Content Integration for Serious Games

Dr. Thomas Hainey
Prof. Thomas Connolly

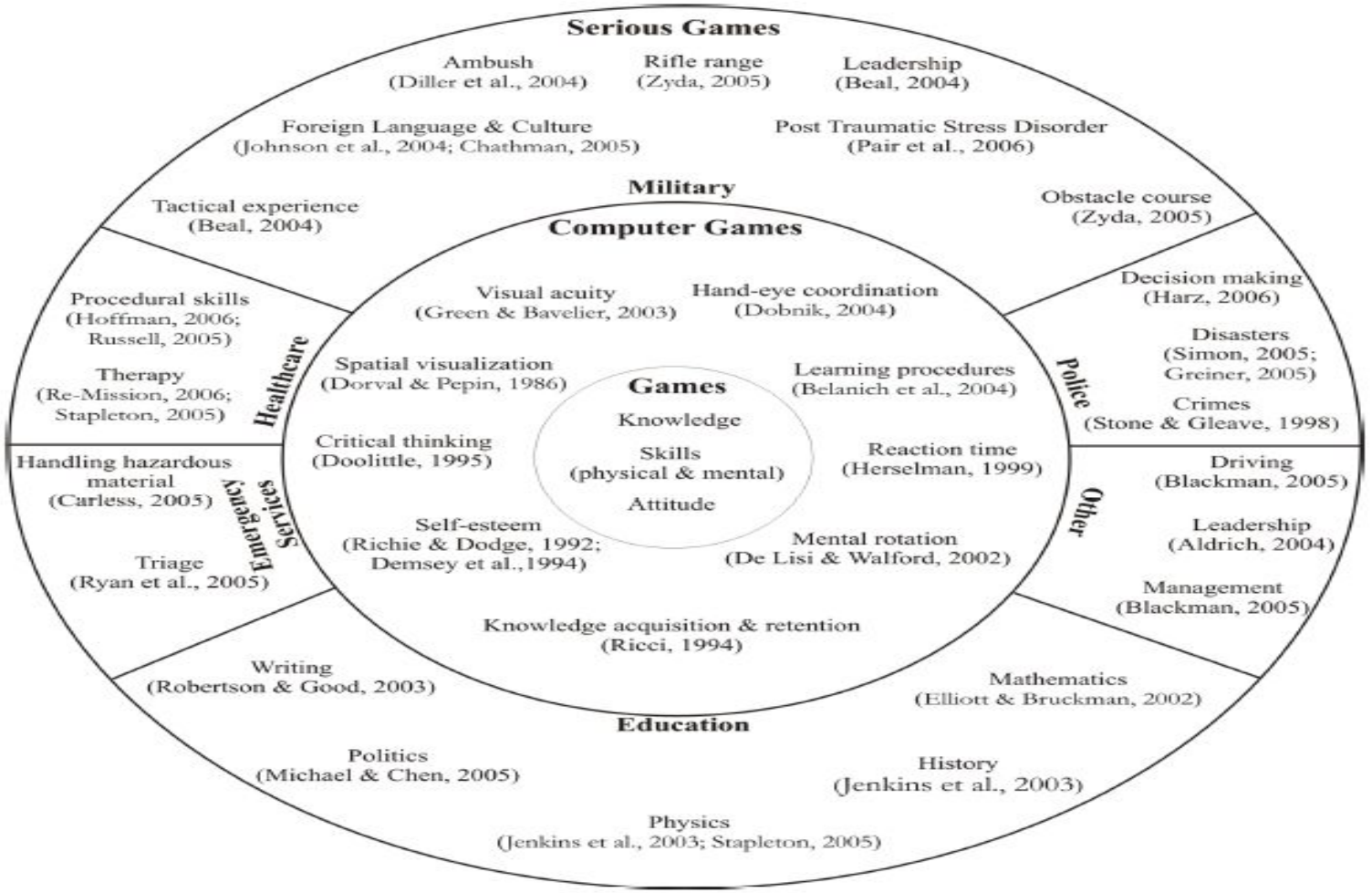
Structure of Presentation

- The challenge of content integration
  - Knowledge/Skills
- What is content?
  - General definition
  - Content in computer games
  - Content in Serious Games
  - Intrinsic and Extrinsic content
  - Implicit and Explicit content
  - Procedural Game content
  - Content Segmentation
- Frameworks mentioning content

