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Analysis of the supporting websites for the use of instructional games in K-12 settings

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Abstract

This article identifies resources to be included in a website designed to facilitate the integration of instructional games in K-12 settings. Guidelines and supporting components are based on a survey of K-12 educators who are integrating games, an analysis of existing instructional game websites, and summaries of literature on the use of educational software in K-12 settings and teacher technology training. The results indicate that educators face three main challenges when integrating games, including: (a) technical and logistical requirements, (b) curriculum integration, and (c) teacher training. To overcome these challenges, K-12 educators should be provided with: (a) curriculum resources, (b) game information and support, and (c) communication tools. Websites designed to facilitate the use of instructional games should be designed with appropriate structures (ie, grid, web, hierarchy) to optimize organization and simplicity. In addition, the websites should include teacher training that (a) apply a teacher training model, (b) address National Educational Technology Standards (NETS), (c) present contents in small doses, (d) make training and information as accessible as possible, and (e) model and mentor the use of instructional games.

Introduction

With the reemergence of instructional (computer video) games, educators and school media specialists are at the forefront of using innovative technology that may change the way students learn. However, teachers and school administrators face many challenges that inhibit the adoption and integration of instructional games. Time, state-wide

standards and exams, equipment, technical skills and support are just a few of the factors that can limit game-based learning. Teachers need resources to support the implementation of instructional games if they are to be widely adopted and used effectively in K-12 settings.

This article provides recommendations for designing a website to support the implementation of instructional games. Specifically, this article identifies the resources educators need to facilitate the adoption and use of such games, and delineates factors to consider when designing the site. The recommendations and guidelines are based upon four primary information sources, including:

1. A summary of literature on the challenges teachers face in implementing instructional games in K-12 settings;
2. An analysis of existing websites designed to support the adoption and implementation of instructional games;
3. A survey of teachers and school administrative staff who are currently implementing games; and
4. A summary of literature on teacher training and professional development on the use of instructional games in K-12 settings.

The results are reported in five primary sections. Sections I to IV detail the information sources used to gather data. Section V synthesizes the findings and presents a collective list of recommendations and guidelines in order of perceived importance for developing a website to support educators' use of instructional games.

Section I: Challenges with implementing instructional games

Instructional games are not necessarily well designed for use in the classroom. Therefore, teachers need resources to support the implementation of instructional games. Identifying the challenges faced by teachers implementing instructional games assists instructional designers obtain a better understanding of these barriers to address them within supporting websites. A literature search was therefore conducted to help identify and delineate the challenges. A total of 13 relevant articles were found using search engines of EBSCO HOST and Google Scholar with keywords of: teacher barriers and educational games, teacher barriers and educational software, and teaching challenges and educational games.

Table 1 identifies three basic categories of challenges experienced by teachers and school media specialist attempting to integrate instructional games in K-12 settings: (a) technical and logistical, (b) curriculum integration, and (c) teacher training (Amory, Naiker, Vincent & Adams, 1999; Elliot, Adams & Bruckman, 2002; Ertmer, 2005; Foreman, 2005; Kirkley & Kirkley, 2006; Morton, 1996; Simpson, 2005).

[Please place Table 1 here]

Findings indicate instructional games are not being adopted in schools because they (a) do not fit within time school constraints (Klopfer & Yoon, 2005), (b) do not directly

support achievement on state tests (Kirkely & Kirkely, 2006), and (c) are not mapped to specified curriculum (Ertmer, 2005). Furthermore, the results indicate if a game is not easy to implement or solutions to problems can not be found quickly, teachers will forfeit the use of these games. Game developers must ensure the games work with preexisting computer systems (Kirkley & Kirkley, 2006; Klopfer & Yoon, 2006; Morton, 1996). Teachers believe that games will not work without alignment to established school curriculum. Although teachers have been mandated to use technology in the classroom, they have not been given the proper professional development to help facilitate this integration. To facilitate the effective integration of games, these challenges have to be addressed by both game developers and educators.

Section II: Analysis of existing instructional game websites

Two studies were conducted to identify best practices in the design of websites that support the use and integration of instructional games. The first study compared the contents and key features of eleven existing educational game websites, whereas, the second study examined their structures.

First study: Analysis of website contents

With the renewed interest in the use of instructional games in K-12 settings, a number of websites have been published to support teachers' use and integration of games in their classrooms. These websites inform teachers about how to use the instructional games by offering various types of resources such as teacher manuals, unit plans, student handouts, and technical documents. Comparing these websites provides a rich source of information that can be used to help develop effective instructional game support and training websites for K-12 educators.

Cooper's (1988) framework for research synthesis was used to find and analyze websites designed to support the integration of instructional games in K-12 settings. Cooper's (1988) framework included the following stages: (a) problem formulation, (b) data collection, (c) data evaluation, (d) analysis and interpretation, and (e) presentation of the results. This framework was used because it provided a procedural systematic method which increased the validity of research synthesis. Using Google and EBSCO HOST engine, over 25 websites were located and a total of 11 sites met the criteria and were included in the analysis. After analysis, patterns were identified among teacher resources, support, and information offered across sites.

