2, a game making program that has a free version to download from https:// www.scirra.com/. The program is windows-based, but the games created can be used on all platforms as they run through the web browser.

The Construct 2 site contains an extensive list of tutorials and example game templates. I found that after perusing a few of the tutorials and utilising some of the supplied sprite images, I was able to create a usable game, currently found at http://ow.ly/rkpEG

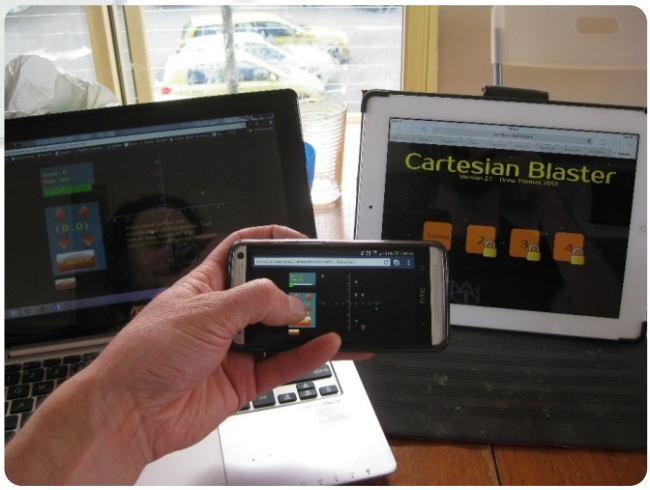
Using games as a part of the school curriculum could have a number of benefits. It is estimated that 91% of US children and young people play digital games, with over half owning a smart


device, either a phone of tablet (NPD, 2011). Given that gaming is so ubiquitous, it would be a shame not to investigate how it could be used to assist in education. If it is possible to create a game that students will want to play, there is reason to believe that learning could be assisted, and positive attitudes towards maths could be fostered.




Numerous studies to discern the learning potential of digital games have been undertaken, with varying results. One aspect that has been consistently noted to arise from utilising games is an increase in engagement and motivation (Perrotta, Featherstone, Aston & Houghton, 2013).

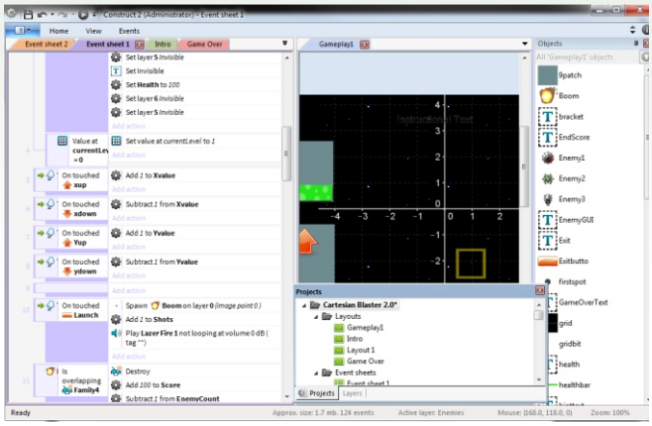
Gros (2007) has claimed that although engagement and motivation are beneficial, they are not enough for educational purposes. If game playing were the only method of instruction, this might be a reasonable assertion, but if game use can increase motivation and a positive attitude towards mathematics, then a student may be better prepared to engage in traditional classroom activities. It has been found that a learner's enjoyment of the game has a significant outcome on their performance (Giannakos, 2013) so it stands to reason that any game created should aim towards being enjoyable.




The game was designed to have simple goals that presented a challenge. Enemy aliens are attacking, and need to be located quickly on a screen that contains a Cartesian plane. By acting quickly, the enemy ships are restricted from damaging the players' ship. Although the goal is straightforward, the task becomes progressively more challenging as the player develops their skill and progresses through levels.

Games that are too easily solved will not be engaging (Van Eck, 2006). Conversely, if a player continues to fail at a task, their frustration increases as their self-esteem decreases (Giannikos, 2013). The perfect level to aim for is to ensure that a player is constantly in a state of cognitive disequilibrium, (Van Eck, 2006) where they are being challenged, but with tasks that are not seen as totally unachievable. One of the benefits of creating your own game is the ability to tweak the difficulty fairly easily if the challenges are too great or too trivial. The downside, though, is that no-one else has done this adjustment for you.

