

# **HCI Professional Involvement in k-12 Education: On Target or Missing the Mark?**

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**Abstract.** The state of learning across geographic, socioeconomic, age, and gender boundaries can be enhanced greatly by Human-Computer Information (HCI) infusion into blended learning [1][2][3] or Course Management System (CMS) software [4][3][5]. The major thrust of this paper is to examine problematic issues examined in popular software such as Moodle™ in which the HCI community could be beneficial. By regarding the ultimate students' goal, i.e. grades, and the desirable benefit of course material understanding, one can develop an understanding of what CMS software needs and CMS software users expect on the high school level.

**Keywords:** blended learning, e-learning, Course Management System (CMS), Virtual Learning Environment (VLE), Human-Computer Interaction (HCI), k-12 Education, magnet schools.

## **1 Introduction**

This paper proposes to identify issues with the open-source, Course Management System (CMS) Moodle™ that can be impacted by the professional HCI community. Colleges and universities have identified the benefits of retail, blended learning software and implemented them into their curricula [1][6][7]. The costs of these programs are easier met on the college level, but public high schools often lack the financial resources. Instead, they rely on open-source courseware, like Moodle™, to meet their needs [8]. Case studies and surveys report successes with the implementation of blended-learning into college curricula [9]. The use of CMS on the high school level is sparsely documented and college-level success cannot be generalized to the high school environment. Differences in CMS software, resources, student maturity, and instructor CMS experience vary widely.

These differences were clear when observing the effects of Moodle™ on a magnet, high school in the Northeastern United States. Teachers integrated Moodle™ into their curriculum to display assignments, accept homework, administer tests and quizzes, and give an opportunity for discussion and collaboration outside the classroom. Surveys were administered to students enrolled in courses that utilized Moodle™, and were asked to report the perceived effect on their understanding of the course material, effectiveness of certain applications, ease of use, etc. (see Tables 2-3). The results were analyzed using the statistical software-package, Minitab™, to determine significant differences in each category.

### 1.1 Blended Learning and Course Management Systems (CMS)

“Blended learning” is a method where students are being taught by two or more sources of information, generally traditional classrooms and online classrooms [10]. Often times, blended learning is implemented by using a Course Management System (CMS). CMS, also known as Virtual Learning Environments (VLE), are online tools for teachers to interact with their students outside of the physical classroom [8]. Interaction may occur in a variety of educational modalities.

## 2 Review of Literature

Blended learning and CMS software can improve learning for all students [1][2][3][4][5]. The use of blended learning has been increasing quickly over the past few years, both in school and businesses [7][11][12]. Many college campuses have realized this and moved to CMS environments to streamline and augment organization, reporting, teaching and learning [1][9][13][14]. These programs have been generally well received, with both students and teachers finding the programs beneficial [6][9][13][14]. These institutions are funded well enough to absorb the costs of retail offerings such as First Class<sup>TM</sup>, Blackboard<sup>TM</sup>, and WebCT<sup>TM</sup> (now owned by Blackboard<sup>TM</sup>), as well as technology training programs. High school funding does not allow this luxury.

Moodle<sup>TM</sup> is an open-source CMS commonly used in high schools that cannot afford more expensive programs [8]. The software vehicle establishes the platform and potential groundswell of increased activity with HCI and the high school communities [8]. Moodle<sup>TM</sup>, educational communities are international in scope with as many diverse uses as cultural approaches to education [2][3][15]. As a vehicle, Moodle<sup>TM</sup> has tools such as blogs, wikis, online tests, instruction, email, and asynchronous collaboration [8]. Its flexibility has caused it to outshine many other open source CMS programs, and even Blackboard<sup>TM</sup> in some cases [16][17].