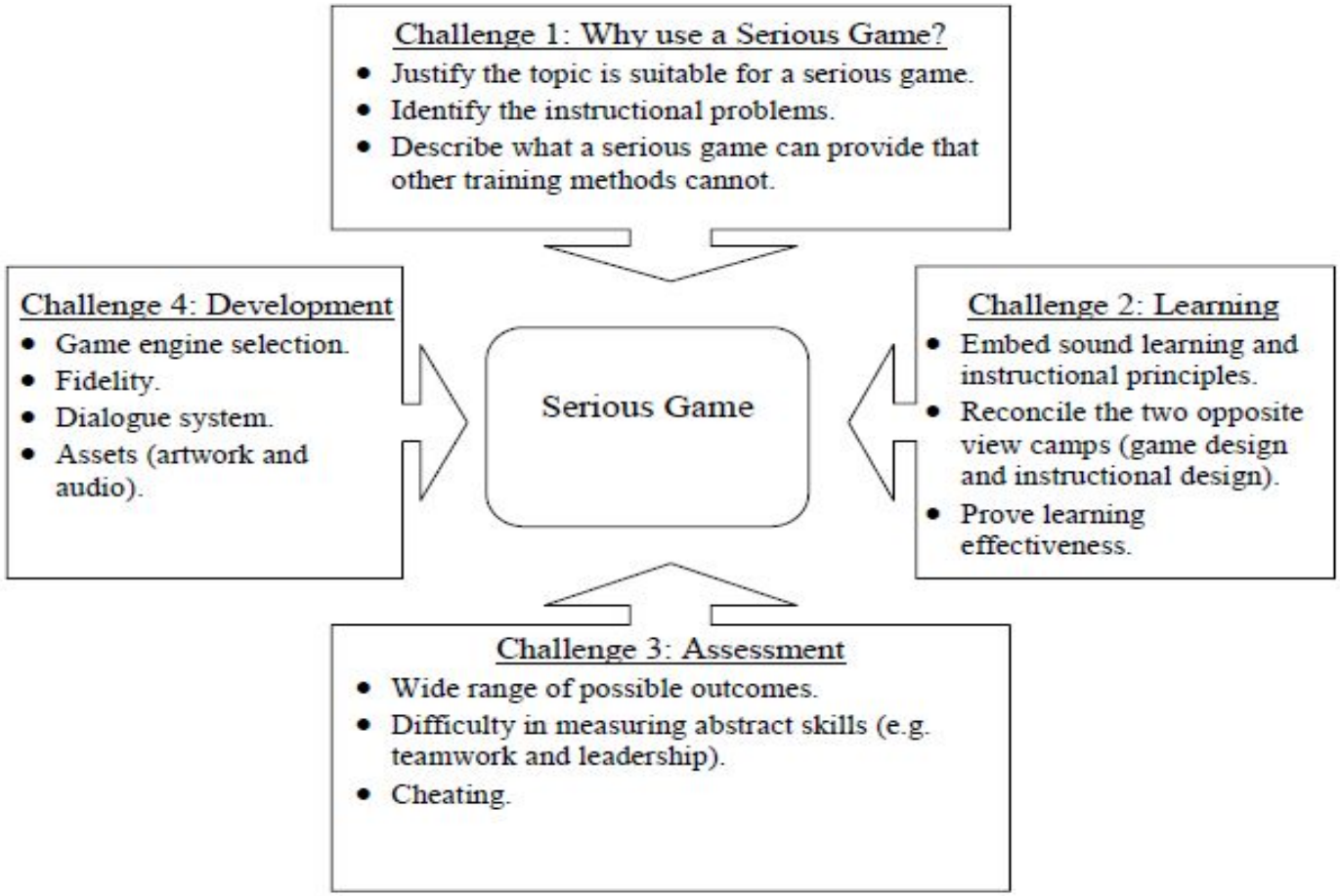
The challenge of content integration

- What content should be integrated into a Serious Game to ensure that learning outcomes are achieved?
- What kind of knowledge or skills are you hoping to impart with the Serious Game?
- Knowledge/skills or both?
- Few studies on games consider the notion of encapsulating content (Sauvé, 2010)

The challenge of content integration



The challenge of content integration



What is content?

- General Definition
- Oxford English Dictionary
  - *The things that are held or included in something*
  - *Information made available by a website or other electronic medium*
  - 'Content' is often used colloquially to refer to media. However, content is more accurately used as a specific term in that it means the content of the medium rather than the medium itself.

What is content?

- Content in Serious Games
  - Learning content has increased importance
    - Procedural, declarative, general, implicit, explicit
  - Text, puzzles, tests, skills, dialogs, feedback
  - Pedagogical underpinnings
  - Learning outcomes
  - Making the game generic

What is content?

- In relation to computer games/videogames in general:
  - Physics – simulating Physics, collision, object movement
  - AI – scripting, planning, rule-based decisions
  - Graphics – characters, levels, objects, NPCs, cars
  - Sound – music, speech, effects
  - Gameplay – game rules and features
  - Story and Narrative – cut scenes
  - User Interface – menus, help and feedback systems
  - Advertisements – F1 2011

What is content?

- Downloadable content:
- **Levels** – new maps, puzzles to the game. Examples include the Map Packs for Modern Warfare 2 and the Puzzle Packs for the Xbox Live Arcade release of Buku Sudoku.
- **Campaigns/Quests** – new story upon the main game, while adding or not adding new maps. Examples include the expansions and bonus quests for The Elder Scrolls IV: Oblivion, 5 expansions for Fallout 3, 4 expansions for Borderlands.