Van Eck (2006) has noted that when games are effective, it is because the learning takes part within a meaningful context. When designing Cartesian Blaster, I attempted to ensure that

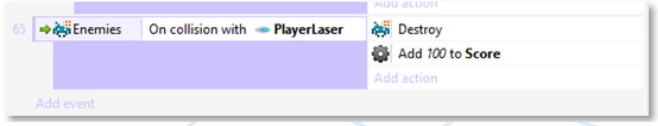


the learning was integral to game play. For example, in Cartesian Blaster, there is an obvious reason why knowing coordinates is important; if we can't name the spot on the map, we can't hope to launch a rocket there! Hopefully by making the educational aspects of the game intrinsically related, I am able to better encourage learning.

One of the strengths of a computer based activity is the availability of immediate feedback. In Cartesian Blaster, when a player has entered their coordinates and hit the 'Launch' button, an explosion sprite will appear at the location they entered. If this was where they aimed, then the enemy will be destroyed, and the player will be awarded points. If the coordinates were not correct, rather than being provided the correct answer, the player will have the opportunity to view and adjust their calculations.

Programming the main aspects of my game in Construct 2 was fairly straightforward. The main task was having all of the steps and requirements logically laid out beforehand. For example, when I launch at the enemy, an explosion appears. What would I like to happen then?

If the explosion is overlapping with the enemy, I'd like to destroy the enemy and add 100 points to my score. In Construct 2, this collision would be called an event, and the resultant destruction and point bonanza would be an action.



Making this event occur, is as simple as clicking on the event sheet, choosing from a list of all possible objects, and then selecting from a range of possible outcomes. It is important to test and play the game to make sure that no important events have been forgotten, such as making your explosion disappear after a short period. Getting the game running in a basic fashion didn't take an overly long time, but once I began to get enthusiastic about adding multiple levels, high score tables, and level unlocking, things began to take a bit longer, and fixing bugs in the game became a bit less straightforward.

To add a sense of socialisation and competition to the game I opted to create a record of high scores. To do this, I referred to one of the online tutorials which stepped me through the process of using an add-on called Clay.io to store high scores. On entering the game, players are asked to input a username to allow their scores to be recorded. Clay.io provides options to record all-time high scores, when any player gains an achievement such as passing a level, and can keep a record of each player's highest scores.

Construct 2 is a fantastic platform for game creation, and I look forward to using it again, possibly even teaching a game creation unit to interested students. I feel that it was a good platform for creating the type of game that I desired, or a scrolling platform game, but wouldn't necessarily suit someone looking to create a more text-based game. While certainly not a project that I would recommend for everyone, creating a game for teaching purposes has provided me with new perspectives on which sort of games I would add to my teaching repertoire.

## References


Giannakos, M. N. (2013). Enjoy and Learn with Educational Games: Examining Factors Affecting Learning Performance. *Computers & Education*. doi: 10.1016/j.compedu.2013.06.005

Gros, B. (2007). Digital Games in Education: The Design of game-based learning. *Journal of Research on Technology in Education*, *40*(1), 23-38.

NPD (2011) The Video Game Industry Is Adding 2-17 Year-Old Gamers at a Rate Higher Than That Age Groups Population Growth. Accessed 17/10/2013 https://www.npd.com/wps/portal/npd/us/news/press-releases/pr_111011/

Perrotta, C., Featherstone, G., Aston, H., & Houghton, E. (2013). Game-based learning: latest evidence and future directions.

Squire, K. (2005). Changing the game: What happens when video games enter the classroom. *Innovate: Journal of online education*, *1*(6).

Van Eck, R. (2006). Digital game-based learning: It's not just the digital natives who are restless. EDUCAUSE review, 41(2), 16.

# Skypathon @ Manor Lakes

Jessica Gallagher
Grade 6 Teacher, Manor Lakes P-12 College

For the first 2 years of my teaching career I was fortunate enough to be involved in a 1:1 iPad program. In 2013 I moved from grade 6 into grade 3… And I had no 1:1 iPad program anymore. At first I panicked. I knew how to use iPads as an effective teaching tool, how on earth was I going to provide authentic, exciting and engaging learning experiences without them?

