

## Validation And Evolution of The Utaut Model: LMS Adoption in K-8 Schools

**Eugene P. Kim**

*School of Education, Concordia University, Irvine, USA*

**Elizabeth A. Thomas**

*School of Education, Concordia University, Irvine, USA*

**[Abstract]** This study used the Unified Theory of Acceptance and Use of Technology (UTAUT) as a survey instrument to determine the factors that affect K-8 teachers' usage of an LMS. The UTAUT consists of four predictor variables: benefits (PE) of the LMS, ease of use (EE) of the LMS, leadership and technology support (FC), and social influence (SI). Using a modified UTAUT questionnaire, 176 participants responded to a survey focused on internal and external factors that affect their usage of an LMS. The internal factors of perceived benefits (PE) of using the LMS and ease of use (EE) had the most significant impact on attitude (A) towards using the LMS. In addition, ease of use (EE) was positively correlated to self-efficacy (SE). The external factors of school site support (FC) and social influence (SI) also impacted attitudes towards the use of an LMS. The results also revealed that teachers who taught grades 5-8 found the LMS more beneficial (PE) to their teaching practice and easier to use (EE) than teachers who taught grades K-4. The findings confirm that the administration plays a crucial role in the success of their staff by understanding teachers' perceived benefits (PE) of the LMS to their teaching practice and student learning, providing various types of professional development and training to ensure the LMS is perceived easy to use (EE), and to provide dedicated time for teachers to learn from each other about how they use the LMS for specific grade levels and subjects.

**[Keywords]** Behavioral intention, effort expectancy, facilitating conditions, performance expectancy, social influence, technology adoption

### Introduction

Technology in education is advancing at a rapid rate. In the past, new technology was more teacher-centered where teachers used the new technology in the front of the classroom to enhance learning (Boekweg et al., 2021; Firmin & Genesi, 2013). For example, the advancement of projectors engaged students' visual sense, then smartboards engaged students' visual and audio senses allowing for video display, and currently, interactive whiteboards to engage students' visual, audio, and touch senses. More recently, schools have implemented 1:1 initiatives providing students with a digital device to access the internet for information and content and other digital learning tools. The advancement of technology has shifted from teacher-centered instruction to student-centered learning. The concept of student-centered learning is not new. It dates to the early 20th century, credited to Hayward and Dewey's work in 1956 (O'Sullivan 2003). According to O'Neill and McMahon (2005), student-centered learning has various definitions and can mean different things to different people. At the core, student-centered learning is where teachers act as facilitators of learning and guide students with questions and create conditions to trigger curiosity and empower the yearning for knowledge (Kaput, 2018; O'Neill & McMahon, 2005).

### **Purpose/Significance of Study**

This study will contribute to elementary and middle school leaders' roles in supporting teachers' use of LMSs, explicitly looking at internal and external factors affecting LMS usage. In addition, leadership support and a strategic vision of new technology implementation are essential in shaping teachers' attitudes towards new technology and technology tools (Heath, 2017; Holland & Piper, 2016; Kimmons & Hall, 2018; Liu et al., 2017).

Teachers have varying backgrounds and views of technology, including experiences growing up with technology. Internal factors for using technology include attitudes and beliefs and technology competency, which can be shaped by experiences. New technology initiatives can be intimidating to incorporate into practices and can be intimidating to learn. Research studies show that there are many benefits of integrating an LMS in the classroom. However, many elementary and middle school teachers lack knowledge of effective ways of using an LMS to enhance teaching since it is a new platform (Fathema & Akanda, 2020; Wichadee, 2015). Garone et al. (2019) stated that "the benefits of learning management systems are promising; however, these benefits can only be attained when the systems are used efficiently" (p. 2470). Teachers with varying attitudes and beliefs about technology implement it differently (Garone et al., 2019; Palak & Walls, 2009). If leaders are aware of the technology needs of elementary and middle school teachers, groups can be formed with similar needs to tier support (Garone et al., 2019; Pynoo et al., 2012).

