

Research Proposal  
**Intelligent Swarm, a program to improve social learning tools**  
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### ***Abstract***

This paper describes Intelligent Swarm, a program designed for instructional technologists to improve the effectiveness of social learning tools through iterative work in an online emergent system. The research environment is a Pattern Library, an affinity space where patterns of social learning and tool use are exchanged and modified over time.

Work in the environment described here may help answer questions upon these scales:

- Individual-level. What patterns of social learning can help manage the Learner's attention, mitigate fragmentation and maximize benefits?
- Team-level. What factors encourage or inhibit dynamism in a social network?
- System-level. How can a pattern library be built as an adaptive environment?
- Cultural-level. What can Connectivist learning theory contribute to the revitalization of educational systems?

While answers for these questions are beyond the scope of this paper, those who are working to answer them may find common ground in Intelligent Swarm.

*This proposal was been developed in the context of studying in these seminars at San Francisco State University, Fall, 2009. ISED 797, Research Writing, H. Hyun; ITEC 830 Emerging Multimedia Design for Instructional Technology, K. Foreman; ITEC 860, Distance Education, B. Beatty.*

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## **Purpose**

The Intelligent Swarm Pattern Library is proposed to serve as an affinity space [Gee, 2007], a peer-to-peer knowledge exchange for instructional designers from in-training - through journey - to expert- levels of experience. A fundamental assumption that will guide development is that every participant has something to learn and to teach. The currency of information exchange is the Social Learning Pattern. The primary work product is expected to be metacognition [Gunawardena, et al, 2009] and measurable improvements in the functionality of socially mediated educational environments built by participants. In addition to increased awareness of social learning patterns this framework will also provide occasions to explore dynamics within social networks. For example there will likely be creative tension between altruism and intellectual property related to contribution or between flexibility and structure in a rules-based environment. When connections between patterns are made explicit they are map-able to different domains rendering “thinking visible” [Collins, Brown & Holmes, 1991] which will further contribute to metacognition and discourse.

## **Justification**

Use of Social Media is a viral phenomena widely affecting the ‘born digital’ generation and any current consumer of information [Bohm & Short 2009].<sup>1</sup> From a cognitive perspective impacts of social media’s uses are not well understood though their power is evident. <sup>2</sup> Solid instructional design requires a

more firmly grounded understanding of the ways social media operates and how it changes the user and therefore learner's perception, motivation and expectations. Successful teaching and learning must follow the student's needs as they shift with their environment. Increasingly, full social participation requires social media literacy and The Student is everyone at every age so instructional design practices must learn to benefit from the deeper structural organization that makes the widest accessibility possible [Lazar, 2007]. The current economic stress in California only further emphasizes scarcity of educational resources that increase pressures on communities to mediate learning environments with more distance education. It is possible that sound interface design deploying social media can help reduce transactional distance in distance education<sup>3</sup> but precisely, how? Many people pride themselves on being "on, on all channels, 24/7". Popular wisdom about the efficiencies that social media offers runs counter to current research outcomes. At Stanford University cognitive scientists have shown that massive multitasking not only degrades information processing performance (impacting both discrimination and memory) during the multitasking behavior but at other times while only one task is being attempted. [Ophir, et al, 2009] With increasingly complex criteria to meet, instructional designers may satisfy them through work in a complex<sup>4</sup> system; to study and adapt through an emergent system.

## **Methods**

### Description

The Intelligent Swarm Pattern Library employs a variation on the theme of Teacher Action research design deployed in a collaborative, hybrid<sup>5</sup> teaching and learning system. Users of the pattern library may document patterns of work done synchronously or asynchronously, remotely or locally. Discourse about the patterns will also occur in these modes. Activity within the network will be supported by intersecting abstract, logical and phenomenological frameworks. The abstract (theoretical) layer is based upon Connectivism which asserts that learning occurs by making connections between ideas, people, places and that meaning is developed socially and by interactions with models. The logical layer will be ordered through social network dynamics in a web interface with form-based data input<sup>6</sup>. The concrete experience of the environment will be structured following user-centered interface design best practices. Requirements of this system include that it learn from its users' interactions and support adaptation through cycles of iteration while emphasizing accessibility and clarity.