This move was the biggest blessing in disguise. I very quickly learnt to think outside the box, stepping away from my comfort zone. I got my hands on some iPods, we began using Twitter heavily, started to blog, explored new tech tools each week… And we ventured down the path of Skype in the classroom.

We dived straight in the deep end! Our first call was to a class from Norbridge Academy in Nottinghamshire, UK and it was absolutely amazing. My class couldn't have loved it more and didn't stop raving about it for weeks. Our students communicated in a question/ answer format and I found that I needed to do very little 'crowd-control', the conversation just seemed to flow. And it continued to do so for almost an hour, an amazing effort for a group of 9 year olds!

I came across Norbridge's ICT Coordinator, Camilla, via @SkypeClassroom on Twitter. I soon learnt that Skype in the Classroom is a massive network of teachers keen to connect their students with other students all around the world.

Norbridge Academy were taking part in an overnight Blogathon, they were making Skype calls to all different parts of the world and blogging about them. After this call I knew what my next big aspiration was, to organise and hold a Skypathon of our very own.

I got the ball rolling straight away, drafting a proposal for School Council when I got home that night. It was enthusiastically passed and I soon placed the 'lesson' onto the Skype in the Classroom website. This allowed other educators to sign their classes up to our Skypathon. I had registrations almost straight away, many from the UK and the US, even one from Sweden and Argentina!

After a term and a half of organisation and planning, my colleague and I (and our classes) held the very first Skypathon of Manor Lakes P-12 College on a Friday evening. Students came back to school at 8pm and we were off! We had set up two Skype spaces so we could speak to as many students around the world as possible. We spoke to several classes in the UK and the US, a class from Ireland and some university students from Sweden. Our students were absolutely fantastic, even at the early hours of the morning! They were engaging in conversations about culture and education, music and art, food and landmarks.

We were keeping parents and other interested parties updated throughout the night via our class Twitter accounts, which led to other classes signing up to the Skypathon on the evening.

The students were incredibly excited to hear the accents of different countries and learn about the things that are important to those students as well as what school life is like for them. There were some very intriguing similarities and differences.

I believe that Skype has allowed my class to learn in a way that is exciting and authentic. They can put faces to names of towns and countries and have been told first-hand what people eat and do for fun in these places.

Skype has shown me that there is always, always, always a way we can provide exciting opportunities for our students no matter what resources we are, or aren't, provided with. It's all about thinking outside the box.

If you wish to follow 3Jess their class twitter handle is @3JessMLP12C

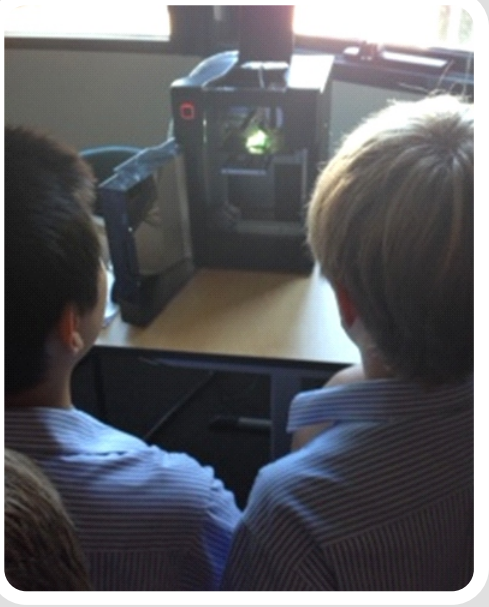

# PRINTING

## IT'S AS EASY AS 1, 2, 3!

Teresa Deshon
IT teacher and Deputy Principal,
Kilvington Grammar School

Kirsty Watts
IT teacher and Academic Dean of Technology,
Kilvington Grammar School

This year at Kilvington Grammar School we ventured into the 3D printing world with our Year 7 students. The attraction of being able to have students produce a 3D object from inception to creation was one that fitted with our Teaching and Learning approach. This new project gave students the opportunity to be creative, problem solvers and work in a more lateral way with technology.