What is content?

- Downloadable content:
- **Gamemodes/Rulesets** – new game modes or rule sets to the game. Examples include the Suppertime of Destruction Pack for Snoopy Flying Ace, Strategic Options Add–On Pack for Halo Wars
- **Songs** – New songs that are either playable (commonly found in rhythm–based games) or alternate game songs (found in other games). Examples include the playable songs in the Rock Band and Guitar Hero series and the Downloadable Music series in Soul Calibur IV.

What is content?

- Downloadable content:
- **Equipment/Clothing** – New equipment and clothing to characters in the game. Examples include the Costume Packs in Street Fighter IV and the Additional Character Colours content for Blazblue: Continuum Shift.
- **Characters** – Content that adds new characters, usually with different abilities and attributes. Examples include Makoto Nanava in Blazblue: Continuum Shift.

What is content?

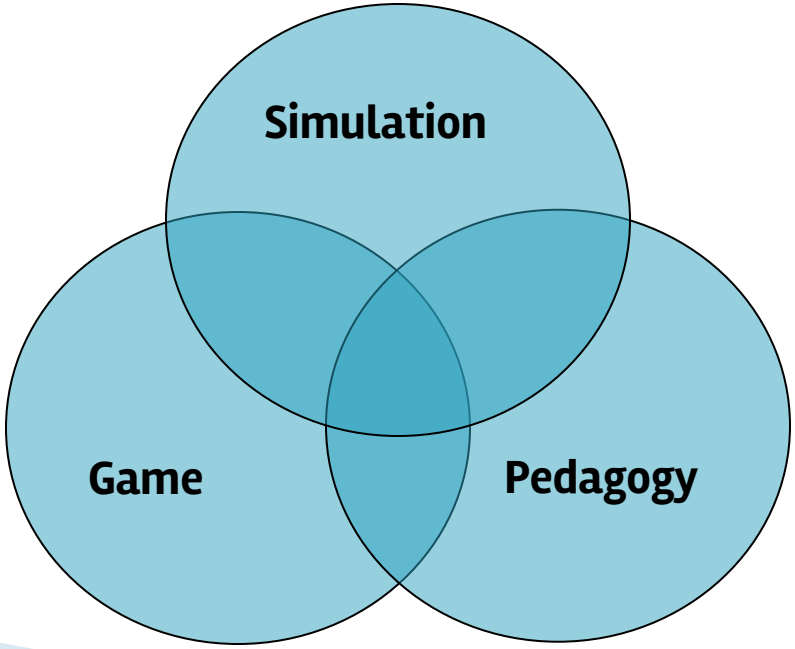
- Downloadable content:
- **Vehicles** – Content that adds new vehicles to the game, sometimes with unique abilities and attributes. Examples include the downloadable cars in Burnout Paradise and Forza Motorsport 3.
- **Cheat/Boost** – Content that unlocks part of a game that is normally earned just by playing the game. Examples include the Time is Money Pack for Skate 3 and the In-Game Money content for The Godfather: The Game.

What is content?

- Aldrich (2004, 2005) defines the following types of content:
  - Linear – much like a lecture, movie or book, this content moves the user along a defined path from beginning to end
  - Cyclical – addresses small repetitive activities that can be combined to impact an environment
  - System – exposes the user to complex, intertwined relationships, rules and principles that govern the operation of the system
  - Open–ended – presents a subject with no set experience, the game should rarely repeat situations twice, and right and wrong is removed from the equation somewhat

What is content?

- Serious Games (Aldrich, 2005)
  - Simulation elements
  - Game elements
  - Pedagogical elements



What is content?

- Intrinsic and Extrinsic content
- **Intrinsic Game:** An intrinsic game is a game in which learning content is integrated within the framework of the game. In this type of game, learning and gaming are closely related and both happen simultaneously.
- **Extrinsic Game:** An extrinsic game is a game in which the scenario is separate or less integrated within the learning content. In this type of game, learning and gaming are independent activities.
- These categories are not an either/or but a continuum of possible options that compliment different content styles (Gomez-Martin, Gomez-Martin, and Gonzales-Calero, 2009).

What is content?

- Intrinsic motivation can be achieved through fantasy which is achieved by the following kinds of games:
  - **Endogenous Educational Games:** Games where the game play is informed by the learning content and pedagogical theory.
  - **Exogenous Educational Games:** Games in which the learning content is adding on top of successful game mechanics without significant modification (Winn, 2009).

What is content?

- Implicit and Explicit content (de Vasconcellos, de Araujo, 2010)
  - Explicit – text, image, video
  - Implicit – rules, constraints, strategies, cheats
- Procedural game content (Nitsche *et al.*, 2006)
  - game material – such as AI, sounds, spaces, objects – that is generated during the game's runtime. Few game use this form of content generation; instead, they rely mostly on pre-fabricated elements.