### Definitions

Cloud: Extension of the human nervous system through web-based tools into Web 2.0 cognitive and community space.

Connectivism: Learning Theory that postulates that meaning occurs in the connections between people and between ideas.

Dynamism: Degree of energy flowing through a system.

Emergence: Systemic conditions that emulate life - homeostasis (self-stabilizing), adaptability (towards self-sustainability), auto-catalysis (self-organizing movement).

Instructional Design: The purposeful structuring of information and experiences to create specific frameworks of understanding and ability.

Metacognition: Reflections upon knowledge and ways of acquiring knowledge.

Massive multitasking: Individuals who use multiple modes or channels of communication at once ( smart cell phone with facebook page, tweeting or micro-blogging, video game, voice conversation, sports).

Pattern Library: Collection of methods for relating information, organizing interactions or structuring experiences.

Social Learning: Making connections between concepts or bodies of knowledge by interaction with or observation of other people.

### Context Analysis

The proposed social context for Intelligent Swarm is a university-based design laboratory. The instructional context is an interactive online pattern library built from freeware and social media tools to collect and exchange information about social learning patterns and tools. It will work to uncover and leverage particular abilities encouraged by use of social media for co-creation and expansion of knowledge related to instructional design. This system will allow designers to share solutions as patterns that other designers can respond to and learn from. Reciprocity will help regulate and energize exchanges between researchers [Bandura, 1990]. Assuming that the fundamental requirement of dynamism is met investigations can operate at the scale of projects, tools and

populations. The prototype is available here:

<http://sites.google.com/site/swarmintelligence/>

### Learner Analysis

This system will support instructional designers at the graduate and practicing professional-levels in a peer-to-peer exchange. These learners will have fluency with regard to diverse learning theories and online instructional strategies and will apply their knowledge to iterate various teaching and learning solutions in social media<sup>7</sup>. A dynamic social network that uses and elaborates social learning tools and patterns will serve to build a knowledge network within the Instructional Technology community that externalizes and improves our collective practice and individual expertise.

### Challenges

The central challenge of this project is to activate and maintain a social network as a research platform. Relevance requires dynamism. Clarity requires structure. There will likely be tension between these two poles. If the Pattern Library isn't well-used the numbers of interactions won't provide adequate adaptive friction to demonstrate the model. Without useful levels of structure in the patterns effective comparisons can't be made. Too much structure may restrict participation and as above, without participation the Library can't be successful.

### *Ethical Considerations*

Participation in an online community characterized as an affinity group carries particular responsibilities for mutual protection of intellectual freedom, respect for personal expression and integrity toward attribution of the work products. The Intelligent Swarm concept and user interface is licensed and protected by Creative Commons. These rights and responsibilities should be made explicit and agreement with them made a requirement for participation. A draft policy is available here: <http://sites.google.com/site/swarmtelligence/policy.html> and in Appendix E.

### *Validity*

As a Teacher Action research design threats to internal validity are minimized. The study of interactions through interactions is inherently subjective but with adequate levels of participation patterns will evolve and the most effective adaptations emerge.

Threats to external validity would result from poor levels of participation and therefore lack of triangulation. Since the project revolves around peer review processes the degree of dynamism in the social network will determine the relative transferability of results. A more dynamic exchange between peers with respect to social learning design elements and patterns will produce highly generalize-able outcomes.

### *Instrumentation*

This study will employ several types of instrument to structure input and assess

interactions within the Intelligent Swarm Pattern Library. These instruments will also appear as submissions in the Pattern Library. This list will be extended over time as evaluation and normalization strategies emerge.