External factors for using technology include professional development support and leadership support. Buabeng-Andoh and Baah (2020) found that in addition to technical support and access to good internet, skills training and management support also play critical roles in technology use. When leaders are aware of teachers' attitudes and concerns about new technologies, they "can plan for continued and focused professional support and specific strategies to help teachers plan for the changes those new technologies require" (Lochner et al., 2015, p. 68). According to Machika and Dolley (2018), technology training needs are continually developing, and leaders must identify the differences in needs to provide various levels of training.

This research is relevant to the current time in that LMS usage at the elementary and middle school levels has dramatically increased since the 2020 pandemic (Westfall, 2020). This research study will add to the knowledge of technology use and acceptance by being amongst the first to use the UTAUT to study K-8 schoolteachers' LMS use, and guide leaders to understand the support and training needed for K-8 teachers to better incorporate an LMS with efficacy. The relevance extends to technology use beyond LMS, such as Artificial Intelligence.

### **Literature Review**

#### ***Learning Management Systems***

Learning management systems (LMS) are a valuable tool to help facilitate learning in different environments. With the development of Moodle in 2000 as the first open source, LMSs have made personalized learning possible by letting learners pick the content they wish to store or export (Athmika, 2020). Foreman (2018) defines an LMS as:

A multiuser software application that is usually accessed through a web browser. It helps organizations manage training events, self-paced courses, and blended learning

programs. It provides automation that replaces rigorous and expensive manual work, saves time, and enables the organization of content, data, and learners. It tracks and reports on training activity and results. (p. 18)

As technology is more prevalent in schools, organizations are looking to adopt platforms, such as an LMS, that help instructors provide their students with learning materials and activities while tracking participation and progress through data systems and assessments (Crouse-Machcinski, 2019). Examples of an LMS for education include Blackboard, Angel, Sakai, Canvas, Schoology, and Moodle.

### ***LMSs Enhance and Transform Learning***

LMSs have many features that enhance learning, such as discussion forums, announcements, alerts and notifications, and multimedia feedback (Foreman, 2018; Green & Chewing, 2020; Snowball & Mostert, 2010; Watson & Watson, 2007). The features allow teachers to use technology to transform students' engagement in learning. Students can engage with content at their own pace and time while communicating with peers and teachers in different forums. In addition to the features, Snowball and Mostert (2010) found that the increased communication via the forums helped teachers address problems and concerns quickly.

LMSs are commonly used in higher education and have the potential to transform teaching and learning at the elementary and middle school levels. Green and Chewing (2020) suggested that, rather than transferring course content, essential digital pedagogy requires a more reflective approach that intentionally integrates curriculum materials into the learning environment. For example, teachers can use an LMS to differentiate due dates, allow multiple ways to show mastery of a topic, and deliver content in various ways. In addition, teachers can use an LMS to create opportunities that empower students as collaborators in the learning process.

An LMS can be a valuable and effective extension of a classical learning environment (Mijatovic et al., 2013). In situations where students are absent, they can log onto the LMS, engage in the same content taught in the classical learning environment, connect with teachers and peers through discussion forums, and submit assignments for understanding. They reported that students' active participation in class and interactive usage of an LMS were high predictors of student achievement in a blended learning environment.

### ***LMSs Implementation - Challenges and Solutions***

An LMS has the potential to enhance students' learning experiences, but it is essential to address the challenges of implementing an LMS and techniques that can address the challenges. According to Snowball and Mostert (2010), most students agreed that the LMS was a helpful resource that improved communication, provided a safe environment to ask questions, and helped with problem-solving through quick feedback. It is essential to be aware that some students have a negative experience using an LMS. Snowball and Mostert (2010) reported that negative student LMS experiences involved technical difficulties such as the stress of logging on, unstable access to an internet connection, and difficulty navigating the interface of the LMS. Administrators and organizational leaders need to be mindful of students' technological skills and knowledge range to

provide opportunities to practice using an LMS in a low-stakes situation (Snowball & Moster, 2010).

