

## Addendum IX: Final set of codes, their descriptions and number of respective quotes

Code and theme names	Quotes	Description/comment
<b>Categorisation of serious games</b>		
!! Application	43	Taxonomy of (Sawyer & Smith, 2008): games for health, advergaming, games for training, games for education, games for science and research, production or games as work
!! Development - platform or tool	56	Use this code to identify any technique, tool or platform used for the development of the game; make sure to capture (where given) some detail of the technique, tool or platform purpose and/or capabilities
!! Development - technique	38	Refers to any programmatic or modelling technique used by game developers to: (a) overcome some development challenge or limitation; (b) add value to the game; or (c) speed up production of the game; there is no need to capture a detailed description of the techniques as this is outside the scope of the current review
!! Gameplay platform	62	PC, mobile, console, VR mask, VR cave or augmented reality; the researcher will also note if any haptic or kinaesthetic devices were employed
!! Genre	78	Classification of (Herz, 1997): action, adventure, fighting, puzzle, role-playing, simulation, sport or strategy; this may include games that are based on game shows (e.g. Jeopardy, Who Wants to be a Millionaire, Family Feud, etc.)
!! Sector	31	Taxonomy of (Sawyer & Smith, 2008): government & NGO, defence, healthcare, marketing and communication, education, corporate or industry
!! Subject or discipline / purpose	85	The specific discipline that the game addresses within a specific field or application; this is different from "Application" in that games for health is the application (albeit within a given field) while obesity is the specific subject addressed by the game
<b>Design aspects of the game</b>		
## Aesthetics	386	Eight player goals and emotional states (Hunicke <i>et al.</i> , 2004:2): sensation (games as sense pleasure), fantasy (game as make-believe), narrative (game as drama), challenge (game as obstacle course), fellowship (game as social framework), discovery (game as uncharted territory), expression (game as self-discovery), submission (game as pastime)
## Aesthetics - evaluation	112	Any comments that show how the aesthetic emotional states can be (are) affected
## AI	49	Only report the AI technique if the author explicitly mentions it as a game feature; there is no need to go into an algorithmic level of discussion
## AI - evaluation	14	Any comments that show how added AI impacts the game, learning or gameplay experience; no need to discuss computational details of the AI that is used
## Feedback - evaluation	65	Any comments by the author(s) or verbatim phrases by the users themselves that provide a sense of usefulness about feedback experienced in the game being studied or games in general
## Feedback - game to player	188	This is feedback that is typically communicated via a heads-up display in the form of points, health status, number of hits... (i.e. the way the reward mechanic(s) is communicated to the player); this is different from communication feedback that only serves to communicate information (not reward)
## Feedback - game to player communication	66	The way the game: (a) responds to an action taken by the user in order to progress in the game; or (b) communicates with the player
## Fidelity	323	Any statements pertaining to physical fidelity (sound, animation, visual or haptic), interaction fidelity (how accurately the game mimics player desired behaviour), functional fidelity (simulation accuracy and NPC response) or psychological fidelity (noise, emotional content and time pressure)
## Fidelity - evaluation	96	Capture any comments by users or authors about fidelity and how it affects games in general, gameplay and/or learning with serious games
## Fidelity - level	31	Only report this if the author explicitly gives a level (even though it will likely be an opinion)
## General - duration of gameplay	78	This can refer to: (a) the amount of time it would take to complete the game; (b) the amount of time afforded to the participants for study purposes
## General - game style	127	Assistance multi-player games, competitive multi-player games, co-operative multi-player games, multi-player games (MMOG and MMORPG); dating games, arcade games, augmented reality games, meta-games, physical games, real-time games, shared screen multi-player games, single-player campaign games, split screen, turn-based games, 3D games, 2D games; mini-/micro-games; coupled games

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## General - gender design preferences	70	This code highlights any differences in gender preference regarding games, gameplay or learning with games (both serious and entertainment);
## General - guiding gameplay	121	Identifies any given instruction that explains how to play, directs players within the game, presents hints or tips on gameplay (e.g. oral instruction by facilitator, helper avatars; instruction manual; in-game bulletin board, etc.)