- **Social Media Literacy Questionnaire** used to benchmark participants' level of engagement in social media, also offered as a Pattern for evaluation. *See Appendix B.*
- **Pattern Template interactive form** used to normalize pattern information submitted to the repository. *See Appendix C.*
- **Webmasters' metrics reports** cover interaction usage in terms of page views, domains of access. *See Appendix D.*

### ***Projected Analysis Strategy***

The Pattern Library will function as a dynamic social network employing the tools and the methods that it is working to improve. Patterns that document social learning tool use will be submitted, reused and modified or deprecated over time. Since a primary goal of the research is metacognition regarding what works well, indicators of the usefulness of the system will be evidenced by dynamism in the pattern submissions and discourse, and by the numbers of connections between documented social learning patterns and between external projects that employ them (Gallery). Because this is a web-based system interactions within it can be tracked via standard web metrics; for example.,

how many visits to a particular pattern, how many links to and from pattern library materials. [See Appendix D] Cloud-based<sup>8</sup> metrics related to discourse may be obtained by use of social bookmarking, RSS feeds from microblogging tools such as Twitter and publishing venues like Voicethread, Facebook or Flickr. Social learning evaluation patterns are important for development of instructional designs and presumably will figure prominently in pattern contributions.

Reporting tools may be “mashed up” from external data sources [Bengston, et al, 2009]. A guiding principle is support for autocatalysis<sup>9</sup> so participants need to be able to generate reports and initiate queries independently to guide their development efforts. Wherever possible the system will benefit from making connections between patterns (and ideas) visible to participants.

### ***Expected Findings***

The success of Intelligent Swarm will be demonstrated in the dynamism of its network: that is, the degree and quality of participation that occurs through it. Beyond this, vitality in this environment will require commitment to scientific method - an open-ended approach to asking and recognizing the answers to questions as they emerge from interactions with the system. Will this activity generate an emergent system? This is uncertain. But the same system that will support metacognition requires a structure that promotes the adaptivity and

open exchanges characteristic of emergent systems. From building such a system there is reason to expect understanding of social learning to improve and from that to spring a modest source of vitality in instructional design.

### **Additional Resources**

The Intelligent Swarm Pattern Library is available here:  
<http://sites.google.com/site/swarmintelligence/>

A presentation about this project is available here:  
<http://docs.google.com/presentation/edit?id=0AW-fw4OxzuEXZGM0Y3dxbTRfMTM5ZDRnNzN4ZHg&hl=en>

Revisions of this paper will be made available here:  
[http://humanorigins.org/ispl/asberry\\_intelligent\\_swarm\\_f.pdf](http://humanorigins.org/ispl/asberry_intelligent_swarm_f.pdf)

### ***Appendix A: Annotated Bibliography***

Intelligent Swarm Pattern Library has its roots in the disciplines of information & learning theory, user-centered design, adaptive management, dynamic network optimization and linguistics. Following is a survey of works that have informed the research design.

Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., Shlomo, A. (1977) *A Pattern Language*. New York: Oxford.

This seminal work has informed design practices in the built environment from physical architecture to computer human interface design. Across between poetry and grammar it has

helped me think about structure and coherence with regard to human factors and map them to social learning.

Arke, E., & Primack, B. (2009). Quantifying media literacy: development, reliability, and validity of a new measure. *Educational Media International*, 46(1), 53 - 65.

This article defines metrics for assessing the “ability to understand, analyze, evaluate and create media messaging in a variety of forms”. Authors find high correlation of their efforts with critical thinking evaluation. Achievements of this study include definition of a conceptual model consisting of five domains: recall, purpose, viewpoint, technique and evaluation which they associated with Bloom's Taxonomy for learning. A significant limitation of the study was the truncation of assessment related to creation and transmission of meaning, which is where social media begins. Useful modeling of application of a theory-based scale to measure interactive behaviors.

Bandura, A. (1990). Some Reflections on Reflections. *Psychological Inquiry*, 1(1), 101-105.

This short response to peer reviews of “Reflections” encapsulates and situates many of Bandura’s beliefs; his brief arguments related to reciprocity, developmental contextualism, the multidimensional nature of self-efficacy helped me structure the complexity of social learning.

Bengston, D. N., Fan, D. P., Reed, P., & Goldhor-Wilcock, A. (2009). Rapid Issue Tracking: A Method for Taking the Pulse of the Public Discussion of Environmental Policy. *Environmental Communication*, 3(3), 367-385. doi: Article.

