

Teacher Adoption of Moodle LMS: A K-12 Diffusion Study

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### **Abstract**

This paper describes the diffusion of Moodle within Cherokee County Schools. The diffusion is evaluated using the Bass Model and the RIPPLES model in order to evaluate relative success or failure. The Bass Model of Diffusion was calculated utilizing forecasting by analogy in order to analyze the adoption rates in a county high school. The adoption of Moodle was then analyzed using the RIPPLES model to understand why the adoption rates were below the projected Bass model adoption figures.

*Keywords:* Diffusion of innovation

Learning management system (LMS)

Moodle

Bass Model

RIPPLES

## **Diffusion of Moodle in Cherokee County Schools**

### **Introduction**

As the landscape of K12 education continues to change, an ever increasing number of teachers are looking for ways to better engage their students with the curriculum. One way in which teachers are choosing to do this is through blended instruction. In order to implement the concepts of blended instruction, school systems are turning to learning management systems (LMS) such as Blackboard or Moodle.

This paper describes the results of an LMS rollout implemented within a suburban school system. In order to gain an understanding of the process of diffusion, both the Bass Model (Bass, 1969), and the RIPPLES model (Surry, Grubb, Ensminger, & Ouimette, 2009) were utilized as evaluation tools.

### **Background**

In the fall of 2007, Cherokee County School District created TEACH21 - a technology endorsement program to move district classrooms to a more technological advanced state (CCSD, 2007). As a requirement for this program, teachers were to create a capstone experience that utilized technology in the classroom. In order to meet this requirement, an English teacher and a Social Studies teacher at two of the five high schools implemented Moodle as a learning management system (LMS) in their classrooms. For the purposes of this paper, these two teachers will be labeled as Innovator 1 and Innovator 2. When the second TEACH21 cohort was constructed, Innovator 1 taught the initial Moodle course, with Innovator 2 taking over and expanding the offerings for subsequent cohorts. At last count there are now 58 courses and 47 teachers utilizing Moodle as an LMS for their courses (Tipton, 2012).

## Review of the literature

For the purposes of this study, the Bass model of product growth (Bass, 1969) and the RIPPLES model (Surry, Ensminger, & Haab, 2005) were used to analyze the relative success of the overall Moodle implementation.

Bass (1969) created a diffusion model that is predominately utilized in the fields of advertising and marketing. His model builds upon the theoretical basis of Rogers' diffusion concepts (Rogers, 2003) and introduces the application of timing to the diffusion theories (Bass). In this model, Rogers' groups two through five are combined to create imitators in Bass' model. The Bass Model Principle consists of four variables:  $M$  is the ultimate number of adopters of the product;  $t$  is the time interval for adoption;  $p$  is the coefficient of innovation; and  $q$  is the coefficient of imitation (BBRI, 2012). Formulaic representation of these variables is;

Bass Model Differential Equation Form	
$a(t) = Mp + [q - p]A(t) - \frac{q}{M}A(t)^2$	
$A(t) = A(t - 1) + a(t)$	

*Figure 1(BBRI, 2012)*

The coefficient of innovation ( $p$ ) is probability that an innovator will ultimately adopt the new product or service, whereas the coefficient of imitation measures the probability that an imitator will adopt the product or service (Soffer, Nachmias, & Ram, 2010). Given the implementation of this model over time it has been found that  $p$  has an average value of 0.03, and  $q$  averages at 0.4 (BBRI). In order to allow for the forecasting of new technologies, the

concept of “forecasting by analogy” was created by the Frank M. Bass Institute (BBRI). By looking at  $p$  and  $q$  values from similar innovations, an adoption curve can be created to predict adoption cycles. This curve can be compared to actual usage data as it is collected.

Although the Bass Model is effective for predicting acceptance of an innovation and for comparing actual results to predictive results, it does not address the reasons for adoption or failure of an innovation. In order to delve deeper into the adoption/diffusion process another model is necessary.

In the RIPPLES Model (Surry, et al.) such questions can be answered. The RIPPLES Model is an acronym which stands for: *Resources, Infrastructure, People, Policies, Learning, Evaluation, and Support* (Surry, et al.). Although originally designed as a way to view technology implementation in higher education, it has been further developed to incorporate K12 education as well (Surry, et al.). The elements of the model are explained as such: Resources refer predominately to the financial resources necessary for the implementation of the innovation. Infrastructure is the hardware, software, network capabilities, and facilities that must be in place to support and deliver the innovation. People illustrates/measures the vital and essential role that the individual plays in the innovation process. Policies describe the need for policies that promote the diffusion/integration of technology within a school environment. Learning is defined as the need for the innovation to enhance education. Users of the new technology must see the educational benefits of the innovation if they are to adopt it for their own usage. Evaluation refers to the need for continued and pervasive assessment of the innovation. Finally, Support refers to the need for there to be a system in place for all users of the innovation or technology (Surry, et al.).