What is content?

- Content Segmentation
- Studies show that an appropriate balance between game time and learning time is needed to maintain motivation (Sauvé & Samson, 2004).

What is content?

- Content Segmentation
- In general, educational game designers follow these steps to segment the content of an educational game:
  - Determine the subject content to teach according to the general learning objective and the target population.
  - Define the major content segments according to specific learning objectives and the target population.
  - Describe the content elements in relation to the specific objectives and the larger segments, in the form of a table or flowchart.
  - Formulate questions or items for every content element.

What is content?

- Content Segmentation

Segment	Content Elements
Prevention	Information about how to break the STI cycle of transmission: types of condoms, identification of at-risk behavior and effective behavior
Prevalence	State of situation on the number infected or carrying an STI; information about infection factors—their nature, their visible or invisible effects
Transmission	Information about how various infections can be sexually transmitted. This part allows players to question myths that are wide-spread and well-anchored in the general population.
Treatment	Information about how to be cured (or to live with) STIs: how to prevent their transmission—for example, to refrain from engaging in certain high-risk behaviors —and about the actions to be taken when a person believes that she has been exposed to an infection

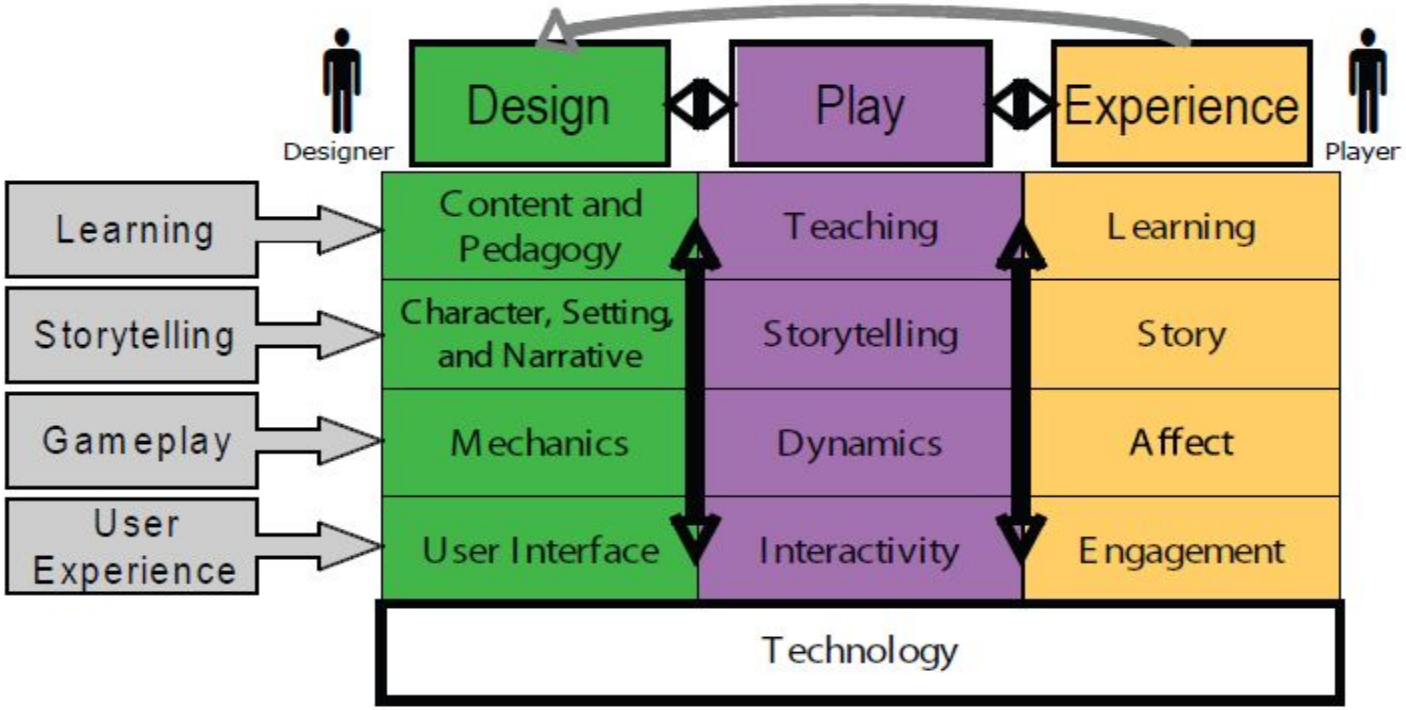
What is content?