Dynamics of cause-driven socially mediated networks.

Bohm, R. & Short, J. (2009) How Much Information? 2009 Report on American Consumers. *Global Information Industry Center*, University of California, San Diego. Available from <http://hmi.ucsd.edu/howmuchinfo.php>.

Quantification of contemporary information consumption in US. Great charts of usage broken out by sector.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, 18(1), 32-42.

This article promotes an understanding of how education can be re-formed through understanding that situations structure cognition. Building from an analysis of language teaching (vocabulary of indexical words), the authors extend their model to all knowledge. All learning indexes (gains meaning) to the activity and situations where it is produced and evolves along with use. Authentic enculturation, where students practice a discipline, is the meaning-making that is fundamental to learning.

Collins, A., Brown, J.S. & Holmes, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator*, 6(11), 38-46.

Gee, J. (2004). *Situated language and Learning: A critique of traditional schooling*.

Greenhow, C., & Robelia, B. (2009). Informal learning and identity formation in online social networks. *Learning, Media, & Technology*, 34(2), 119-140. doi: Article.

Authors describe methods for incorporating identity formation from social networking into broader educational ecology to stimulate creativity and authenticity in interactions.

Gunawardena, C. N., Hermans, M. B., Sanchez, D., Richmond, C., Bohley, M., & Tuttle, R. (2009, March). A theoretical framework for building online communities of practice with social networking tools. Retrieved from <http://0-search.ebscohost.com/opac.sfsu.edu/login.aspx?direct=true&AuthType=ip.cookie.url,uid&db=ufh&AN=37141620&site=ehost-live>.

This article describes process of spiraling toward socially mediated metacognition. Authors propose to create theoretical framework to understand Web 2.0 usages by reflecting on texts and interacting within a community of practice mediated by Web 2.0 tools. Provides a description of the development of the Appreciative Inquiry (AI) method for organizational change from the Anticipatory Principle related to collective imagination and personal motivation.

Kennedy, J., Eberhart, R. (2001) *Swarm Intelligence*. San Francisco: Morgan Kaufman Publishers.

Exploration of intelligence both biological and artificial, modeling, evolutionary computation, optimization patterns, memetics and sociocognitive theory. Clear explanations, technical depth about how intelligence emerges from social organization and interactions.

Lazar, J., ed. (2007) *Universal Usability*. Chichester, England: Wiley & Sons.

Compilation of articles treating design of computer interfaces for diverse users. Wide range of topics including public participatory design practice, technology used to enhance quality of life for alzheimer's patients, blind people. Very good resource for research models.

Lin Lin . (2009). Breadth-biased versus focused cognitive control in media multitasking behaviors. *Proceedings of the National Academy of Sciences of the United States of America*, 106(37), 15521-15522.

Maldonado, H., Lee, J. E. R., Brave, S., Nass, C., Nakajima, H., Yamada, R., et al. (2005). We learn better together: enhancing eLearning with emotional characters. In *Proceedings of the 2005 conference on Computer support for collaborative learning: learning 2005: the next 10 years!* (pp. 408-417). International Society of the Learning Sciences.

Ophir, E. Nass, C. & Wagner, A.D. (2009) Cognitive Control in Media Multitaskers. *Proceedings of the National Academy of Sciences* 106(37), 15583 -15587.

This article makes a significant contribution to literature by creating an index of media multitasking and measures of systematic processing and stylistic differences in the effort to understand cognitive costs and benefits of working through multiple media channels simultaneously. It represents a significant counter to popular wisdom on the subject researchers found that chronic multitaskers have degraded abilities to focus upon and respond to stimulus that extend beyond periods of multitasking activity. Broad samples were evaluated for filtering and response inhibition, two and three back tasks and task-switching which measured participants abilities to resist distraction, remember, change activities both when operating in multiple channels and not.

Scott, J.(2000) *Social Network Analysis*. London: Sage Publishing.