The analysis revealed three groups of key features: (a) curriculum resources, (b) game information and support, and (c) communication tools. Table 2 identifies curriculum resources included within each analyzed website.

[Please place Table 2 here]

Analysis of curriculum resources revealed teacher manuals and sample student activities and assignments, including student handouts, were offered by 4 of 11 websites. Integration strategies and assessment guides, including pre and post-test items, were used by 3 of 11 websites. The least common resources used by only 1 of 11 sites, were lesson

plans and teacher aids that explain the purpose and duration of gaming activities. Five of the analyzed websites did not offer any items from this classification, however, they did provide other potentially useful teacher support and information tools which are described in the following sections.

Table 3 lists the classification of teacher support and information in order of frequency.

[Please place Table 3 here]

Table 3 reveals the most frequently offered teacher support and information were: (a) game overviews, was provided by all 11 websites, (b) partner and sponsor information, which is mainly informative instead of supportive, was provided by 10 of 11 websites, (c) links to game related publications provided by 9 of 11 web sites, (d) list of Frequently Asked Questions (FAQs) was seen within 8 of 11 sites, (e) community information and technical support documents were found to be offered by 7 of 11 websites, whereas, screen shots of games were only accounted for 4 of 11 sites, (f) game manuals, describing game characters and missions, were provided by 3 of 11 websites, and (g) training workshops, whether delivered online and/or face-to-face, were offered by 2 of 11. The least common types of support and information were insider tips, game trailers, flash tutorials, teacher testimonials, and problem reports. Each of these items was provided separately by only 1 of 11 websites.

The last key feature classification, communication tools, can be reviewed within Table 4.

[Please place Table 4 here]

Table 4 indicates email was the most popular tool offered by 8 of 11 websites to facilitate communications, free downloads of support and information are offered by 7 of 11 websites, followed by message boards, offered by 6 of 11, and portals, offered by 5 of 11 websites. Blogs, however, were only implemented within 2 of 11 analyzed sites. The least popular communication tools were found to be virtual library (ie, NICI, the National Institute for Community Innovations) and WIKIs, each was offered separately by 1 of 11 websites.

In total, 27 key features were identified within the three classifications of (a) curriculum resources, (b) game information and support, and (c) communication tools. As specified within Tables 2, 3 and 4, of 11 websites, the Re-mission website (www.re-mission.net/) and the Virtual U website (www.virtual-u.org/) contained the most number of key features with 15 features, followed by Quest Atlantis (atlantis.crlt.indiana.edu) with 14 features. The average number of features offered by 11 websites was 10.

Second study: Analysis of website structure

The basic structure of websites used to facilitate educators use of instructional games is believed to be as important as the contents of the website. To identify patterns of practice, the above eleven websites were analyzed according to four basic website structures as defined by Lynch and Horton (1999), including: sequence, grid, hierarchy and web.

Based on a literature search conducted in EBSCO HOST, Lynch and Horton (1999) provided the most inclusive website structure guide that can be used to categorize the structure of game websites. Figure 1 illustrates the organization of each of the four suggested web structures.

[Please place Figure 1 here]

Sequence is the simplest way to organize information in a linear narrative format. Grid structure is useful for developing websites that correlate a number of topics. Most of the procedure and manual websites are designed using this structure. Hierarchically structured websites are designed as off shoots of a single website. Information hierarchy is the most common way of organizing websites. Most users are familiar with this structure. Web structure imposes limited restriction on the pattern of the information use. All of the sub-web pages can be accessed from all sites. This structure could be confusing for the users and is good for small websites due to its limited organization.

Table 5 indicates that 7 of 11 instructional websites adopted the grid structure, 3 websites adopted the web structure, and only 1 website adopted the hierarchy structure. None of the reviewed instructional games adopted sequence structure. Large websites with high amount of information adopted the grid structure while small websites with low amount of information adopted the web structure.

[Please place Table 5 here]

To better depict the four web structures screen shots of some reviewed game websites are provided. The examples of grid educational game sites are SimSchool, Quest Atlantis, Global Island, Virtual U, Army Excellence in Leadership (AXL), A Force More Powerful, and Re-mission. SimSchool as an example of grid structure is shown in Figure 2.

[Please place Figure 2 here]

Figure 2 illustrates how information on the SimSchool website is grouped under three main topics. The sub-web pages are accessible only from upper level pages in SimSchool. In addition, using parallel links and sub grouping topics in the SimSchool website is very similar to grid structure.

The KinEtic City website, an example of hierarchy structure is shown in Figure 3.

[Please place Figure 3 here]

As Figure 3 shows, sub-pages of KinEtic City are accessible only from its home page. This structure is similar to hierarchy structure as its home page is seen as one single website containing off shoots from the main site.

Discover Babylon, Rapunsel, and Immune Attack are examples of the web structure. Figure 4 shows Immune Attack websites.

[Please place Figure 4 here]

As shown in Figure 4, all sub-pages in Immune Attack are accessible throughout the entire Immune Attack website.

A comparison of the four different web structures according to Lynch and Horton (1999) are provided in Figure 5.