Moodle<sup>TM</sup> is well known for focusing on student interaction, often considered the main advantage of blended learning. The educational philosophy that advocates this is known as social constructivism [8][18]. According to Berger and Luckmann [22], this theory posits knowledge is actually created by students and teachers through interaction with themselves and their environment. They contend that social constructivism is important to learning [22]. However, despite this focus on interaction, there is sparse research on the actual content of online student interaction [19]. A study of a blended learning class at Blackpool and The Fylde College found that 77% of students in the class preferred a normal learning environment, and more reflective students tended to avoid the online portion of the class as much as possible [9]. Martin Dougiamas, the creator of Moodle<sup>TM</sup>, did a similar study in which he found Moodle<sup>TM</sup> did not even allow social learners to properly interact with each other [18]. Hetlighen and Anderson surmise that information overload is another large problem facing CMS users. This occurs when the students are given too much information absorbing little [20][21].

A 2000 study by The US National Center for Education Statistics found that of k-12 teachers who used the Internet, only 39% used it for instructional material, and just 16% used it for gathering information to plan class lessons [6].

### 3 Methodology

The sample, drawn from a magnet school population in the Northeastern United States, contains grades 10-12. Socio-economic statuses range from multimillionaire families to wards of the state. Gender distribution is approximately 66% male and 34% female in a population of 114 students. Diversity of the population results in reduced bias.

It should be noted that all students at the school have Internet 75% of the day. Two computer labs are available for a required, introductory technology class (32 students). Increased exposure to technology and high academic rigor could bias the survey responses toward CMS software and blended learning.

The school uses the open-source CMS Moodle™ [8]. Approximately two thirds of the population used the CMS for at least one of their classes at the time of the data collection. The students were given an anonymous survey on their perception of Moodle's™ influence. This volunteer survey resulted in 63% response. Non-Moodle™ users' responses were excised.

The survey consisted of two parts. In the first part, students gave information about their general experience with Moodle™. In the second, students gave information about their experience specifically within their class which used Moodle™ the most.

#### 3.1 Semantic Differential

Students used the following semantic differential to rate effects:

**Table 1.** Semantic Differential

Choice	Acronym
Large Negative Effect	LN
Medium Negative Effect	MN
Small Negative Effect	SN
Small Positive Effect	SP
Medium Positive Effect	MP
Large Positive Effect	LP
Not Applicable or Not Used	N/A

## 4 Results

Students were first asked to give information about their experience with Moodle™ in general.

The students were asked to furnish data concerning their experiences with Moodle™, specifically within the class that used the CMS the most.

**Table 2. Moodle™ General Results**

Question	Results		
What is your gender?	Male – 26	Female – 22	
What grade are you in?	Sophomore – 11	Junior – 21	
	Senior – 16		
How many classes are you taking this semester?	Four – 15	Five – 17	Four – 15
	Seven – 4	Eight – 1	Seven – 4
About how often do you log onto Moodle™?	Never – 0	1 to 3 Days Per Month – 7	
	1 to 3 Days Per Week – 23		
	4 to 6 Days Per Week – 8		
	Daily – 10		
About how often do you have difficulties when using Moodle™?	Never – 13	Rare – 20	
	Mildly Often – 6	Very Often – 9	
Overall, what effect has Moodle™ had on your grades?	LN – 0	MN – 4	SN – 8
	SP – 26	MP – 9	LP – 1
Overall, what effect has Moodle™ had on your understanding of the subjects of your classes?	LN – 1	MN – 2	SN – 7
	SP – 25	MP – 11	LP – 0