This text bridges mathematical and ethnological techniques for graphing relational data and attributes in service to transferable methods of analysis and synthesis of social networks. Includes historical development of the discipline, case studies and definition of core concepts such as multi-dimensional matrices, information acquisition and flow, adjacency, cliques, communities, clusters, strong and weak links.

Subrahmanyam, K., Reich, S. M., Waechter, N., & Espinoza, G. Online and offline social networks: Use of social networking sites by emerging adults. *Journal of Applied Developmental Psychology*, 29(6), 420-433. doi: DOI: 10.1016/j.appdev.2008.07.003.

Analysis of relationships between online and offline social behaviors in young people., contrasts between “friending” synchronous (Instant Messaging) and asynchronous (Facebook) behavior in college students who spent approximately 2-3 hours studying per day, nearly all went online daily. Online and offline relationships were highly integrated.

Yee, R. (2008) *Web 2.0 Mashups, Remixing Data and Webservices*. Berkeley: Apress.

This volume surveys techniques for embedding multiple data sources in web pages to create applications. Includes useful technical information about tagging, spatial data, AJAX and the semantic web.. Samples and examples.

### ***Appendix B Social Media Literacy Questionnaire***

Available from:

<http://sites.google.com/site/swarmtelligence/home/social-media-literacy-questionnaire/assessing-social-learning-readiness>

**Intelligent Swarm**  Search this site

Social Learning > Assessment >  
**Assessing Social Learning Readiness**

This survey is designed to help researchers understand the perspective and experience of college students with respect to online social connectivity tools and environments.

\* Required

What is your primary language? \*  
 If multilingual, list them all.

Select one \*  
 Gender

What is social media? \*  
 Describe your impression or experience.

RSS Feed subscription  
 HERE

 License

**Tools and Context** \*  
 Please indicate which tools you use and where.

	Friends	Family	Work	Volunteer Work	Other
email	<input type="radio"/>				
facebook	<input type="radio"/>				
LinkedIn	<input type="radio"/>				
mySpace	<input type="radio"/>				
twitter	<input type="radio"/>				
Flickr or Picassa	<input type="radio"/>				
Delicious or Technorati	<input type="radio"/>				
Google Docs	<input type="radio"/>				
blogger or wordpress	<input type="radio"/>				
YouTube	<input type="radio"/>				

How often do you use social media? \*  
 several times a day  1  2  3  4  5 once a month or less

How satisfied are you with your use of social media tools? \*  
 it meets my needs completely  1  2  3  4  5 it frustrates me completely

*Fields include: Language, gender, definition, a rating scale of tools, context, duration and frequency of use.*

**Appendix C Pattern Template Interactive Form**

Available from:

<http://sites.google.com/site/swarmtelligence/home/social-learning->

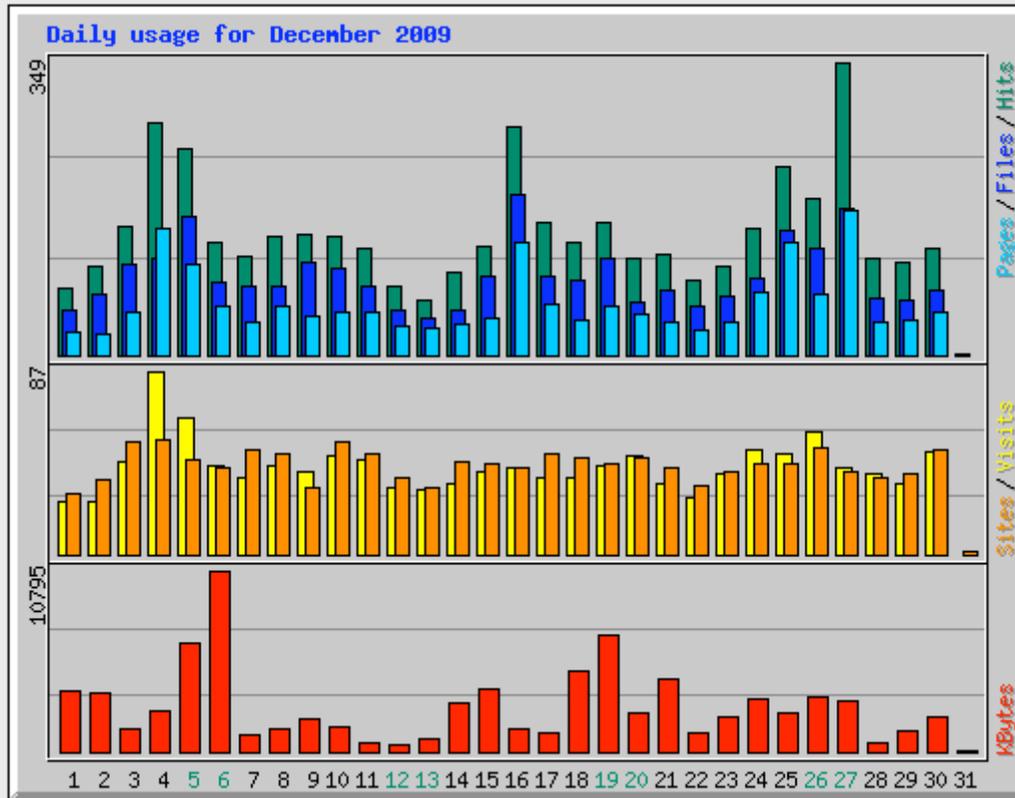
The screenshot shows the 'Patterns-Contribute' page on the Intelligent Swarm website. The page has a dark grey header with the site name 'Intelligent Swarm' and a search box. A left sidebar contains navigation links for 'Social Learning' (Assessment, Patterns, Resources, Tools), 'Gallery', and 'ITEC Swarm' (Contact, Exchange). Below the sidebar is an RSS feed subscription link and a Creative Commons license icon. The main content area is titled 'Patterns-Contribute' and contains a form with the following fields:

- Pattern Name \***: A text input field with the instruction 'Descriptive or conventional names work best.'
- Interaction Family \***: A dropdown menu currently showing 'Connection'.
- 'Other' Interaction Family Name \***: A text input field with the instruction 'Propose new interaction family name.'

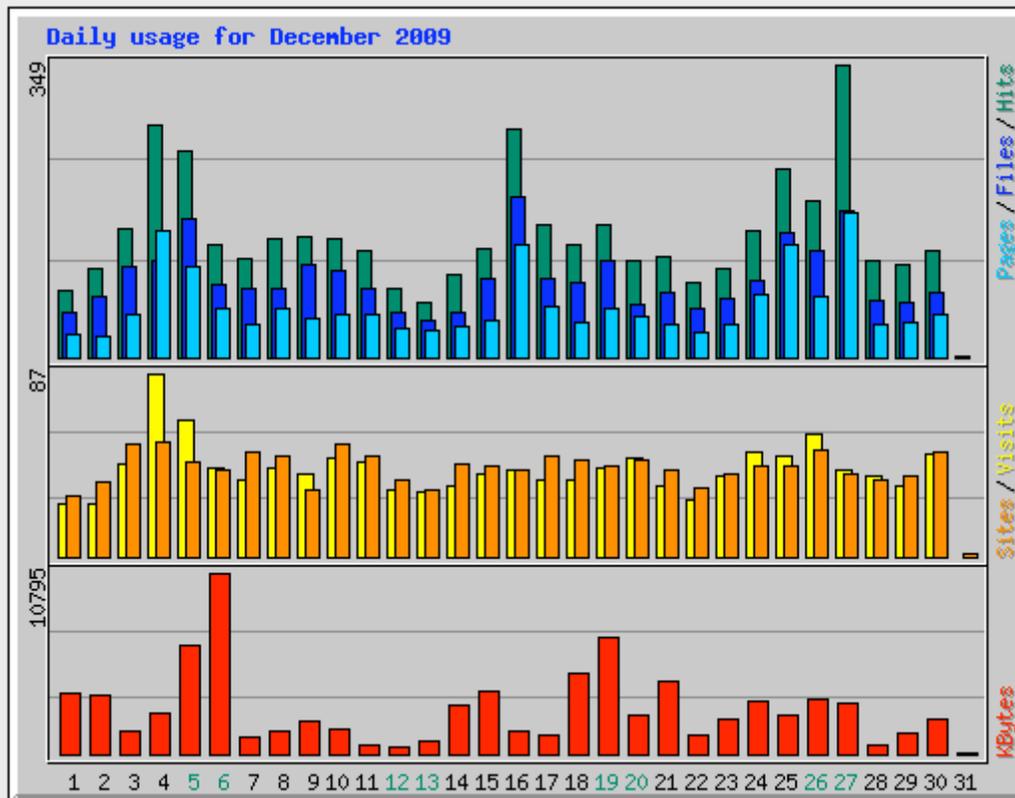
At the top of the form, there is a paragraph of text: 'Contribute social learning patterns to the Intelligent Swarm pattern library. This pattern library is organized by families of interaction related to social learning: Connection, Co-creation and Discourse(making meaning). Please locate the pattern you contribute in one of these families (or suggest a new one).'