Implementing an LMS takes clear communication on the users' vision of use and outcomes and takes much training for all stakeholders. Green and Chewning (2020) suggested that an effective form of training is collaborating with mentors, instructional designers, or coaches. By cultivating collaborative partnerships, teachers can rely on area experts to pursue help and guidance to focus on the students and spend more time and energy on creating a transformative learning environment. Lochner et al. (2015) found that ongoing and systemic support during an LMS implementation process is critical to helping teachers move from self-concern to impact concerns. Hall and Hord (2011) described self-concerns as concerns about the technology and how it will affect them personally and impact concerns as concerns about the effect of the technology on their students' performance, cooperating with other teachers to maximize the technology in their practice, and exploring more about the technology. In addition to training, qualified and efficient technical support can ease users' anxieties about the technology and allow users to focus on the task at hand when implementing an LMS (Fathema & Akanda, 2020; Zheng et al., 2018).

### Theoretical Framework

Acceptance of new technology by its intended users is a significant factor in implementation (DeLone & McLean, 2003; Venkatesh et al., 2003). The Unified Theory of Acceptance and Use of Technology (UTAUT, Momani, 2022, Table 1), which determines technology usage intention and behavior (Venkatesh et al., 2003). The UTAUT model consists of four predictor variables, performance expectancy, effort expectancy, social influence, and facilitating conditions (Garone et al., 2019; Figure 1).