## General - human-human interaction	44	This refers to any type of communication that takes place (via any medium) that the player can have with other players; the most typical example of this is a chat interface (for real-time communication)
## General - name of game	47	Just provide the name (if given) of the game being studied
## General - theoretical approach	50	Only the name of the theory, model or framework; there is no need to into extra detail as this falls outside the scope of the review
## Mechanics - additional to game-play	36	Refers to additional (e.g. an integrated glossary or encyclopedia, an accompanying exhibit) and/or follow-up activities (e.g. Lego building to practice skills or discussions concerning the storyline) that are used as part of the learning experience but are not part of the digital gameplay
## Mechanics - controls/controllers used	77	Keyboard and mouse, Wii-type controller, gesturing or posture, joystick, racing wheel and pedals, thermal mouse, controller with haptic feedback, bespoke controller (provide description) and possible others; Also use this code to capture underlying technology for controls/controllers (e.g. GPS, camera, motion sensors, pressure sensors, etc.)
## Mechanics - core	249	This is what the player does over and over (most often) in the game; this does not have a clear-cut set of answers, but may include run, jump, shoot, press buttons, move tokens around, roll dice, drive a car (or other type of vehicle) or others
## Mechanics - evaluation	158	Capture any comments by users or authors about the mechanics or interaction with the interface and how these affect games in general, gameplay and/or learning with serious games
## Mechanics - game objects and what to do with them	218	There is no clear-cut set of answers; make use of the game descriptions to determine these; they may include shift them, collect them, blow them up, rescue them, speak to them, solve a problem or others
## Mechanics - progression	13	This has to do with saving, exiting, pausing, restarting or similar; not to be confused with “Narrative - progression” which relates to anything that progresses the game’s storyline
## Mechanics - reward	185	Points (can include game specific score, health bar, hit points), levels, challenge, virtual goods, leader board, gifting, charity, sound and/or possibly others
## Mechanics - victory	42	Game specific goals (describe briefly), loss avoidance, elimination, puzzle-solving, racing, structure building or territory control (there may be others)
## Narrative	182	Give a very concise rendition of the narrative (this may be verbatim if the author already shortens it); provide any comments that address the game’s story and how it is integrated into the game
## Narrative - evaluation	70	Capture any comments by users or authors about the narrative and how it affects games in general, gameplay and/or learning with serious games
## Narrative - progress through game	94	Linear, open-ended, sandbox or possible others; also use this code to identify if a player needs to perform specific activities to progress the game’s storyline—not to be confused with “Mechanics - progression” reserved for start, stop, save, pause, exit, etc.
## Production - came about	35	Capture indications that explain why the game was made; may include user need, commissioned by government, commercial brief, seemed like a good idea or others
## Production - content related	96	Points out more specific learning content/topics within the game—this is a deeper level than the “!! Subject or discipline” code; this code also shows how the content was decided on and who the decision makers were
## Production - design and dev phases/steps	40	This code should describe any particular steps taken during the design and development phases; can also be used to capture a specific design methodology (e.g. DSR)
## Production - design established	38	This code captures any comments showing who or what was involved purely in the design phase; may include end-user involvement, desktop research, collaborative design, commercial or other
## Production - roles	51	Designer, developer, content expert, pedagogical expert, artist, storyboard writer and sound engineer; this code can also be used to identify vague indications of dev teams (e.g. three teams participated in the design and development of the game)
## Production - testing	9	Refers to any testing of the game (NOT testing the player)
### Feedback - how presented	31	This code very specifically captures how the feedback is given and is usually coupled with the “Feedback - game to player” code

<b>Code and theme names</b>	<b>Quotes</b>	<b>Description/comment</b>
### Feedback - other mechanisms	29	For example, post-game debriefing/summarising by a subject-matter expert or psychological counselling, in-game tracking and recommendation by therapist or caregivers...