[Please place Figure 5 here]

Lynch and Horton (1999) comparison shown in Figure 5 indicates that grid and hierarchy optimize organization and simplicity of the contents. The web structure may be confusing especially for large websites and sequence is appropriate for very simple websites with basic content. The result of Lynch and Horton (1999) comparison are in agreement with the results of this study which indicate that large instructional game websites with greater amounts of information adopted grid structure while small game websites with less information adopted a web structure.

In addition to site structure, a number of other critical issues in designing websites to facilitate the use of instructional games have been revealed as a result of analyzing and comparing the eleven game websites, including:

- The game website content should be accessible to all users including those with disability. This feature is referred as accessibility and its importance is stressed by Lynch and Horton (1999). The game website should meet the accessibility defined by World Wide Web Consortium guidelines available at (www.w3.org/WAI). The website text should be written and evaluated for the target audience readability.
- The game website should apply colors, text, and themes consistent with games.
- The game website should include tabs and/or differential access for parents, educators, and technical support staff as different groups of stakeholders have different needs and interests

Section III: Survey of teachers and school administrators

Approximately 40 educators in 6 middle and high schools in Florida, Texas and Washington D.C. who are currently implementing a math instructional game were surveyed to identify the information and resources they believe would help facilitate the integration of instructional games. Twenty-two educators, including teachers, technology support staff, and administrators responded to the survey provided in Appendix. The survey consisted of total of 50 questions with 32 Likert-scale items, 5 open-ended questions, and 13 closed-ended questions. The 32 Likert-scale items developed based on the components of the reviewed websites described in Section II.

Respondent's included: (a) twelve females and ten males, (b) sixteen teachers with an average of seven years teaching experience, three technologists, and three school

administrators, (c) eleven born between 1961-1979, five after 1980 and six before 1960, (d) eleven self reported non-gamers, nine casual gamers and two avid gamers, and (e) all had computers at home with connection to the Internet.

Potential responses to each Likert scale item ranged from a score of 5 = essential, 4 = very useful, 3 = useful, 2 = somewhat useful, to 1 = little to no use. Of the 32 Likert scale questions, the mean scores of ten items were greater than 4.0 (very useful to essential). These results are listed in rank order in Table 6.

[Please place Table 6 here]

The greatest concerns regarding the integration of instructional games, as noted in responses to the open-ended section of the survey included: (a) fitting of the game into curriculum, learning time versus playing time, ease of use, complexity of game-playing or time to learn how the game works (noted by five of the twenty-two respondents), (b) matching the game portions and missions to benchmarks or state standards (suggested by four of the twenty two respondents), and (c) other concerns such as students' preference for game format, interruptions during class, time to organize students, ability to search and sort by objectives and benchmarks, hardware requirements, and game missions resetting if students do not complete the game in one sitting. In addition, the following components were suggested for inclusion in game websites: (a) available student reports, (suggested by three of the twenty two respondents), and (b) benchmarks, help menu, lesson plans, and FAQ's for both teachers and tech support (suggested by one of the twenty two respondents).

Section IV: Review of teacher training and professional development

To identify factors to consider when designing training on the use of instructional games, a literature search was conducted using EBSCO HOST search engine and the keywords of educational games, professional development, teacher resources, effective usage, and continuing education. As a result, 179 articles were found. Most findings only addressed physical game usage within the classroom, or discussed perceived feelings towards the usage of educational software in general. Only 12 resources were found related to training on the use of instructional games and reviewed for this section.

The findings revealed that teacher training and professional development on the use and integration of instructional games, whether face-to-face or in electronic format, may include, but are not limited to:

- Worksheets
- Student usage rotation schedules
- Student Learning stations
- Step-by-step teacher guides
Resource guides (text & multimedia formats)
- Instructional game content guides
- Class practice calendars for unit/modules completions
- FAQs
- Student question sheet creation that align with district objectives
- Game/units comparison sheets
- Assessment rubrics

(Morrison & Lowther, 2005; Roblyer, 2003)

The findings also revealed a number of guidelines for designing teacher training on the integration of instructional games that may be included as an integral component of game websites

Guideline I: Apply a teacher training model

The process of how to train teachers, otherwise known as teacher professional development, should follow a professional training model (Smaldino, Russell, Heinich & Molenda, 2005; Roblyer, 2006). Most of these models, however, are of large scale and reflect much of the overall analysis and design process educators must go through to utilize technology in their classroom. These models do not necessarily address the localized implementation process of educational software, but much can be gained by following their prescribed development steps.

Two frequently referred to models are the ASSURE and TIP models. The ASSURE model, named after its basic tasks (i.e., Analyze, State, Select, Utilize, Require and Evaluate), is meant for the individual instructors as they focus upon media implementation and usage in the classroom (Smaldino et al, 2005). Whereas the Technology Integration Planning (TIP) model can be implemented without regard to any instructional strategy (Roblyer, 2006), much like the focus of an online instructional repository such as an educational website.

Technology implementation and usage in the classroom requires significant preparation (Newby, Stepich, Lehman & Russell, 1996). Media must not only match methods used, but the overall course objectives as well. In drill and practice or simulation case, only sections of the above models are encouraged to be used since the entire process is too involved. Teachers may already have performed this type of analysis or training on a larger scale for planning their lessons, thus it is not necessary to repeat whole models for one component within the overall lesson.