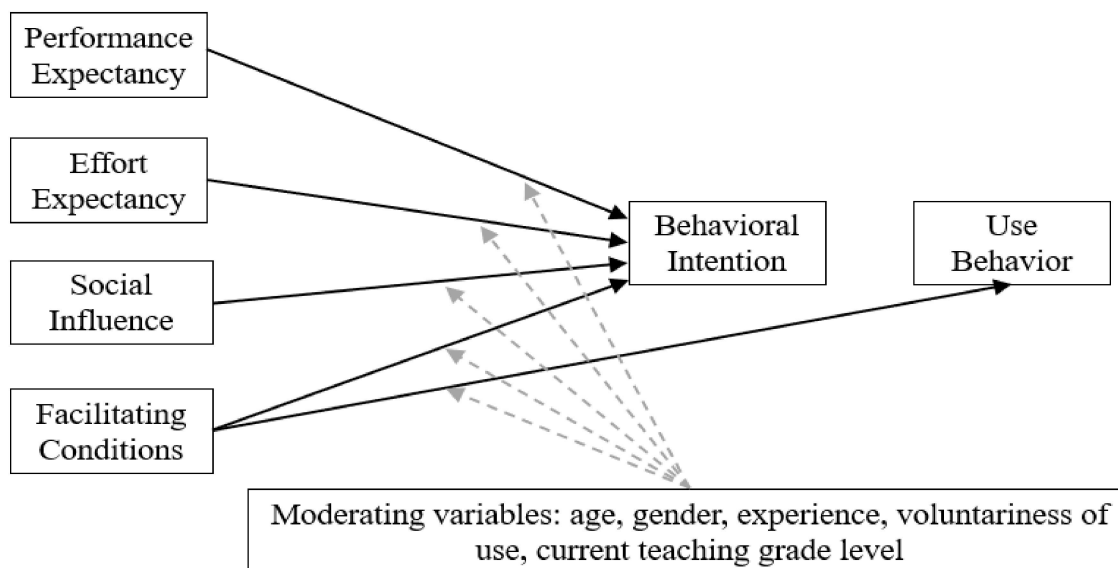
**Table 1**

*Definitions of Constructs of the UTAUT Model*

| Constructs              | Definition                                                                                                                                                     |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Performance Expectancy  | The capability of the technology to provide benefits and enhance the performance of the user according to their expectations (Venkatesh et al., 2003, p. 447). |
| Effort Expectancy       | User expectations about the ease of use of technology (Venkatesh et al. 2003, p. 450).                                                                         |
| Social Influence        | The expected influence of others on the user to start and continue using the technology (Venkatesh et al., 2003, p. 451).                                      |
| Facilitating Conditions | The expected level of organizational and technical infrastructure that can support the use of technology (Venkatesh et al., 2003, p. 453).                     |
| Behavioral Intention    | The expectation of the user's intention to perform plans and decisions regarding the use of technology (Venkatesh et al., 2003).                               |

*Note. Momani (2020, p.84).*

**Figure 1**  
*Unified Theory of Acceptance and Use of Technology*



*Note. Adapted from Garone et al. (2019, p. 2469.)*

According to research studies, the performance expectancy construct, which is highly task-oriented, tends to be the strongest predictor of intention in voluntary and mandatory settings (Buabeng-Andoh & Baah, 2020; Khechine et al., 2020; Venkatesh et al., 2003). Effort expectancy is significant in voluntary and mandatory usage conditions, but only in the beginning stages of a new behavior after initial training. Social influence is not significant in voluntary settings but does become significant in mandatory settings due to compliance and social pressure. Alternatively, facilitating conditions become more significant with age and experience because older workers tend to attach more importance to receiving help and assistance on the job. The UTAUT model will reveal the constructs that affect elementary and middle school teachers' use of an LMS.

### Research Design and Method

This study used a mixed-methods approach and followed the procedures of a convergent QUAN+qual parallel design that allows quantitative and qualitative data to be integrated and co-understood. The survey instrument, modified from the UTAUT Questionnaire (Venkatesh et al., 2003), includes both qualitative and quantitative questions. IRB approval for the study was granted by Concordia University Irvine, and data was collected in 2023.

### Research Questions

Multiple factors can affect efficient LMS usage at an elementary and middle school level. To better understand the use of an LMS in an elementary and middle school level, the following research questions guided this study.

***Primary Research Question:***

PQ1. What factors affect K-8 teachers' usage of a Learning Management System (LMS)?

***Secondary Research Questions:***

SQ1. How do technology attitudes and beliefs (internal factors) affect LMS usage?

SQ2. How do the conditions at a school site (external factors) affect LMS usage?

SQ3. What other external and internal factors affect LMS usage?

***Sampling and Sampling Procedures***

This study included 176 K-8 teachers required to use an LMS at schools that have adopted an LMS between 2016 and 2022 to compare data collected from schools that specifically adopted an LMS during or after the COVID-19 pandemic. The study used a parallel sampling, "using the same people, from different populations, in the quantitative and qualitative components of the study" (DeCuir-Gunby & Schutz, 2017, p. 114), with convenience sampling mixed in. In addition, the sample included several social media groups geared toward education, including Canvas for Elementary (Teachers), Primary Collaborative, Catholic School Tech and More, Schoology Educator Community, and Distance Learning Educators.

***Instrumentation and Measures***

A survey distributed via multiple platforms and three school sites was used to collect data. The survey included demographics and questions based on the UTAUT model developed by Venkatesh et al. (2003) and Garone et al. (2019). Acceptance of new technology by its intended users is a big factor in implementing the new technology (DeLone & McLean, 2003; Venkatesh et al., 2003). The Unified Theory of Acceptance and Use of Technology (UTAUT) is a widely accepted instrument for measuring user acceptance, behavioral intention, and use (Venkatesh et al., 2003).

The UTAUT questionnaire used a five-point Likert scale adapted from Venkatesh et al. (2003), measuring identification to a statement (1: strongly disagree to 5: strongly agree). The questionnaire incorporated the four primary UTAUT constructs of performance expectancy, effort expectancy, facilitating conditions, and social influence (Venkatesh et al., 2003), in addition to attitude, self-efficacy, anxiety, behavioral intention, and innovation (Buabeng-Andoh & Baah, 2020; Garone et al., 2019).

