# Peer Production of Online Learning Resources: A Social Network Analysis[1]

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Abstract. This paper describes methods for collecting user activity data in a peer production educational system, the Instructional Architect (IA), and then takes a social network perspective in analyzing these data. In particular, rather than focusing on content produced, it focuses on the relationship between users (teachers), and how they can be analyzed to identify important users and like-minded user groups. Our analyses and results provide an example for how to select the most important factors in analyzing the dynamics of an online peer production community using social network analysis metrics, such as in-degree, out-degree, betweenness, clique, and community.

## 1 Introduction

The increased pervasiveness of networked computing coupled with a vibrant participatory web culture has spawned new models of innovation and creation. In education, the scalable deployment of media-rich online resources supports peer production in ways that promise to radically transform teaching and learning. Recent research, however suggests these peer production models may only succeed when they are aimed at focused tasks, coupled with incentives to harness the work of the best collaborators. More is not simply better, and for educational peer production models to succeed, we need more nuanced understandings of how people participate in such environments to efficiently and effectively collaborate around learning resources.

Social network analysis (SNA) is a well-established method for studying interactions among human organizations [1]. It has also been applied in educational research. In particular, patterns of social relationship revealed by SNA, coupled with results from other qualitative evaluation methods such as content analysis, interviews, survey, reports, and sociometry, are frequently used in longitudinal study of the participatory aspects of computer-supported collaborative learning (CSCL).

In our own work, we have developed a simple, web-based authoring tool, called the Instructional Architect (IA.usu.edu), which supports teacher peer production. In this study, we examine the teacher users in the IA system and conduct a social network analysis to begin to characterize teachers' networked relationships.

## 2 The Instructional Architect and its Social Networks

The Instructional Architect allows teachers to freely find, gather, and produce instructional activities for their students using online learning resources. Teachers can share these resulting activities, called *IA projects*, by making them publically available on

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[1] For full paper, graphs, and references, please visit http://edm.usu.edu/publications/sna.pdf

the Web. These IA projects can then be *viewed*, *copied*, and *adapted* by other IA users, in ways that support innovative teacher peer production.

For each registered user, we determined the networks between users based on the following two pairs of relationships: 1) user A *viewed* user B's IA project, and user B's IA project was *viewed* by user A, 2) user A *copied* user B's IA project, and user B's IA project was *copied* by user A. Thus, the vertices in each network represent IA users, and the link directions and values represent the number of viewer/viewed or copier/copied actions between two users. These two networks (termed *viewer* network and *copier* network respectively) are represented as weighted, directed graphs.

## 3 Data Analysis

The present study consists of the view and copy actions occurring between September 2008 and February 2010. The view and copy networks were represented within the freely-available SNA software Visone, which also computes key SNA measures for each network. The graph of viewer network is much denser than the copier network. From a user perspective, viewing represents an action with a much lower "cognitive" cost (a simple click) compared to a copy action (which represents a decision to use/adapt the content). Not surprisingly, this difference is reflected in the number of participating users and the density of the two networks.

We studied the relationship between user production of IA projects, and viewing and copying actions. Users with a large number of views are not necessarily those who create a large number of IA projects. Conversely, the mean number of IA projects created does not saturate and exhibits an increasing trend as the function of copy action. Thus, the number of copies is a more accurate signal than the number of views in estimating project creation magnitude, serving as a better metric for describing meaningful user's activity within the IA network.

Finally, we applied a *clique* analysis on the copy network – the more important network of the two. A *clique* is a subgraph in a network in which every two vertices are connected by an edge. When the number of vertices in such a subgraph is k, it is called a *k-clique*. A clique represents closely tied subset of the network. A *k-clique-community* is defined as the union of all k-cliques that can be reached from each other through a series of adjacent k-cliques. We detected 11 k-cliques inside the copy network. These cliques suggest that some small subsets of users share common interests such that they could make use of each other's IA projects. The largest community in the copy network is a 6-clique-community formed by four adjacent 3-cliques. Since this community represents a closely tied subset of the copy network, not surprisingly, all six users teach the same subject area – language arts, and five of them teach both math and science, and four of them teach social studies. In sum, the clique analysis helped identify teachers with shared interests.

**References**

[1] Knoke, D. & Yang, S. *Social Network Analysis*, 2008. London: Sage.