- Content Segmentation

Conditions for Learning	Game Mechanisms
Repetition	• Insert a mechanism in the game to randomly repeat activities to provide an element of novelty. • Limit the number of questions or learning activities in the game so that they are revisited during play. • Use repetition of information to increase points in the game so that the player recognizes the importance of repetition in winning the game.
Content Segmentation	• Establish a balance between game time and learning time to maintain participants' motivation. • Limit the game content to a specific subject and offer varied and numerous exercises. We propose four steps to establish content boundaries: 1. Determine subject content to teach according to the general objective and the target population. 2. Define the major content segments according to specific learning objectives and the target population. 3. Describe the content elements in relation to the specific objectives and larger segments. 4. Formulate questions or items for every content element.
Feedback	• Insert feedback messages linked to navigation so that players can see in real time the results of their game actions. • Integrate just-in-time feedback with each learning task so that players can identify their successes and failures. • Insert motivational feedback messages that encourage the player and value his learning achievements. • Include oral or written synthesis mechanisms with peers who support the learning to allow the learner to reflect on the activities and his feelings. • Include content review mechanisms to enhance feedback on learning realized in the game and access to supplemental material for learning that was not achieved.
Reinforcement	• Include game rules that have players accumulate points or move forward or back on the game path according to whether answers are correct or incorrect. • Include activities that have learners evaluate their success rate during completion of a given task. • Integrate a real-time feedback mechanism so that the player can gauge the quality of her performance.

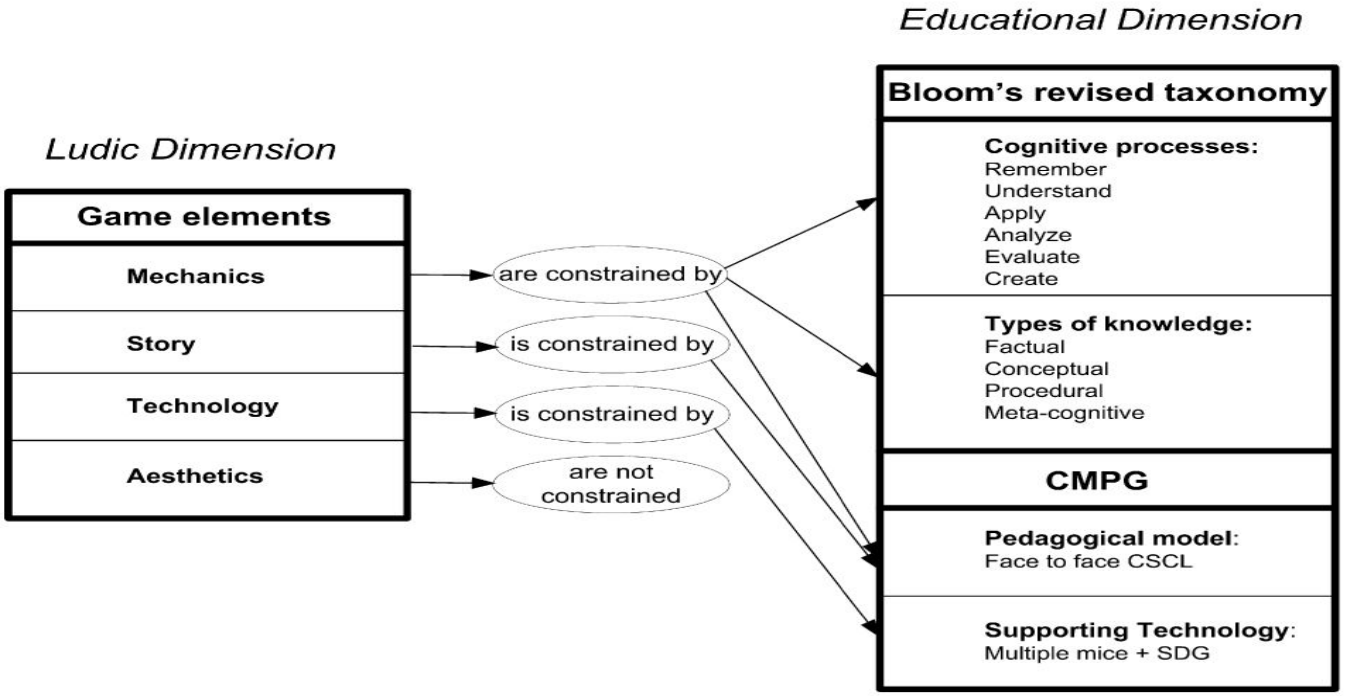
Frameworks mentioning content

- Design, Play and Experience Framework (Winn 2009)