Guideline II: Address national educational technology standards (NETS)

Professional development should (a) introduce the technology to educators (Salpeter, 2003), (b) show how other educators are using the technology in their area (Salpeter, 2003), (c) reinforce national and local objectives (McKenzie, 2001; NCATE, 2006), and (d) demonstrate how the use of the educational software will extend their classroom capabilities (Weston, 2005). Therefore, it is the task of each instructional designer, trainer and educator to ensure that teachers' professional development include correlations to the latest National Educational Technology Standards (NETS) available at <http://cnet.iste.org/>.

Guideline III: Present training in small dose

The goal of educational software integration must be shown in small doses, repeated, and demonstrated at a pace that is not overwhelming to the educator; otherwise they may step away from the entire implementation process (Weston, 2005). Many professional

development programs make use of hands-on training labs when technology is being considered (Salpeter, 2003).

Guideline IV: Make training and information as accessible as possible

Teachers simply do not have the time to stop teaching their lessons to go to long professional development training sessions. Therefore, training and information on the implementation of educational software (including games) must be readily accessible.

A professional development website should also allow teachers to collaborate with their counterparts to create a societal synergy (Salpeter, 2003). All sessions must be created with the understanding of limited time requirements and made available when teachers are available (electronically whenever possible) outside of their classrooms (Wiemer, 2006). However, in some cases, skills offered in electronic professional development may be learned out of context and resulted in questioning the mission behind the professional development (McKenzie, 2001). Therefore, online professional development must show relevance to the curriculum being taught (Ma, Andersson & Streith, 2005).

Guideline V: Model and mentor use of educational software

Based upon teacher surveys, Salpeter (2003) suggests teachers feel ongoing training is a necessity, and that online communities, modeling, mentoring, and case study demonstrations are the best types of professional development for a well-connected, strategically aligned community, such as education. Ongoing modeling and mentoring allow educators to perform their jobs to the best of their ability; hence giving credibility to the usage of electronic professional development.

Section V: Conclusions, recommendations and guidelines

A synthesis of findings from the four primary information sources reported in Sections I to IV of this article indicate that to facilitate the adoption and use of instructional games educators need:

1. Information to address technical and logistical challenges
2. Information to address curriculum challenges
3. Communication tools to facilitate interactions between the game designers and educational partners as well as among educational partners
4. Training on the technical use and curriculum integration of the instructional game

Based on the findings, game designers should publish the following information and resources on a website designed specifically for educators to facilitate the adoption and implementation of the games. The information and resources are grouped into two categories (ie, Technical and Logistical, and Curriculum Integration) and are presented in order of perceived value and importance for educators (see Table 7). A set of guidelines for designing and delivering the resources for K-12 educators follows.

[Please place Table 7]

The recommended guidelines for posting online information and resources include:

1. Use an appropriate structure (ie, grid, web, hierarchical) as described on the Website Analysis section and suggested by Lynch and Horton (1999).
2. Write and evaluate text for target audience readability as described on the Website Analysis section.
3. Include multimedia elements when possible as described on the Website Analysis section.
4. Address accessibility issues suggested by World Wide Web Consortium guidelines available at (www.w3.org/WAI) as suggested by Lynch and Horton (1999).

The recommended guidelines for the design and delivery of training include:

1. Training should be systematically designed to address learner needs and contextual requirements, and to ensure alignment between objectives, instructional strategy and assessments (Smaldino et al, 2005; Roblyer, 2006).
2. Training should address both technical and logistical issues, as well as curriculum integration issues (Newby et al, 1996).
3. Training should be provided in small doses (Weston, 2005).
4. Training should delivered both Face-to-Face (f2f) and online. Face-to-Face sessions should use online materials as much as possible to facilitate transfer (Wiemer, 2006).
5. Technical training on use of games and teaching modules should include job aids that participants may refer to after the training session (MacKenzie, 2001; Salpeter, 2003).
6. Training should introduce the technology and topic to educators, show how other educators are using technology in their area, reinforce national and local objectives, and demonstrate how the use of this educational software will extend their classroom capabilities (Salpeter, 2003).
7. Training should be ongoing and include the formation of online communities. modeling, mentoring, and case study demonstrations (Salpeter, 2003).
8. Training should address the latest version of National Educational Technology Standards (NETS) for both educators and students (IsteNETS, 2005).
9. Training should be as accessible as possible (Salpeter, 2003).
10. Effort should be made to coordinate training opportunities with school districts so that teachers earn professional development credit for their efforts (Walker, Laboube & Birkenholz, 2002).

The information and resources given to support the implementation of instructional games are believed to be as important for optimizing learning as the quality of the game. It is hoped that the recommendations and guidelines identified by this study provide a practical framework for developing websites to facilitate the use and integration of instructional games. The next step is to evaluate the perceived usefulness of websites that apply the posited guidelines. Future studies should test the clarity, feasibility, and impact, as well as the usability of such websites. Formative evaluations and usability tests are recommended for improving instructional resources (Reigeluth & Frick, 1999) and may also be used to test the posited guidelines and resulting websites.