## **Methodology**

The study was conducted by sending a survey to thirty-eight high school teachers. This sampling consisted of teachers who are both users and non-users of Moodle in their classroom. Of the thirty-eight surveys, twenty-seven were completed for a 71% response rate. Both qualitative and quantitative data were collected and analyzed. The survey was implemented using Survey Monkey (Gagnon, 2012). Personal interviews were also conducted with Innovator 2, Network Administrator 1, Adopter/Imitator 1 and 2, Technology Supervisor, and Assistant Superintendent. Non-adopters were also interviewed in order to understand why they had not yet adopted Moodle in their classroom.

Data collected was used to calculate adoption rates as compared to potential adoption as calculated in the Bass model. Two adoption curves were calculated using the “forecasting by analogy” model based off the values of  $p$  and  $q$  as calculated by Soffer (Soffer, et al.) for the College of Education, and using base mean values. The Bass model of adoption was tested using data for Cherokee High School’s Social Studies department, as this department showed the greatest adoption within Cherokee County.

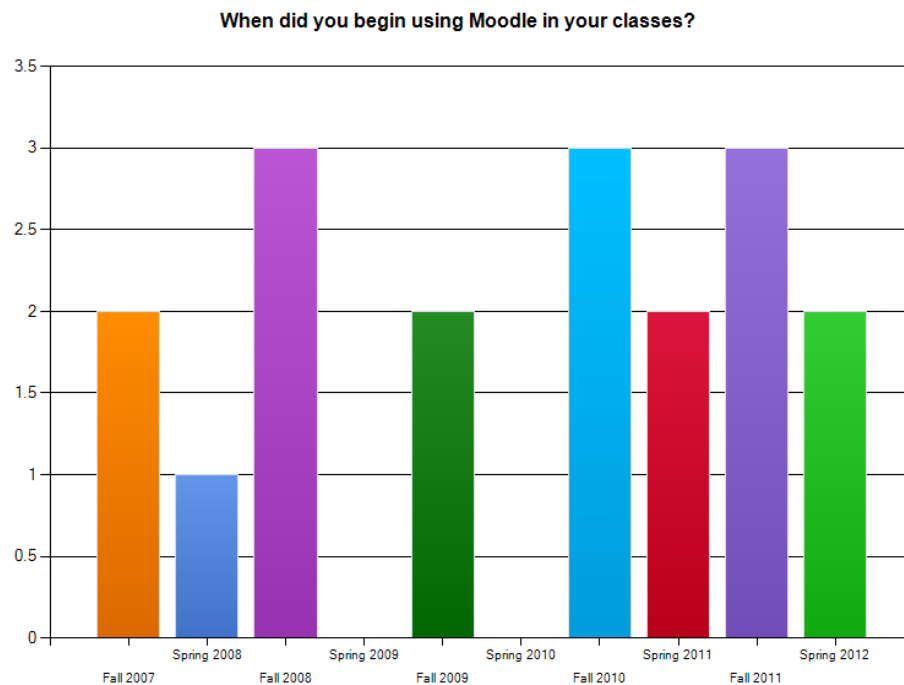
Relationship mapping between Innovators and Imitators was completed utilizing SocNetV (Kalamaras, 2010). This software is designed to visually represent social network relationships and weights of interactions. Although not specifically designed for educational networks, it served as a reliable tool for this purpose.

## **Results**

Results were analyzed in multiple phases. The first section of analysis represents the Moodle implementation process as compared to the Bass model. The second section utilizes the RIPPLES Model to assess the relative success or failure of the diffusion process.

### **Moodle implementation and the Bass Model**

Moodle diffusion within Cherokee County schools has not reached widespread adoption as of the 2012 academic year. From the initial implementation in the fall of 2007 until the current semester, only 47 high school teachers county-wide have implemented Moodle in the classroom. Adoption rates have held rather steady throughout the entire diffusion process, with an initial rollout of two teacher and highs of three teachers per semester. Figure 2 shows survey respondent's information regarding adoption time frame.



*Figure 2 (Gagnon, 2012)*

County implementation of Moodle has been completed through the TEACH21 and Professional Development department. Innovator 1 was the initial instructor of the Moodle course, with Innovator 2 taking over instructional duties shortly after initial implementation.