## 1

### Hardware and Software

One of our main priorities was to find a 3D printer that would be economical and relatively easy to operate from a teacher's point of view. We spent much time researching what was available and looking at what other schools had purchased. Robustness was a factor, as we wanted the students to have access (albeit limited to begin with) to the printers to see how they worked.

In addition, we wanted a package so that the extra tools, support and warranty were included. The cost of the filament was also a factor as it is easily used up when printing more complex designs. We decided to go with UP! Mini at $1095 + $40 delivery and $39 – $59 per filament. These printers to date have been reliable, durable and more than sufficient for the objects we have been printing with our students.

Rather than looking at purchasing any specialised software to use with the 3D printers and there are many choices in this area. We decided to stick with Google SketchUp which we have used for the past couple of years with our students to design 3D objects. This is a free piece of software downloadable from the internet that students find relatively easy to use. It comes with a range of video tutorials, ideas for projects and the ability for students to save their 3D objects as dae (digitial assest exchange) files. These are useful for other applications and can be opened in Adobe Photoshop and inserted into software as 3D simulations.

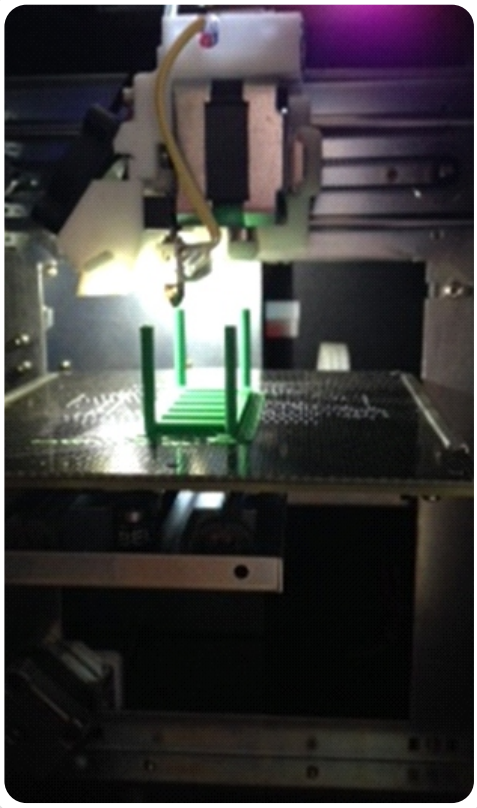
## 2

### The Project

We had an existing task we had used with Year 7 students successfully in the last two years so we simply adapted that task to include the 3D printing. The task involved students either individually or in pairs to design a child's playground containing a minimum of structures set by the teachers. Other aspects were included in the task such as OHS requirements, landscaping, suitability for children, safety/security, engagement and fun! Students were required to research these areas, design on paper and annotate the layout of the playground and then create in Google SketchUp.

The task was open ended enough to enable all students to achieve success and extend those who needed it by including more complex structures and layout.

Each playground was assessed using the rubric presented to students at the beginning of the project and students could then nominate one structure of their playground to print in 3D and in what colour. The end result being, across the four classes of Year 7, four complete playgrounds printed in 3D to be displayed around our school.



3

Hiccups and Successes

As is the case with most new IT devices and projects we did have some hiccups along the way. None of these were insurmountable and have enabled us to develop strategies to deal with these in the future.

- Tunnel and other structures
  - We found that tunnel structures and the like needed to have a substantial design inside to print effectively and not collapse
- Safety procedures with the printers
  - Students needed to be briefed on the safety procedures especially in relation to how hot the inside of the printer can get. This needed to be done regularly.
- Calibration of the printers
  - Once calibrated the printers need to remain in the one place so they didn't need to be recalibrated which does take time
- Time taken to print
  - Structures take several hours to print so this time needs to be taken into account when planning for a project of this kind

The introduction of 3D printers and this project to our school has been a big success with many more exciting projects to come. It has opened the eyes of our students to a different way to think about design and development as well showing them a new technology. It has also enabled us to include concepts of manufacturing into our IT curriculum.

The whole year level was engaged in this project and the excitement it created spread amongst the whole school peaking interest in this concept in other curriculum areas. Students have since then been busy coming up with new ways to utilise 3D printing in their studies.