Appendix

Online Teacher Resource Survey

To facilitate your use of instructional computer games in your school, we would like to know what tools, training, and information you would like to see on the game websites to facilitate your use of the games. This questionnaire consists of 50 closed and open-ended questions. It should take you approximately 15-25 minutes to complete. Please return the questionnaire to Dr. Atsusi “2c” Hirumi at your earliest possible convenience.

Your time and insights are greatly appreciated.

Concerns

1. When you think about an instructional game, what are your greatest concerns? Please list them in priority order.
2. What actions are being taken (or should be taken) to rectify these concerns?

Information

What types of information would help you use and integrate instructional games? Please rate each item in terms of relative value to you personally and please let us know if you have any additional recommendations for information to put on the web site.

Information on National and State Standards and Product Specific Information	Little to No Use	Somewhat Useful	Useful	Very Useful	Essential
<u>Instructions</u> Please circle one answer for each statement below					
3. List of targeted learning objectives organized by games and game missions.	1	2	3	4	5
4. Data base correlating learning objectives to your specific state standards.	1	2	3	4	5
5. Data base correlating learning objectives to national standards.	1	2	3	4	5
6. News reports and updates about national standards.	1	2	3	4	5
7. News reports and updates about your state standards.	1	2	3	4	5
8. Directory of the instructional game partners and centers (schools using the instructional game nationwide)	1	2	3	4	5
9. Directory of other the instructional games partners (universities, researcher centers)	1	2	3	4	5
10. Brief description of all related game products and services.	1	2	3	4	5
11. Brief description of the benefits and targeted outcomes of instructional games related products and services.	1	2	3	4	5

12. Brief description of pedagogical foundations and design of each instructional games related product.	1	2	3	4	5
13. Cheats. Short description of how to get through each game level.	1	2	3	4	5
14. Short video clip and description of each mission contained in games.	1	2	3	4	5
15. Sample lesson plans (following conventional teacher-directed lesson planning model).	1	2	3	4	5
16. Sample lesson plans (following learner-centered, inquiry based approach to teaching and learning).	1	2	3	4	5
17. Sample pre-tests and post-tests to measure student learning.	1	2	3	4	5
18. Student handouts and worksheets.	1	2	3	4	5
19. List of Frequently Asked Questions (FAQ's).	1	2	3	4	5

General Instructional Game Information					
<u>Instructions</u> Please circle one answer for each statement below	Little to No Use	Somewhat Useful	Useful	Very Useful	Essential
20. Brief summary of benefits and reasons for using instructional games to enhance learning and student motivation.	1	2	3	4	5
21. Bibliography of books, articles and web sites dedicated to game-based learning.	1	2	3	4	5
22. Annotated bibliographies of books and articles on game-based learning.	1	2	3	4	5
23. News reports and updates about game-based learning and digital video games.	1	2	3	4	5
24. Information about game related professional organizations and conferences.	1	2	3	4	5

Additional Information Resources

25. Are there any other types of information that you would like to see posted on the game Teacher Resource web site that would help you (or other teachers) use and integrate the games? Please list below and note relative value along with each item.

Telecommunication Tools

What types of telecommunication tools would help you use and integrate instructional games? Please rate the relative value of each tool and please let us know if you have any additional recommendations for tools to put on the web site.

Tools					
<u>Instructions</u> Please circle one answer for each statement below	Little to No Use	Somewhat Useful	Useful	Very Useful	Essential
26. Open Message Board (asynchronous user discussion board)	1	2	3	4	5
27. Scheduled Chat Sessions (with pre-specific topics)	1	2	3	4	5
28. Open Chat Area	1	2	3	4	5
29. Instant Messenger (with indicator of who is currently online)	1	2	3	4	5
30. Blog (a web site where entries are made in journal style and displayed in a reverse chronological order).	1	2	3	4	5
31. Wiki (Web site that allows the visitors to easily add, remove, and otherwise edit available content).	1	2	3	4	5
32. Scheduled Desktop Videoconferences (with pre-specific topics)	1	2	3	4	5
33. Open Desktop Videoconferencing Area	1	2	3	4	5
34. Help Desk	1	2	3	4	5
35. Data base of game related Lesson Plans (created by teachers)	1	2	3	4	5

Additional Tools

36. Are there any other tools that you would like to see available on the web site that would help you (or other teachers) use and integrate instructional games? Please list below and note relative value along with each item.

Demographic Information

37. Your Name: 38. Gender: a. Male | b. Female
39. Phone Number: 40. Email Address:
41. School Name: 42. Job Title:
43. Your birthday (please circle one):
- a. before 1945 (Silent Gen)
 - b. 1945-1960 (Baby Boomers)
 - c. 1961-1979 (Gen X)
 - d. after 1980 (Digital Natives)
44. What classes do you teach?
45. How long have you been teaching Pre-Algebra, Algebra or other math subjects?
46. How often do you play video games (average number of hours and times per week)?
47. Which title best describes you (please circle the most appropriate title)?
- a. Avid Gamer
 - b. Casual Gamer
 - c. Non-gamer
48. Do you have a computer at home? If so, approximately how old is it and is it connected to the Internet?
49. Do you have any questions or additional comments you would like to convey to the instructional game developers?
50. Can we contact you to discuss your answers and gain further input?
- a. Yes | b. No

Thanks Again for your Time and Input!