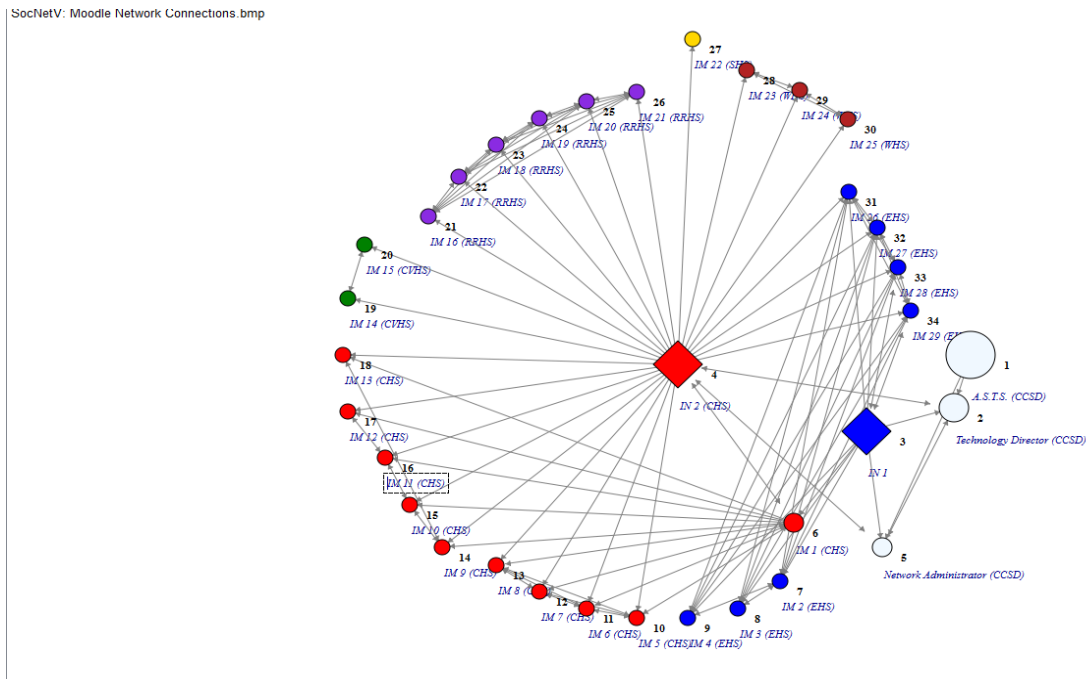


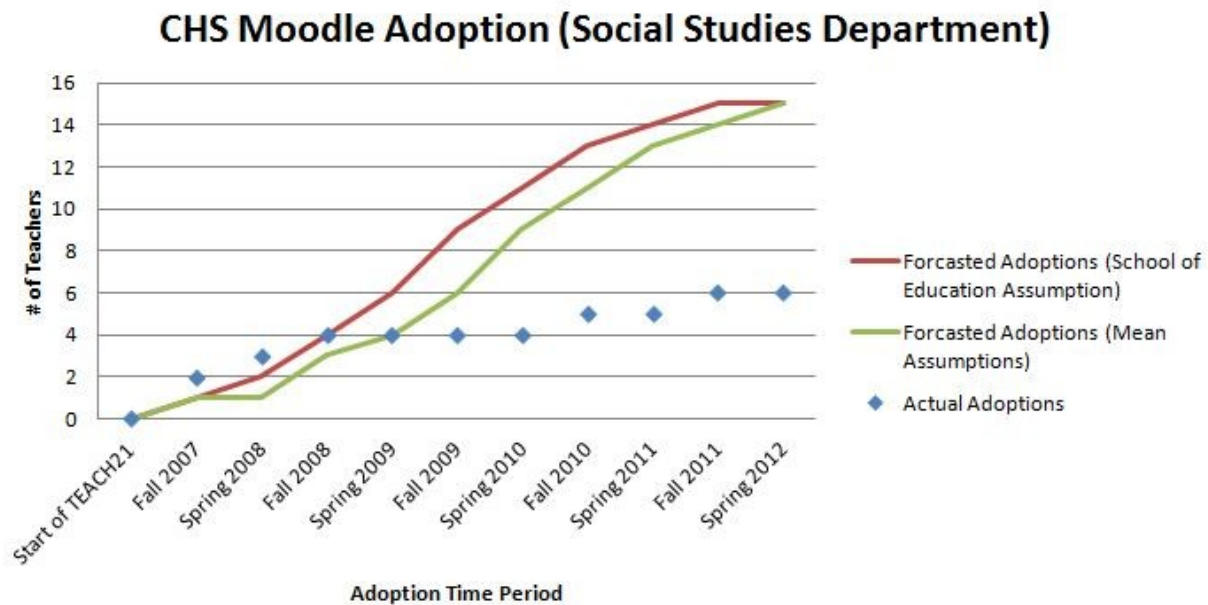
Figure 3(Kalamaras, 2010)