**Results**

Both internal factors of technology perception and external factors of leadership and technology support at the school site, affect teacher use of a learning management system (LMS) in a K-8 elementary and middle school; however, internal factors had a greater impact. The internal factors that affect teacher use of an LMS include the perceived benefits of teaching and learning and the perceived ease of use of the LMS (Buabeng-Andoh & Baah, 2020; El-Masri & Tarhini, 2017; Garone et al., 2019; Venkatesh et al., 2003). The external factors that affect teacher use of an LMS include the leadership and technology support at the school site and the social influence of colleagues at the school site. Also visualized are the correlations between the internal/external factors and mediators (attitudes, anxiety, and self-efficacy) for LMS use as well as between the

mediating factors of attitudes, anxiety, and self-efficacy to the behavioral intention to use the LMS.

### ***UTAUT Constructs and their Effect on Mediating Factors***

Internal and external factors of teacher use of an LMS were correlated with the mediating factors of attitude, anxiety, and self-efficacy (Table 2).

**Table 2**

*UTAUT Constructs and the Strength of the R-Value Correlation to Mediators (N = 176)*

| Mediators          | UTAUT Constructs                         |           |                                         |             |
|--------------------|------------------------------------------|-----------|-----------------------------------------|-------------|
|                    | Tech - Internal Factors<br>Benefits (PE) | Ease (EE) | Site - External Factors<br>Support (FC) | Social (SI) |
| Attitude (A)       | .793                                     | .680      | .557                                    | .365        |
| Anxiety (ANX)      | -.377                                    | -.421     | -.312                                   |             |
| Self-Efficacy (SE) | .386                                     | .561      | .364                                    |             |

Note: \*\*\* $p < .001$ .

Out of the factors that are correlated to teachers' LMS attitudes (A), anxiety (ANX), and self-efficacy (SE), teachers' perceptions of how the LMS benefits (PE) their teaching and student learning had the strongest correlation to attitude (A),  $r(174) = .793, p < .001$ .

### ***Mediating Factors and Their Effect on Outcomes***

The mediating factors of attitude, anxiety, and self-efficacy towards teacher use of an LMS were correlated with the outcomes of behavior and innovation, as shown in Table 3.

**Table 3**

*Mediating Factors and the Strength of the R-Value Correlation to Outcomes (N = 176)*

| Outcomes         | Mediating Factors |               |                    |
|------------------|-------------------|---------------|--------------------|
|                  | Attitude (A)      | Anxiety (ANX) | Self-Efficacy (SE) |
| Behavior (BI)    | .283***           | -.159*        | .152*              |
| Innovation (INN) | .651***           | -.338***      | .415***            |

Note. \* $p < .05$ . \*\*\* $p < .001$ .

The mediating factors that affect teachers' innovation (INN) and behavioral intention (BI) and to use an LMS were inversely correlated with anxiety (ANX) and positively correlated with attitude (A) and self-efficacy (SE). Out of these mediating factors, attitude (A) had the strongest correlation with behavioral intention (BI),  $r(174) = .283, p < .001$  and with innovation (INN),  $r(174) = .651$ .

### ***Effects of Demographic Factors***

Participants provided demographic data including gender, grade levels taught, school size, number of years with teaching experience, age, type of school (e.g., private, Catholic, public, etc.), number of years using an LMS as a teacher, and the name of LMS platforms participants are using or have

used in the past. An Analysis of Variance revealed that the demographic with the most significant impact is teacher's grade levels taught and years of teaching experience (Table 4). The teacher's age and gender as well as the size of the school, the type of school, and the LMS platform used had minimal or no significant effects on teacher use of LMS.