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Tables:

Table 1: Summary of challenges facing teachers

Challenges	Details
Technical & Logistical Challenges	<ul style="list-style-type: none"> • Working with preexisting systems • Authentic use of communication tools • Ease of use • Technical support • Scheduling problems • Not enough chairs/computers • Broken or inadequate computers. • Time constraints (for teachers to implement and students to use games)
Curriculum Integration Challenges	<ul style="list-style-type: none"> • Unstructured lessons that did not go along with the curriculum • Clear presentation of what students are learning • Ease of implementation/integration • Gender and cultural biases • Use with students with disabilities • Learner assessment methods • Cost effective (student achievement vs. time playing)
Teacher Training Challenges	<ul style="list-style-type: none"> • Needs to address individual teacher practices and methods • Lack of training (computer software and classroom management) • Variance in (technical) ability • Teacher support teaching from prior experiences • Monitoring of students appropriate use

Table 2: Curriculum resources included in instructional game websites

Instructional Game Website	Curriculum Resources					
	1. Teacher Manual	2. Student Activities	3. Integration Strategies	4. Assessment Guide	5. Lesson & Unit Plans	6. Teacher Aids
1. Quest Atlantis	X	X		X	X	
2. Re-mission	X					
3. SimSchool						
4. Rapunsel						
5. Discover Babylon						
6. Virtual U	X	X	X			

7. Army Excellence in Leadership (AXL)					
8. A Force more Powerful		X			
9. Kinetic City		X	X	X	
10. Immune Attack			X		
11. Global Island		X		X	X
TOTALS		4	4	3	3

Table 3: Teacher support and information contained in instructional game websites

Instructional Game Website	Teacher Support & Game Information													
	1. Game Overview	2. Partners & Sponsors	3. Publications	4. FAQ	5. Community Information	6. Technical Support	7. Screen Shots	8. Game Manual	9. Training Workshops	10. Insider Tips	11. Game Trailer	12. Flash Tutorials	13. Teacher testimonial	14. Problem Report
1. Quest Atlantis	X	X	X	X	X	X	X		X					
2. Re-mission	X	X	X	X	X	X	X	X		X	X			
3. SimSchool	X	X	X		X									
4. Rapunsel	X		X				X							
5. Discover Babylon	X	X	X						X					
6. Virtual U	X	X	X	X	X	X			X			X		X
7. Army Excellence	X	X	X	X										
8. A Force more Powerful	X	X	X	X	X	X								
9. Kinetic City	X	X		X	X	X		X						
10. Immune Attack	X	X	X	X		X							X	
11. Global Island	X	X		X	X	X	X	X						
TOTALS	11	10	9	8	7	7	4	3	2	1	1	1	1	1

Table 4: Communication tools available on instructional game websites

Instructional Game Websites	Communication Tools						
	1. Email	2. Downloads	3. Message Boards	4. Portals	5. Blogs	6. Wikis	7. Virtual Library
1. Quest Atlantis	X	X					
2. Remission	X	X	X		X		
3. SimSchool		X	X	X	X		X
4. Rapunsel						X	
5. Discover Babylon				X			

6. Virtual U	X	X		X			
7. Army Excellence in Leadership (AXL)	X		X				
8. A Force more Powerful	X	X	X	X			
9. KinEtic City	X		X	X			
10. Immune Attack	X	X	X				
11. Global Island	X	X					
TOTALS	8	7	6	5	2	1	1

Table 5: Web structures of eleven reviewed instructional game websites

Instructional Game Web site	Web Structures			
	1. Sequence	2. Grid	3. Hierarchy	4. Web
1. Quest Atlantis		X		
2. Remission		X		
3. SimSchool		X		
4. Rapunsel				X
5. Discover Babylon				X
6. Virtual U		X		
7. Army Excellence in Leadership (AXL)		X		
8. A force more Powerful		X		
9. KinEtic city			X	
10. Immune Attack				X
11. Global Island		X		
TOTALS	0	7	1	3

Table 6: Level of usefulness of game supporting components from educator's perspective

Level of Usefulness of Components from Educators' Perspectives	Game Supporting Components
High level of usefulness with a Mean >4.0 and Standard Deviations between .802 and 1.362	<ol style="list-style-type: none"> 1. Data base correlating learning objectives to the specific state standards. 2. List of targeted learning objectives organized by game and mission. 3. Sample pre-tests and post-tests to measure student learning. 4. Student handouts and worksheets. 5. Short video clip and description of each mission contained in games. 6. Sample lesson plans (following teacher-directed lesson planning model). 7. Sample lesson plans (following inquiry based lesson planning model). 8. Data base of Lesson Plans created by other teachers. 9. List of Frequently Asked Questions (FAQ's). 10. Online access and phone number to Help Desk.
Medium level of usefulness with a Mean between 3.0 and 4.0 and Standard Deviations between	<ol style="list-style-type: none"> 1. Screen shots and information on available student records and data. (Only 7 educators responded to this question due to changes made to the initial draft of the questionnaire) 2. Cheats. Short description of how to get through each game level. 3. Brief description of pedagogical foundations of game designer products.