***Fields include: Pattern Name, Family, Class, Purpose, Description, Samples, Related Learning Theory, tags, Contributor's information, Swarm membership.***

## Appendix D Webmasters' metrics report



Daily Statistics for December 2009												
Day	Hits		Files		Pages		Visits		Sites		KBytes	
1	80	1.80%	54	1.92%	27	1.46%	25	2.00%	29	7.06%	3624	4.42%
2	105	2.36%	72	2.56%	26	1.40%	25	2.00%	35	8.52%	3470	4.23%
3	152	3.41%	107	3.80%	52	2.81%	44	3.52%	53	12.90%	1342	1.64%
4	276	6.20%	115	4.09%	151	8.15%	87	6.95%	54	13.14%	2486	3.03%
5	245	5.50%	164	5.83%	108	5.83%	65	5.20%	45	10.95%	6510	7.94%
6	135	3.03%	87	3.09%	58	3.13%	42	3.36%	41	9.98%	10795	13.16%



Day	Hits	Files	Pages	Visits	Sites	KBytes
1	80	54	27	25	29	3624
2	105	72	26	25	35	3470
3	152	107	52	44	53	1342
4	276	115	151	87	54	2486
5	245	164	108	65	45	6510
6	135	87	58	42	41	10795

Analytics reporting Includes information about page views and visitors' activities in the site such as above.

### *Appendix E Privacy & Intellectual Property Policy*

Intelligent Swarm adheres to Creative Commons licensing standards in safeguarding privacy and intellectual property. The license agreement states that works posted here are protected with the following understandings and

rights reserved.

1. No personal information about any participant or contributor will be shared or sold to a third party.
2. All works contributed to Intelligent Swarm Pattern Library are protected from reproduction without attribution. No work derived from this work or the work itself may be sold except by the work's author.
3. Creative Commons License for Intelligent Swarm is available here:  
<http://creativecommons.org/licenses/by-nc-sa/3.0/us/>

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## *Notes*

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<sup>1</sup> The average American consumes 34 GB of information per day. An information day for this average person lasts 11.8 hours.

<sup>2</sup> Whether accurately or not, social media is popularly credited with electing the most recent US president.

<sup>3</sup> Transactional distance is a strong demotivator for learners in distance learning, reduction may improve self-efficacy or confidence which increases interactions and therefore the opportunities for achievement- a positive feedback loop.

<sup>4</sup> Eberhart & Kennedy, p. 459, define complexity as the *interaction* of many parts of a system, giving rise to behaviors and/or properties not found in the individual elements of the system.

<sup>5</sup>Hybrid teaching and learning is multi-modal and multi-channel; incorporates synchronous-asynchronous, online and face-to-face exchanges between learners, learners and teachers.

<sup>6</sup> The current interface uses Voicethread (Voicethread.com) to allow multiple points of view to display in real time discourse.

<sup>7</sup> Social Learning Tools

<sup>8</sup> Interactions using Web 2.0 tools where relationships are generated through co-locations of datasources, they are 'mashed-up'.

<sup>9</sup> self-organizing and self-perpetuating functions