### Feedback - when is it given	46	This code very specifically captures when the feedback is given and is usually coupled with the “Feedback - game to player” code; may include immediate, post-game, pre-gameplay or others
### General - camera position/perspective	38	2D (parallel projection, top-down perspective; side-scrolling; 2,5D; 3/4 perspective); 3D (fixed 3D, first-person, third-person); pseudo-3D
### Mechanics - how interaction accomplished	62	This code indicates how interaction is initiated; may include click to select, run over them, click and drag, typing, speaking (i.e. voice recognition is used) or others
<b>Implementation and environment</b>		
\$\$ Distribution or dissemination	23	Points out any mechanisms, channels or networks that were utilised to distribute the game to a wider audience (i.e. the supply side of SGs); categories include (amongst others), packaging, distribution or informing players of availability; also collects information about the commercialisation of the game (if any)
\$\$ Facilitator/mediator perceptions	18	This code captures any mention of how teachers, facilitators, parents and others feel about the use of digital games for learning or entertainment purposes
\$\$ Game evaluation criteria	21	Answers what is considered when evaluating the game or its impact
\$\$ Incentive/motivation for playing	180	Name the intrinsic or extrinsic rewards that the author cites; can also be used to indicate the incentives for taking part in the study—make sure enough context is given to distinguish between study incentives and game incentives
\$\$ Obtaining the game	3	This code captures the demand side of SGs
\$\$ Progress tracking	62	This code explains how (follow-up e-mails, respond to incoming virtual queries about the game, review data collected by the game) and why (ensure smooth continuation of the research, monitor the rate of learning, formative assessment purposes) the game players are tracked in their game progress
\$\$ Requirements - environment	75	Also read requirements as “recommendations”; this code can also be used to capture descriptions of the environment surrounding the implementation of the game or study; the details that need to be in place within the serious games environment (where the games will be used) to secure their successful implementation
\$\$ Requirements - game development	115	Also read requirements as “recommendations”; points to characteristics of the game that are not strictly design elements, but should be in place within the game to allow smooth implementation and integration into the environment (e.g. games should connect to SQL databases); this also includes constructs of the game architecture to ensure more efficient development of similar games (e.g. modular development), reaching a wider user group or smooth integration into common (or limiting) technologies that are in place; why and how this is done (relating to game requirements) can also be identified with this code
\$\$ Requirements - technology	44	Also read requirements as “recommendations”; refers to the requirements the surrounding technology should adhere to for successful implementation with serious games
\$\$ Support - who and how	165	This code captures by who (facilitator, supplementary material, instructional support, therapist and/or others) and how support is provided (by means of telephone (sms, call or some other communication app), over the web (social media or other), e-mail or as in-game avatar; this code refers to learning support where “guiding gameplay” refers to more technical gameplay support
\$\$ Teaching and/or learning approach	108	Use this code to report on any teaching and learning approaches that were undertaken by the teachers or researchers; also capture anything that is expected from the players to be able to meet the learning impact
\$\$ Where is game played/implemented	82	Laboratory, classroom, web, sports field, LMS, in-your-pocket and/or others
<b>Impacts and effects of the study/game</b>		
%% Affective impact	51	When the impact of the game elicits some lingering emotional state or attitude after playing—there is some overlap with behavioural impact (e.g. instill confidence, or generate excitement, happiness, sadness, anger, fear...); not to be confused with psychological fidelity pertaining to emotional states DURING gameplay
%% Behavioural impact	80	Anything concerning intended behaviour change by the game
%% Cognitive effect / Knowledge acquisition	270	Anything concerning intended knowledge transfer or acquisition impact
%% Control group - who/what	48	Use this code to describe the control group used in the study; this is used to determine the extent with which the game had a positive learning impact

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%% Factors affecting impact	199	Some studies test if there are factors that influence the impact(s) of the game (e.g. gender, ethnicity, years in school, major subject in school, work experience...); there are specific codes for these later, but if they affect the games learning impact, it must be captured here
%% Impact intentional/unintentional	2	Mostly to be used if some unintended (surprising) learning has taken place
%% Level of engagement and immersion	137	Use this code to identify text that eludes to how engaged players are with the/a game; the researcher feels that in many instances, immersion is a deeper level of engagement (hence the use of one code for both) triggered by aesthetic
%% Measurement of impact	152	Describes the experiment and how it is set up—although not the intention of the review it may be handy for future work; also note number of participants with this code
%% Motor skill	8	Impact that affects the player's physical ability (e.g. range of motion of a limb, balance, use of specific equipment (laparoscopy tools); improved reflexes are also targeted by this code
%% Physical health	10	This code is particularly suited to games where physical exertion is required to progress with gameplay (i.e. exergames); this is different from motor skills where a specific skill (e.g. to walk again) is impacted; also use this code to capture quotations related to energy expenditure
%% Soft and other skills	21	This code is used to capture skills that do not fall into the cognitive, behavioural or motor skill brackets (e.g. management, communication, negotiation, critical thinking, creative writing, learning to collaborate and cooperate);
& Limitations	88	Points out anything that the game in question or games (serious or entertainment) in general are not able to achieve; this can be because of design, environmental limitations, time constraints and others
& Negative influencers or barriers	132	Refers to any type of negative influence, both from within and outside the game that hampers gameplay or a player's willingness to engage with the game; also use this code to capture challenges that game (serious and entertainment) designers face or need to overcome
& Other serious game examples	37	This code targets the introductions of the primary sources where authors list/name several other SGs that exist; typically some detail (e.g. name, subject discipline, target audience, game style...) is given about the game, which the researcher can arrange during the analysis phase; this code is put in place so that the codes (e.g. ## General - game style, @@ Age, etc.) dedicated to the detail discussion of the game under study is not inundated with mentions of other games
& SG and EG benefits	116	Refers to any benefit that can be drawn from playing not just serious games, but entertainment games as well; this code is particularly used during the introduction and background sections of the articles where more general explanations are given (e.g. engaging medium, stimulates cognitive processes, immersive, hones problem-solving skills, real-time interactivity, mediator for learning, personalisation); although these examples overlap with fidelity, aesthetic and others, this code relays what the benefits are rather than how they were achieved.