1.901 and 1.377	<ol style="list-style-type: none"> 4. News reports and updates about (your) State standards. 5. Data base correlating learning objectives to national standards. 6. Brief description of the benefits and targeted outcomes of each product. 7. Brief summary of benefits and reasons for using video games.
Low level of usefulness with a Mean <3.0 and Standard Deviations between .950 and 1.262	<ol style="list-style-type: none"> 1. News reports and updates about national math standards. 2. Directory of instructional game Partners and Centers (nationwide) 3. Directory of other instructional game Partners (universities, researcher centers) 4. Brief description of all game designer products and services. 5. Bibliography of books, articles and web sites dedicated to game-based learning. 6. Annotated bibliographies of books and articles on game-based learning. 7. News reports and updates about game-based learning and digital video games. 8. Information about game related professional organizations and conferences. 9. Open Message Board (asynchronous user discussion board) 10. Scheduled Chat Sessions (with pre-specific topics) 11. Open Chat Area 12. Instant Messenger (with indicator of who is currently online) 13. Blog (website where entries are made in journal style) 14. Wiki (website that allows users to add, remove, and edit contents). 15. Scheduled Desktop Videoconferences (with pre-specific topics). 16. Open Desktop Videoconferencing Area.

Table 7: Recommended information and resources for supporting teachers' use

Information and Resources	Recommended Components
Curriculum Integration	<ul style="list-style-type: none"> • Student reports (documenting time, access and achievement). • List of targeted learning objectives organized by game and mission. • Data base correlating learning objectives to specific state and national Standards. • Sample pre-test and post-test items to measure student learning for each game or game mission. • Lesson plans for each game/mission that fit into a 60 or 90 minute period. • Research from reputable source on impact of specific games on learner math achievement and motivation. • Short video clips and description of each mission contained in each game. • Brief description of pedagogical foundations of the instructional games and services (eg, training). • Training on how to integrate games and teaching modules into school curriculum. • Quick reference on how to incorporate special education standards. • Student handouts and worksheets, and supplemental student activities for each game/mission.

**Technical and
Logistical**

- FAQs regarding curriculum integration.
 - Downloadable samples/demos of each game and teaching modules.
 - Information and screen shots of student reports.
 - Brief summary of benefits and reasons for using video games.
 - Database of lesson plans created by teachers.
 - Online Bulletin Board Discussion Forum.
-
- Training (simulations) on how to use games and teaching modules.
 - Quick reference of computer requirements, including information on how to set up stations and how to install and uninstall games and teaching modules.
 - Reference guide on how to implement games and teaching modules with a single computer, classroom computers, computer labs, with in and after school and home access, including student usage rotation schedules and lab scheduling.
 - FAQs addressing technical and logistical issues.
 - Online access (via email) and phone number to Help Desk.
 - Cheats. Short description of how to get through each game level.
 - Online Bulletin Board Discussion Forum.
-

Figures:

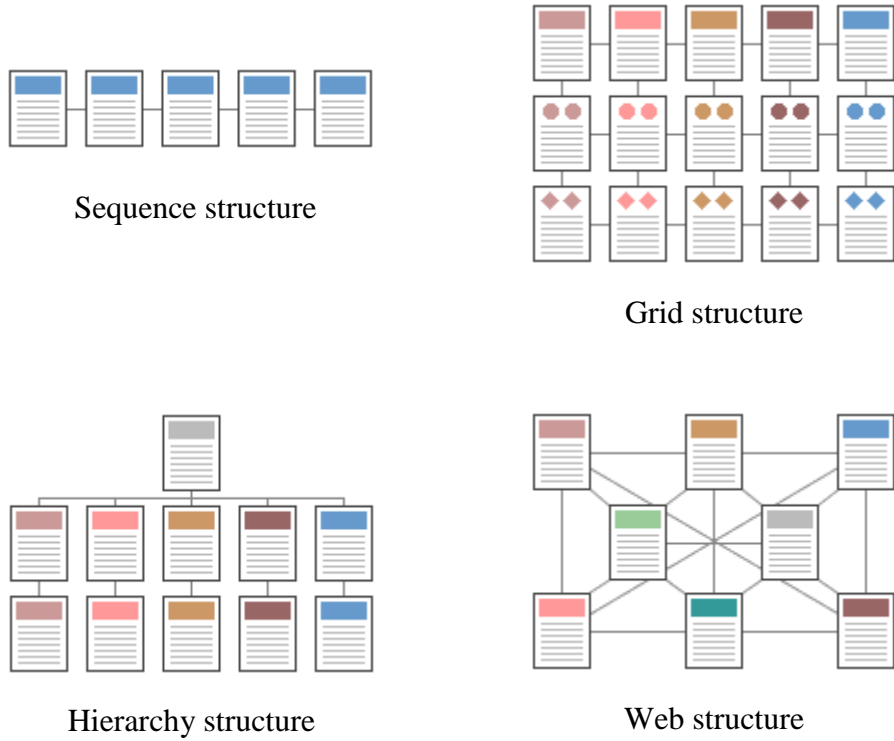


Figure 1: Four basic types of website structure

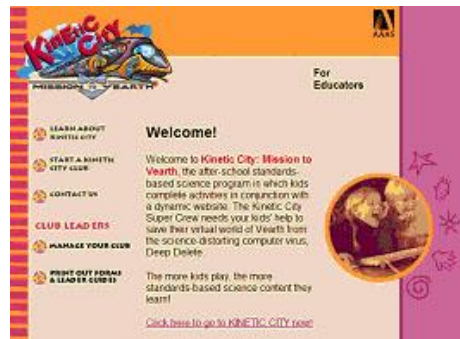
Note. From “Web style guide: Basic design principles for creating web site” by P. Lynch, and S. Horton, 1999, New Haven: Yale University Press. Retrieved from <http://info.med.yale.edu/caim/manual/contents.html>. Copyright 1999 by Lynch and Horton. Adapted with permission of the authors.



Figure 2: Screen shots of SimSchool as example of grid structure



KinEtic City Home Page

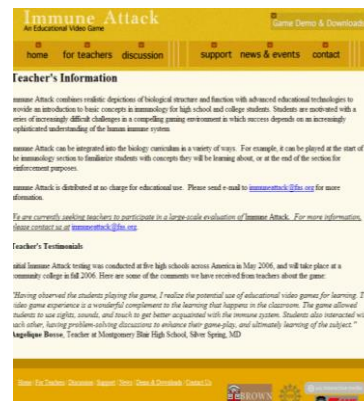


KinEtic City Educator Sub-Page

Figure 3: Screen shots of KinEtic City as an example of hierarchical structure



Home page



For teachers sub-site

Figure 4: Screenshots of immune attack with web-like structure

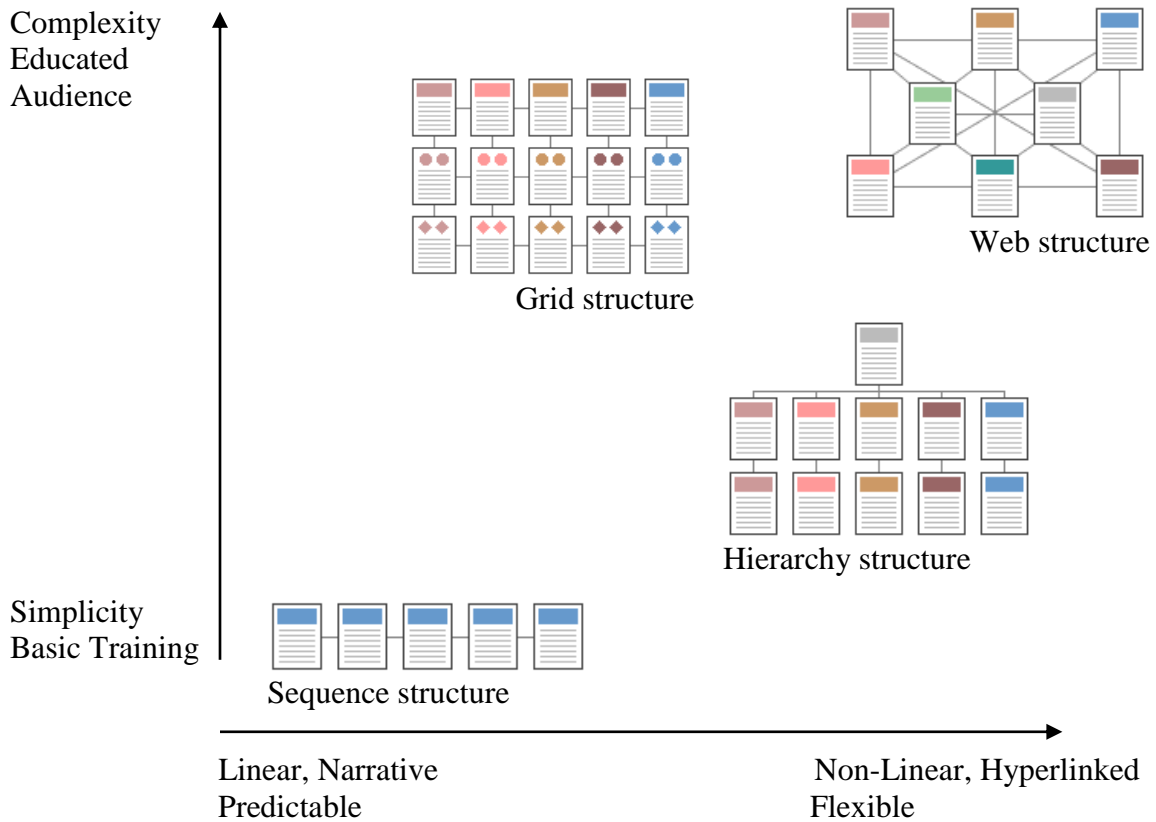


Figure 5: Comparison of the four website structures

Note. From “Web style guide: Basic design principles for creating web site” by P. Lynch, and S. Horton, 1999, New Haven: Yale University Press. Retrieved from <http://info.med.yale.edu/caim/manual/contents.html>. Copyright 1999 by Lynch and Horton. Adapted with permission of the authors.