**Table 3. Moodle™ Intensive Class Results**

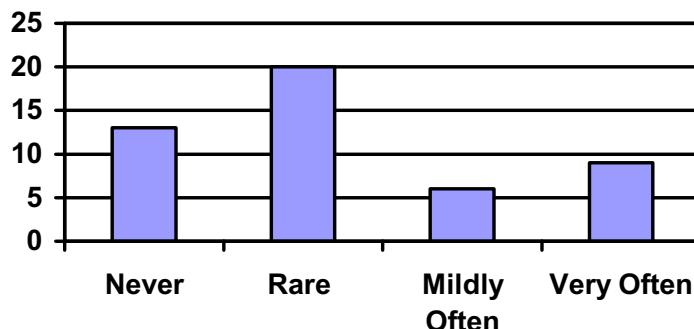
Question	Results		
Approximately how many days a week does your teacher required you to log onto Moodle™ for this class?	Zero – 19	One – 8	Two – 5
	Three – 5	Four – 3	Five – 5
	Six – 1	Seven – 2	
Approximately how many days a week are you advised to log onto Moodle™ for this class?	Zero – 6	One – 7	Two – 6
	Three – 4	Four – 1	Five – 8
	Six – 2	Seven – 14	
Approximately how many days a week do you log onto Moodle™ for this class?	Zero – 6	One – 11	Two – 8
	Three – 4	Four – 7	Five – 3
	Six – 2	Seven – 7	
Rate the effect Moodle™ has had on your grade in the class.	LN – 0	MN – 3	SN – 8
	SP – 19	MP – 9	LP – 3
	N/A – 6		
Rate the effect Moodle™ has had on your understanding of the class subject.	LN – 1	MN – 2	SN – 5
	SP – 23	MP – 7	LP – 2
	N/A – 6		
Rate the effect Moodle's™ Assignment Page has had on your grade in the class.	LN – 1	MN – 1	SN – 6
	SP – 5	MP – 7	LP – 5
	N/A – 23		
Rate the effect Moodle's™ Assignment Page has had on your understanding of the class subject.	LN – 1	MN – 0	SN – 7
	SP – 10	MP – 5	LP – 2
	N/A – 23		

Rate the effect Moodle's™ Weekly/Topic Outline has had on your grade in the class.	LN - 0 SP - 12 N/A - 19	MN - 1 MP - 9 LP - 3	SN - 4
Rate the effect Moodle's™ Weekly/Topic Outline has had on your understanding of the class subject.	LN - 0 SP - 15 N/A - 19	MN - 3 MP - 7 LP - 0	SN - 4
Rate the effect Moodle's™ Discussion Board (forums) has had on your grade in the class.	LN - 2 SP - 13 N/A - 23	MN - 0 MP - 4 LP - 1	SN - 5
Rate the effect Moodle's™ Discussion Board (forums) has had on your understanding of the class subject.	LN - 2 SP - 11 N/A - 23	MN - 1 MP - 5 LP - 3	SN - 3

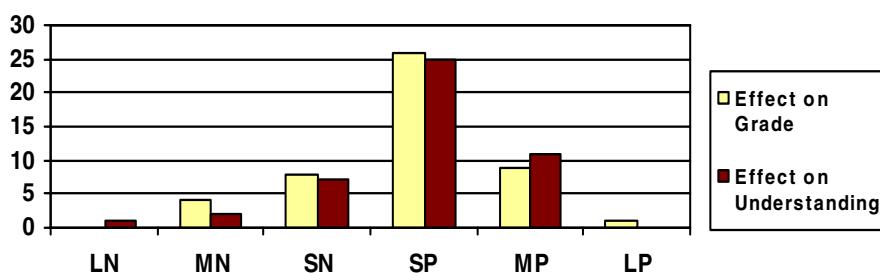
Results of "N/A" on the last few questions indicate that the student responding did not use that particular feature of Moodle™ in his or her class which used the CMS most.