<b>Player/user profile</b>		
@@ Age	58	Either given as a numerical range or category
@@ Attitude to subject/discipline	106	Capture any data that eludes to learner attitudes about the subject in question or even learning in general (e.g. students are averse to collaborative learning, workers were keen to learn more about safety, students dropped out of mandatory curriculums)
@@ Disability/health condition	34	Describes any physical, mental or psychological disability the playing audience may have; also indicates other health related issues of the playing audience (e.g. obesity, diabetes, addictions...)
@@ Education - level	81	The educational level of the test participants (e.g. high school (grade if given), primary school (grade if given), pre-primary school, graduate or post graduate); can also be used to indicate if the game is intended for professional settings and training
@@ Education - prior learning/knowledge	73	Refers to any learning that has been undertaken prior to the game intervention that was relevant for gameplay; also use this code for perceptions of existing subject knowledge or measured prior knowledge
@@ Ethnicity	7	Use this to indicate ethnicity of the study participants (if mentioned)
@@ Gamer/gaming behaviour	52	Use this code to highlight habits, tactics or strategies players exhibit in pursuit of playing games (e.g. searching for cheat sheets/codes, researching possible game strategies, mostly play late at night...); used for both serious and entertainment games (grab enough context to distinguish between them)
@@ Gender	48	Male / Female; this code can also be used to indicate gender behaviour differences in gameplay; not to be confused with the code for gender design preferences
@@ Geographic region	44	Region, country, state, province or city/town where the study took place
@@ Language proficiency	8	Any comment regarding the language ability of the players; regardless of the language of the game

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@@ Learning style	29	Four-dimensional model of Felder and Silverman (1988) (sensing-intuitive, visual-verbal, active-reflective, sequential-global); also use this code to indicate other learning style related comments
@@ Perceived usefulness	22	Gathers information on perceptions (from players) of usefulness of serious games in general or the specific game being tested; this code can capture pre- or post-intervention sentiments
@@ Socio-economic status	11	Kuppuswamy socio-economic status scale (lower, upper lower, lower middle, upper middle or upper)
@@ Technology exposure and preference	89	How much access and for how long players have already been using technologies such as smart phones, tablets, PCs and other; also indicates their experience with digital games (entertainment or serious)
<b>Game as assessment tool</b>		
^^ Assessment outcome communicated to player	3	Use this code to indicate any comments about assessment outcomes and how they are communicated to the player
^^ How assessed	50	Observation, assignment, test, oral questions, looking at work products or other
^^ Reflection and debriefing	61	Indicates any reference to reflective sessions or exercises within the study; pay particular attention to debriefing as the researcher views this as a catalyst for reflection
^^ Unit of measure	13	Capture the unit of measure used to assess the player (e.g. number of correct answers, %, mm (if measuring range of motion), nuances of behaviour, etc.)
^^ What is assessed	46	This question also answers, "Why is it measured?"; the why bit is to assess knowledge, understanding, skill or behaviour change; what bit is for example, medieval Amsterdam, nuclear fission, catching a ninja star or fruit and vegetable intake
^^ When assessment	27	When the assessment takes place; may include post-game, in-game, a week after gameplay or others
^^ Where assessment	4	Where (physically) the assessment takes place
^^ Who/what performs assessment	17	May include game itself, facilitator, teacher, mentor, psychologist or others