We have been able to add depth, creative thinking and collaboration skills to our curriculum through the use of this new technology. It was as easy as 1,2,3!

# 3D DESIGN & PRINTING

## PLAYGROUND TASK

Design and create a playground for children aged 3-15 years. You will work in pairs or individually to create your playground.

You must include at least 3 structures from the list below in your playground:

- Slide
- Swing for big kids
- Swing for little kids (toddlers)
- Monkey bars
- Skate ramp
- Tunnel
- Wizzy Dizzy
- Fort
- An idea of your own?

Your playground needs to include consideration of the following:

- Layout
- Materials
- Pathways
- Colours
- Variety of activities
- Safety

When you have completed your playground you are to decide which structure to be printed in 3D. Collaborate with the other groups in your class so that together you will have a complete 3D playground to be disaplyed in the school.

Time Frame:

You will have 4 lessons in total to complete this task. One lesson to research and design the playground on paper as a layout sketch. The other 3 lessons are to be used to create the playground in GoogleSketch Up.

Your playground is to be uploaded into Sharepoint when compelted using the filename "YournamesPlayground".

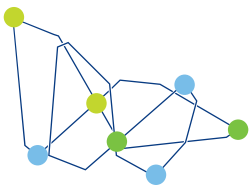
## Assessment Task Rubric

| CRITERIA | VERY HIGH | HIGH | MEDIUM | LOW |
|---|---|---|---|---|
| Four structures included in playground and 3D design is solid | Four Structures included and designed solidly | Two-Three Structures included and designed solidly | One - Two structure included | No structures |
| Layout of playground appropriate to design | Very good use of space in layout, structures are placed in safe proximity to each other | Good use of space. Structures are safety placed in relation to each other. | Not enough space in playground. Structures too close together. | Playground cramped and structures not far enough apart. |
| Variety of Materials used in playground | Playground design include a large range of materials for structure and landscape that are appropriate. | Some difference in materials shown in playground design. | Little difference in materials used for playground shown in design. | Use of different materials for playground not evident in design. |
| Pathways evident | Pathways are designed to encourage flow and take into account child traffic. They are safe and wide. | Pathways are included that attempt to cater for flow of child traffic. Pathways size adequate. | Pathways included but not designed well for traffic flow. | No pathways included. |
| Variety of colours used to attract children | Attractive and colourful playground using a variety of colours | Limited colour use | Only one colour used throughout playground | No colours. |
| Variety of activities for children in playground | Many activities in playground | Limited range of activities in playground | One or two activities in playground | No activities. |
| Playground displays safety measures | Safety measures are clear | Safety measures are difficult to see | | No safety measures are evident |
| Use of different 3D shapes – circles, rectangles, arcs, lines | All 3D shapes have clearly been included | More than one 3D shapes has been included but not all | | Only one 3D shape has been included |
| Playground shapes are in portion and playground scale is appropriate | All shapes are in proportion and scale is appropriate | All shapes are in proportion but scale is not appropriate | Scale is appropriate but shapes are not in proportion | Shapes are not in proportion and scale is inappropriate |
| Playground is in the same plane | Playground is in same plane | Parts of playground in the same plane. | | Playground is not in same plane |
| Demonstration of a range of drawing skills: eg<br>- Push/pull - Paint bucket<br>- Arc - Pan<br>- Move - rotate | All drawing skills have been included | Some skills have been included | Few skills have been included | |
| Creative use of shapes for playground | An excellent variety of shapes including non regular shapes have been used to enhance design of playground. | A good variety of shapes. Attempted non regular shapes. Playground attractive and interesting to children. | Use of regular shapes in playground. No attempt at irregular shapes. | No use of irregular shapes. Regular shapes not used in a creative way – no interesting aspects to the playground. |
| 3D Printing | Structure is suitable for the 3D printer. | Structure is mostly suitable for the 3D printer. | Structure is not suitable for the 3D printer. | |

Digital Learning and
Teaching Victoria
Statewide Resources Centre
Level 2, 150 Palmerston Street
Carlton VIC 3053 Australia

Phone: +61 3 9349 3733
Fax: +61 3 9349 5356

Email: office@dltv.vic.edu.au
www.dltv.vic.edu.au



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