#### 4.1 Graphs

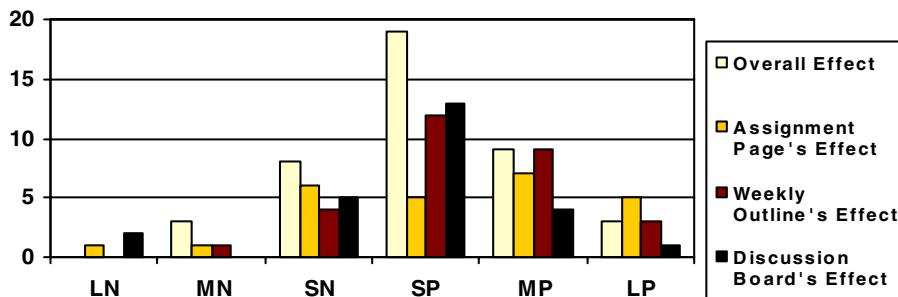
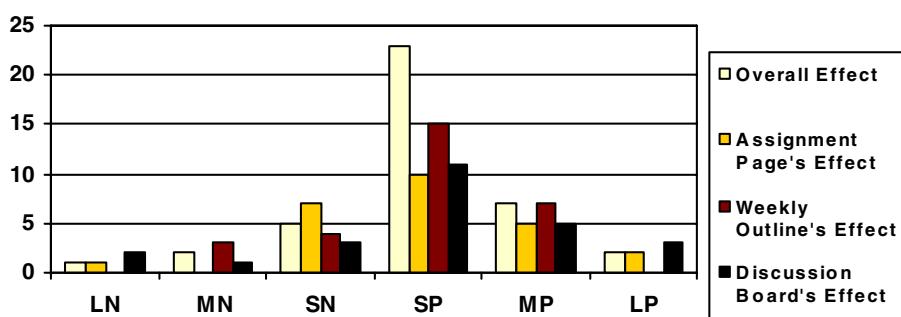
Only data relevant to the conclusion were graphed.



**Fig. 1.** Frequency of Difficulty



**Fig. 2.** Overall Effect of Moodle™

**Fig. 3.** Moodle's™ Effects on Grade by Components**Fig. 4.** Moodle's™ Effects on Understanding by Components

## 4.2 Significant Differences

Using the Kruskal-Wallace test, a nonparametric that compensated for unequal cell sizes, the following significant differences were obtained:

**Table 4.** Significant Differences

Independent	Dependent	P - Values
Gender	Frequency of Difficulty	0.031
Frequency of Difficulty	Effect of CMS on Class Grade	0.008
Frequency of Difficulty	Effect of CMS on Subject Understanding	0.017
Frequency of Difficulty	Effect of CMS' Assignment Page on Subject Understanding	0.032
Frequency of Difficulty	Effect of CMS' Weekly Outline on Class Grade	0.023
Frequency of Difficulty	Effect of CMS' Weekly Outline on Subject Understanding	0.004
Class Subject	Effect of CMS on Class Grade	0.013
Class Subject	Effect of CMS on Subject Understanding	0.001

## 5 Conclusion

Seventy-three percent of the sample perceived problems with the CMS. The significant differences found indicate the importance of enhancing ease of use, ease of navigation, clarity of command and menu structures, as well as other factors of HCI.

Poole's study found no students having difficulties with their CMS [9]. This contrasts starkly with the 73% of students at the secondary school. The large difference demonstrates that studies on higher education's use of blended learning cannot be generalized to the high school level. Of approximately 40 articles reviewed for this paper, only four scholarly sources could be found which focused on k-12 education. Current research on blended learning does not address the needs of secondary schools or the HCI components that may need reconstruction or clarification. A new body of research is needed for high schools.

The significant difference between the genders when crossed with perceived difficulties gives a direction to improve CMS in high schools. Both psychological and sociological HCI concerns should be addressed. Historically, young females have addressed computers as antagonists, with some trepidation [23].

The current generation of students is facing a greater risk of information overload [21]. If the CMS adds to the learning curve, rather than simplifying the experience, the learning process becomes obfuscated. Therefore, a CMS needs to be as simple relative to HCI standards as possible.

In follow-up conversations with the student body, students did not notice or take advantage of help pages. In fact, 80.4% of the sample was unable to locate and access the help modules. The help pages were perceived as confusing and detracting from the subject matter. Although Moodle™ is used throughout the world due to its open-source nature; it is believed that HCI professional community can contribute to its efficacy by improving HCI concerns.

Despite the problems facing blended learning, the literature signifies great potential. Previous studies conducted on blended learning on the college level have shown that college students appreciate the process of blended learning [8][9][13][18]. High school students in this study believed that blended learning helped increase their knowledge acquisition (See Figure 2). As such, blended learning as an idea is not flawed, but needs more data based underpinnings.

Students found the broader aspects of the information delivered by the CMS to be more relevant to both grades and understanding than those components that fostered depth. This may also lead to the supposition that a better navigational experience would have enhanced the students' use of the blended learning tools (see Figure 3 and Figure 4).

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