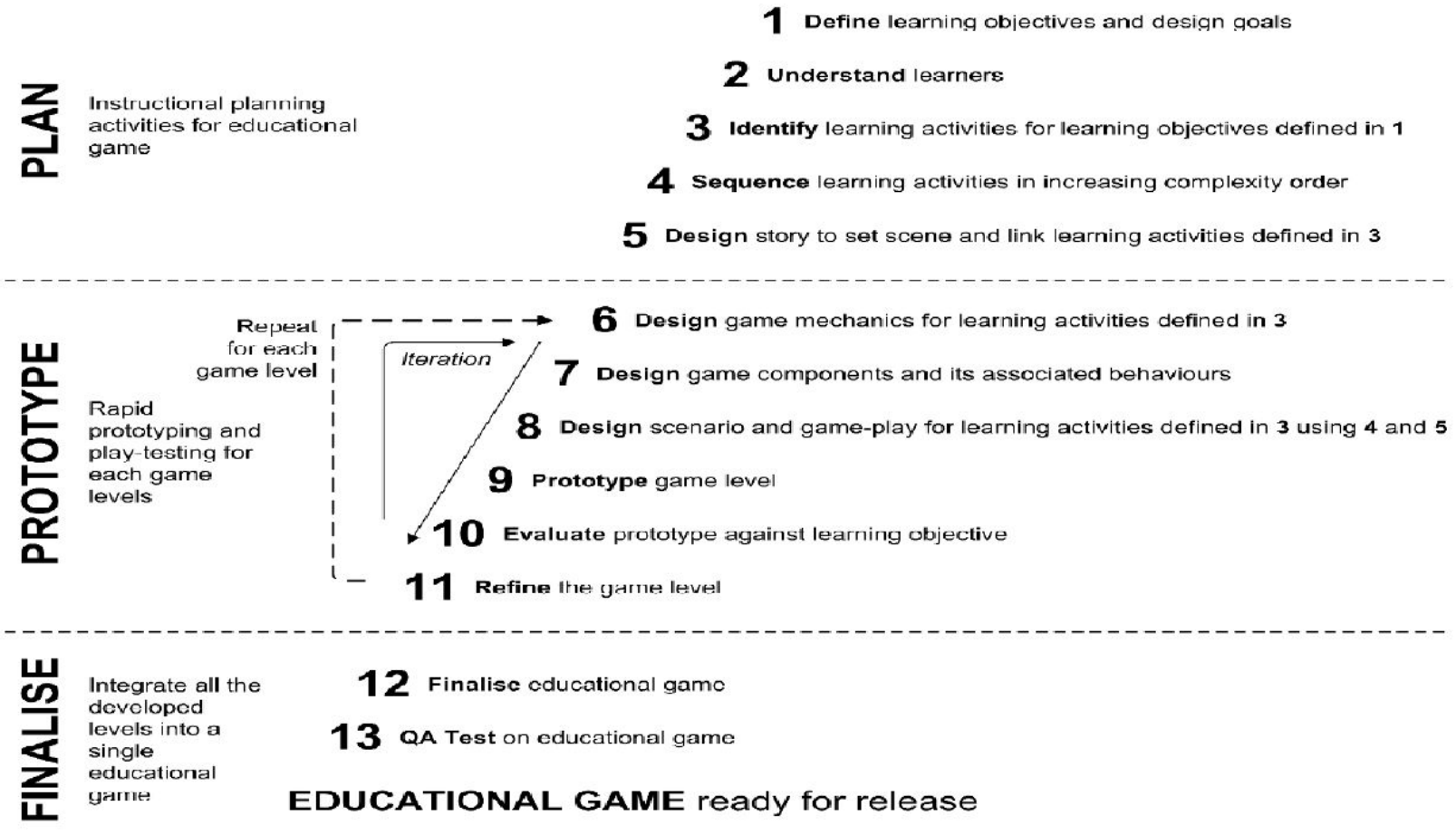
Frameworks mentioning content

- Classroom Games Design Framework (Echeverria et al, 2010)



Frameworks mentioning content

- Educational game design methodology (Tang and Hanneghan, 2010)



Frameworks mentioning content

- Tang and Hanneghan (2010) propose the following guidelines for embedding pedagogical content into game-play:
  - in line with defined learning objectives and assessable
  - in increasing order of difficulty and achievable
  - in the form of an intellectual exercise with minimal abstraction
  - applicable and readily transferable to a real world scenarios
  - carefully balanced and achievement should be based on Weiner's 'Attribution Theory' rather than pre-destined winning
  - Learners should be given feedback to assist in success and error recognition

Frameworks mentioning content

- Tang and Hanneghan (2010) propose the following guidelines for embedding pedagogical content:
  - be embedded within the storytelling and narrative components of the game whenever possible
  - use multiple representations where appropriate and be concise but avoid oversimplification
  - contain challenges allowing learners to apply acquired knowledge and thus increase retention
  - not have more than 7 key concepts in order to aid information recall.