Figure 3 represents the social network that is created by the Moodle implementation. Individuals are represented as circles or diamonds. Circles represent the imitators, as defined by Bass (Bass), and the diamonds are the Innovators. Innovator 1 is the blue diamond and Innovator 2 is the red one. Schools are represented by their colors, and county officers are light blue. Connections are one way from Innovator 1 and 2 to the imitators that were present in their Moodle class. Connections are two-way between imitators from the same school. This two-way connection represents the social interaction and peer collaboration that they share. These two-way connections illustrate the fact that 77% of respondents stated that they show/tell others about



their Moodle usage and 68% claimed that they utilized Moodle because of personal motivation or due to peer recommendations (Gagnon, 2012). While there may be two-way connections between schools, these connections were not evaluated for the purposes of this study.

In order to better understand the diffusion process, data from Cherokee High School's Social Studies department was analyzed against the Bass Model (Bass). Cherokee High School (CHS) was chosen for two specific reasons; Innovator 2 is a teacher in the department, and it has the highest diffusion of any individual department within the school district. CHS' Social Studies department consists of 16 teachers. In the Bass Model this number represents  $M$  (Bass, 1969).



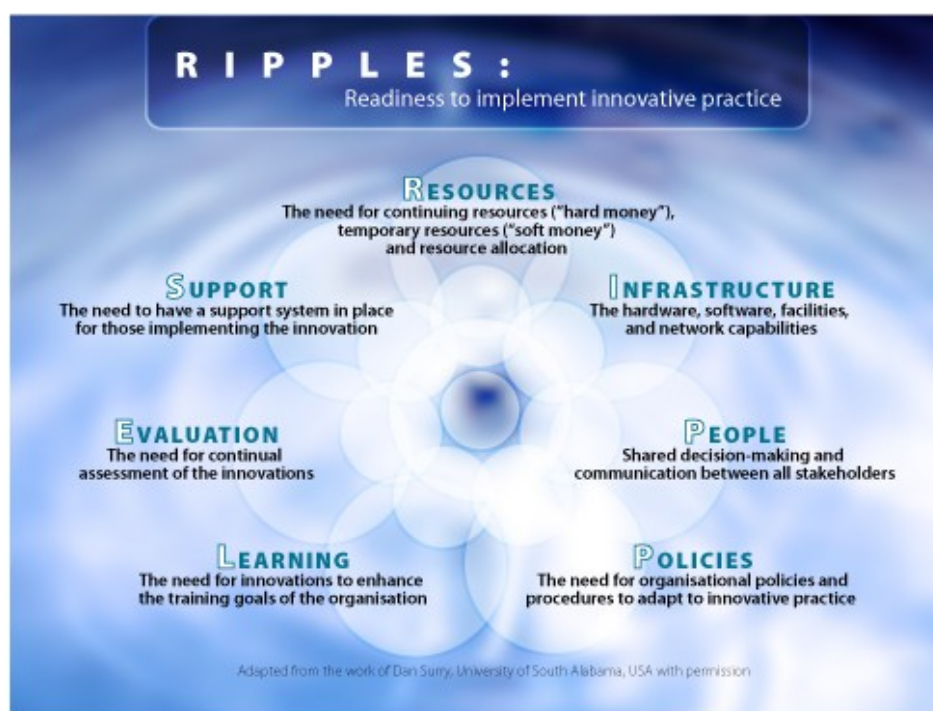
*Figure 4*

According to the Bass Model, given the assumed values of  $p$  and  $q$ , adoption within the department should have reached 94%, or 15 users, by the fall semester of 2011. Actual adoption

at that point was only 38%, or 6 users. This represents the best case scenario within the county, and falls well short of projected adoption.

### **Moodle adoption and the RIPPLES Model**

The Bass Model illustrated the shortfall in diffusion, but it is not able to discern why the shortcoming exists. In order to determine why Moodle did not diffuse at the rate predicted in the Bass Model, the RIPPLES model was utilized (Bass; Surry, et al.).