Frameworks for content integration

- Van Eck (2007) presents examples of Nine Events from games based on Gagne's Instructional Design

Frameworks mentioning content

Nine Events	Examples of Nine Events from Games
Gain Attention	Motion, cut scenes, noise, music, character speech, health meters, attacks, death.
Inform of Objective	Documentation for the game, introductory movies, cut scenes, character speech, obstacles that limit movement or interaction.
Recall Prior Knowledge	Environmental cues, obstacles (search for solutions involves recalling solutions and events from earlier in the game)
Present Instruction	All of the above (characters, environment, objects, puzzles and obstacles, conversation) arranged according to goals of game
Provide Guidance	Cut scenes, non–player character (NPC) or player character (PC) speech, hint books, cheats and walkthroughs, friends, partial solutions to puzzles (pressing on the wall makes it rumble, but it does not open). Also, much comes from the learner themselves as they process what has occurred in the game, but the arrangement of the actors and objects in the environment and the structure of the story itself also provide implicit guidance

Frameworks mentioning content

Nine Events	Examples of Nine Events from Games
Provide Practice	Players cannot progress through the game without demonstrating what they know or think they know—all knowledge is demonstrated within the confines of the game narrative and structure.
Provide Feedback	Character speech, sounds, motion, etc., Player gets past the obstacle or achieves the goal, or does not. Every action has immediate feedback, even if that feedback is that nothing happens.
Assess Performance	Movement through the game IS assessment. Nothing is learned that is not also demonstrated.
Enhance Retention and Transfer	Things learned early in games are brought back in different, often more complex forms later. Players know that what they learn will be relevant in the short and long term.

General example – Accident

(a) Receive the accident call.

(b) Travel to the accident.

(c) Contact the operation room for further assistance.

(d) Secure the scene by parking the patrol vehicle at an appropriate place.

(e) Secure the scene using traffic cones.

(f) Attend injured.

(g) Identify and question people at the scene.

(h) Search for clues.

(i) Mark clues.

(j) Take photographs.

(k) Take measurements.

(l) Draw the accident scene.

(m) Collaborate with paramedics.

(n) Collaborate with tow truck operator.

General example – Accident

(a) Receive the accident call.

(b) Travel to the accident.

(c) Contact the operation room for further assistance.

(d) Secure the scene by parking the patrol vehicle at an appropriate place.

(e) Secure the scene using traffic cones.

(f) Attend injured.

(g) Identify and question people at the scene.

(h) Search for clues.

(i) Mark clues.

(j) Take photographs.

(k) Take measurements.

(l) Draw the accident scene.

(m) Collaborate with paramedics.

(n) Collaborate with tow truck operator.

Relevant Games in relation to the coursework

- Requirements Collection and Analysis Game
- Runs from four files – XML tags
  - Content.ini contains the dialogue, questions, requirements, todos
  - Groups.ini contains object name, default greeting, questions that can be answered and what dialogue is unlocked
  - Office NPCs – name, position, clothing, path
  - Office Objects – name, position, active

Relevant Games in relation to the coursework

- Dialog Editor

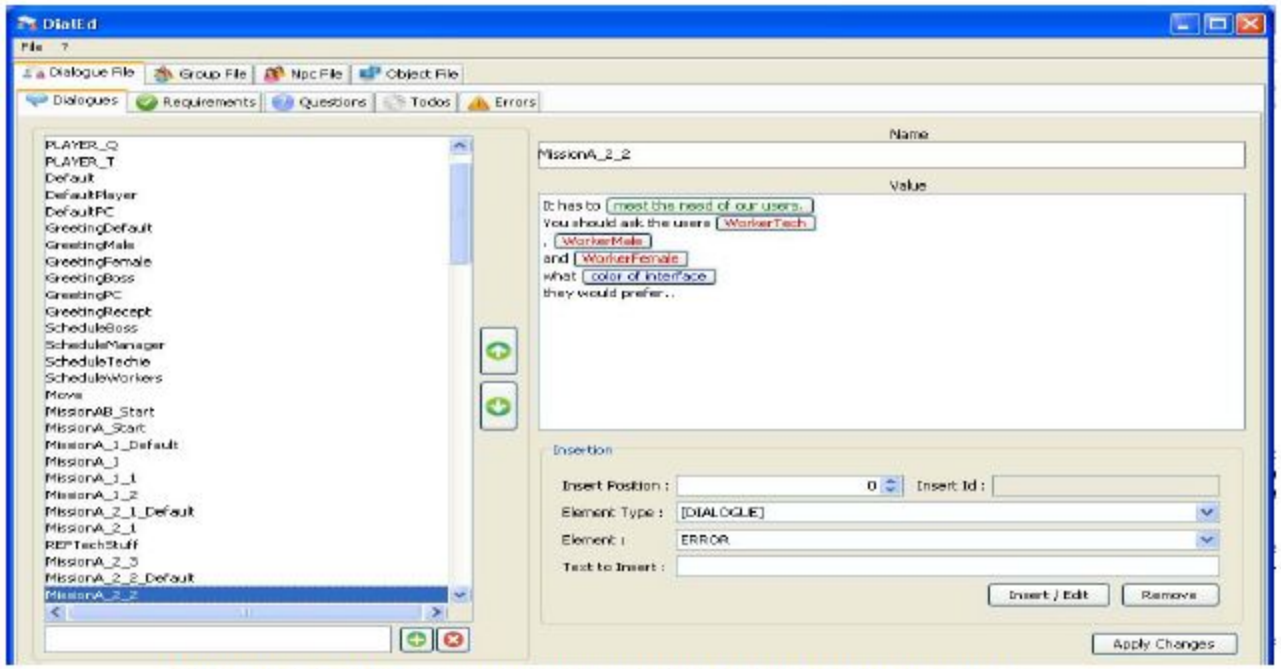


Figure 7.2 (b) Screen allowing embedding of requirements

Relevant Games in relation to the coursework

- Content integration can be handled in the following ways:
  - Base files that are searched for the information required
  - XML (Moreno-Ger, Sierra-Rodríguez, and Fernández-Manjón, 2008)
  - Object Orientation
- The primary goal is to design a structure and a series of search algorithms to make interaction effortless

Relevant Games in relation to the coursework

- For ideas about content:
- SPM – SimJava SP, The Incredible Manager, KM Quest, SimSE, Sim VBSE, Open Software Solutions
- Maths – Zombie Division, Phoenix Quest, SMILE, “Math Games Online”
- Hotel Management – MacDonald's Game, Habbo Hotel, “Serious Game Hotel”
- Running a pub – The Beer Game, MacDonald’s Game – Age challenge

Relevant Games in relation to the coursework

- McDonalds Game

References

- Aldrich, C. (2004). *Simulations and the Future of Learning: An Innovative (and Perhaps Revolutionary) Approach to e-Learning*. San Francisco: Pfeiffer
- Aldrich, C. (2005). *Learning by Doing: A Comprehensive Guide to Simulations Computer Games, and Pedagogy in e-Learning and Other Educational Experiences.* Pfeiffer.
- BinSubaih, A., S. Maddock, D. Romano (2009), "Serious Games for the Police: Opportunities and Challenges", Special Reports & Studies Series at the Research & Studies Center (Dubai Police Academy).
- de Vasconcellos, M.S., and de Araujo, I. S. (2011) The Potential of Videogames in Public Health Communication. In Proceedings of Videogame Cultures and The Future of Interactive Entertainment, 8 July to 10th July, Oxford, United Kingdom.
- Echeverria, A., Garcia-Campe, C., Nussbaum, M., Gil, F., Villalta, M., Amestica, M. and Echeverria, S. (2011). A framework for the design and integration of collaborative classroom games. *Computers and Education.*
- Gagné, R. M. (1965). *Conditions of Learning*. New York: Holt, Rinehart and Winston
- Gomez-Martin, M. A., Gomez-Martin, P. P. and Gonzales-Calero, P.A (2009). *Content Integration in Games-Based Learning Systems*, In Games-based Learning Advancement for Multisensory Human Computer Interfaces: Techniques and Effective Practices (Eds: T.M. Connolly, M.H. Stansfield and E. Boyle). Idea-Group Publishing: Hershey. ISBN: 978-1-60566-360-9.
- Moreno-Ger, P., Sierra-Rodriguez, J. L., and Manjon, B. F. (2008). Games-Based Learning in e-Learning Environment. *Technology Enhanced Learning,* 9(3).
- Nitsche, Michael/ Ashmore, Calvin/ Hankinson, Will/ Fitzpatrick, Rob/ Kelly, John and Margenau, Kurt, 'Designing Procedural Game Spaces: A Case Study' in: Proceedings of FuturePlay 2006 (London, Ontario October 10-12, 2006) (digital proceedings)
- Sauvé, L. (2010). Effective educational games. In Kaufman, D., & Sauvé, L. (Eds.), Educational gameplay and simulation environments: Case studies and lessons learned (pp. 27-50). Portland, OR: Book News, Inc.
- Sauvé, L., & Samson, D. (2004). *Rapport d'évaluation de la coquille générique du Jeu de l'oie du projet Jeux génériques:multiplicateurs de contenu multimédia éducatif canadien sur l inforoute* [Evaluation report on the Mother Goose generic game shell for the project Generic games: Multipliers of Canadian multimedia educational content on the Internet]. Québec, QC, Canada: SAVIE and Fonds Inukshuk inc.
- Tang, S. and Hanneghan, M. (2010), *"Designing Educational Games: A Pedagogical Approach,"* in Design and Implementation of Educational Games: Theoretical and Practical Perspectives, P. Zemliansky and D. Wilcox, Eds., Hershey, PA: IGI Global, ISBN13: 9781615207824, pp. 108-125.
- VanEck, R. (2007), Six ideas in search of a discipline. In B. E. Shelton and D. Wiley (Eds), The Design and Use of Simulation Computer Games in Education (pp. 31-60). Rotterdam, The Netherlands: Sense Publishers.
- Winn, B.M. The Design, Play, and Experience framework, in R.E. Ferdig (ed.), *Handbook of Research on Effective Electronic Gaming in Education* (Vol. III, pp. 1010-1024), Information Science Reference, Hershey PA, 2009.