*Figure 5(Surry, 2012)*

#### *Resources*

Interview responses from both the Assistant Superintendent and the Technology Director confirm that although initial funding was provided through the TEACH21 umbrella, budget constraints have discontinued that funding. In terms of overall Moodle costs to the county,

Moodle itself is open-source software (meaning no costs) but there were costs to upgrade the servers due to age.

According to the Technology Director, funding for the Moodle courses is now coming from the professional development department and not the technology department. This was also corroborated by the Assistant Superintendant (Childress, 2012).

### *Infrastructure*

In 2007 when Moodle was first rolled out in Cherokee County, it was running as a virtual server. Meaning that it shared processor time and space with other servers in the county. This, according to the Network Administrator, was deemed to be the best option given the small number of users (Tipton). The Network Administrator reported that Moodle was not expected to be used by a significant amount of users initially (Tipton). At the end of the Fall 2011 semester the Moodle server was upgraded to a dedicated server and the Moodle software updated from version 1.9 to version 2.2. As a result of the upgrade, all version 1.9 teacher sites were deleted (some without prior teacher knowledge). According to the Network Administrator and verified on the Moodle website, version 1.9 cannot be migrated to version 2.2 (Tipton, 2012). This migration caused a great deal of undue stress and frustration among new Moodle users, especially those users at schools other than where Innovator 1 and 2 teach (Childress & Tipton, 2012).

### *People*

Within the social network of Moodle usage in Cherokee County, there are a few key players. Even with 77% of respondents stating that they tell/show others how they are using Moodle in the classroom there is still a lower than predicted adoption rate. Innovator 1 is located

at Etowah High School. Etowah has the second most adopters of Moodle in the county and much of this can be attributed to proximity to an innovator (Surry, et al.). Innovator 2 and Imitator 1 are both at Cherokee High School, which boasts the largest Moodle usage (Gagnon). Again, this can be attributed to proximity to an innovator. Innovator 2 is also the primary instructor for the county Moodle courses, this adds to the overall pressure on imitators (Surry, et al.). Schools that lack proximity to either Innovator 1 or 2 have much smaller Moodle usage. This may not be the only factor impacting lack of use, and further research is necessary.

### *Policies*

Currently there are no policies in place in respect to Moodle adoption in the classroom. Teachers/Imitators are not required to take a Moodle course before they can adopt the LMS in their classroom. According to the Assistant Superintendant and the Technology Director the county is in the process of writing policies regarding social network usage, but they are not specific to Moodle usage or adoption (Childress & Tipton).

### *Learning*

This aspect of the RIPPLES model does not focus on Teacher/Imitator learning, but on how the technology is utilized or viewed as a learning tool. With that said, it is valuable to look at what some of the non-users said about why they do not use Moodle. One respondent stated, “Moodle doesn't address everything I absolutely need. It has some features I could use, but the tradeoff in time it would take to implement isn't worth it right now (Gagnon)”. Another respondent stated that, “I don't see the need or benefit (Gagnon)”. Even with a significant majority of users touting the benefits of Moodle, non-users still have a difficult time seeing the benefits.

### *Evaluation*

Although teachers interviewed stated that they continually evaluate and modify their instructional use of Moodle, there is no official evaluation process in place to measure the overall effectiveness of Moodle in the classroom (Childress).

### *Support*

The support of Moodle falls primarily within the realm of duties of the Network Administrator (Tipton). The network administrator handles all the backend Moodle administration, and supports the two Innovators when they discover new modules that they wish to have implemented (Childress & Tipton). Whereas the Network Administrator deals exclusively with the Innovators, it falls to the Innovators to deal with the Imitator support needs. Both Innovators respond to emails and requests for support from teachers. Although they do their best to support the Imitators, that support is in some instances not as immediate as some would like (Gagnon). This is especially the case for those Imitators who are not in the same schools as the Innovators.

### **Discussion and Conclusions**

Although Moodle has been available to teachers for almost seven years, the diffusion of this innovation is well below what the Bass Model predicts the adoption should be. Utilizing the RIPPLES model it becomes apparent that a lack of institutional parameters is, at least, partially to blame. This trend may, in fact, be changing however. Due to the current fiscal environment, the Assistant Superintendent is beginning to encourage school administrators to look at Moodle as a way to save funds. If this is the case, the county would be well served to look at how the current implementation of Moodle is working before they increase usage across the county.

County officials will have to significantly improve the resources, infrastructure, policies, and support for expansion, as well as increasing teacher training of pedagogical models.

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