**Table 4**

*Analysis of Variance Between Grade Levels Taught and UTAUT Constructs and Outcomes (N = 176)*

| Construct        | All Levels<br>(Group 1) |           | Primary K-4<br>(Group 2) |           | Upper 5-8<br>(Group 3) |           | <i>F</i> (2, 173) | $\eta^2$ |
|------------------|-------------------------|-----------|--------------------------|-----------|------------------------|-----------|-------------------|----------|
|                  | <i>M</i>                | <i>SD</i> | <i>M</i>                 | <i>SD</i> | <i>M</i>               | <i>SD</i> |                   |          |
| Benefits (PE)    | 3.68                    | .8        | 3.13                     | 1.27      | 4.06                   | .93       | 14.33***          | .14      |
| Ease (EE)        | 3.63                    | .78       | 3.16                     | 1.05      | 3.76                   | .93       | 7.34***           | .08      |
| Support (FC)     | 4.04                    | .61       | 3.92                     | .65       | 4.19                   | .63       | 3.38*             | .04      |
| Attitude (A)     | 3.74                    | .9        | 3.16                     | 1.1       | 3.94                   | .95       | 11.27***          | .12      |
| Behavior (BI)    | 2.81                    | .66       | 2.69                     | .65       | 3.1                    | .55       | 8.95***           | .09      |
| Innovation (INN) | 3.12                    | 1.1       | 2.88                     | 1         | 3.35                   | .78       | 4.3*              | .05      |

Note: \* $p < .05$ . \*\*\* $p < .001$ .

These results reflect the grade levels taught and the mean and standard deviation based on a Likert scale (1=Strongly disagree to 5=Strongly agree) to UTAUT constructs (benefits, ease of use, and support), mediating factor (attitude), the behavioral intention to use the LMS, and innovative use of an LMS. All constructs, subjects from Primary K-4 (Group 2) had significantly lower average responses compared to those from Upper 5-8 (Group 3). In other words, Primary K-4 teachers indicated less benefit, ease, support, and attitude regarding LMS use than their Upper 5-8 peers. The strongest effects were seen in benefits (PE),  $F(2, 173) = 14.33, p < .001$ ; ease of use (EE),  $F(2, 173) = 7.34, p < .001$ ;  $p = .036$ ; attitude (A),  $F(2, 173) = 11.27, p < .001$ . Support (FC) had the smallest significant gap between groups,  $F(2, 173) = 3.38, p < .05$ . In regard to outcomes, there were group differences for both behavioral intentions (BI),  $F(2, 173) = 8.95, p < .001$ ; and innovation (INN),  $F(2, 173) = 4.3, p = .015$ , with a greater effect for behavioral intentions.

The number of years a teacher has had experience using an LMS had significant effects on teacher use of an LMS (Table 5). The more experienced teachers had more positive results when it came to attitudes towards LMS use. In other words, those who taught between 0-3 years had a less favorable view of the benefits (PE),  $F(1, 167) = 4.21, p = .042$ ; ease of use (EE),  $F(1, 167) = 6.44, p = .012$ ; and self-efficacy (SE),  $F(1, 167) = 9.35, p = .003$  towards the use of AI compared to the group with 4 or more years of teaching experience. In addition, the less experienced teachers had greater anxiety (ANX) compared to those with more experience,  $F(1, 167) = 4.66, p = .032$ .

**Table 5**

*Analysis of Variance Between Years of Experience Teaching with an LMS and UTAUT Constructs and Mediating Factors (N = 176)*

| Construct          | 0-3 Years<br>(Group 1) |           | 4 or More Years<br>(Group 2) |           | <i>F</i> (1, 167) | $\eta^2$ |
|--------------------|------------------------|-----------|------------------------------|-----------|-------------------|----------|
|                    | <i>M</i>               | <i>SD</i> | <i>M</i>                     | <i>SD</i> |                   |          |
| Benefits (PE)      | 3.49                   | 1.14      | 3.85                         | 1.1       | 4.21*             | .02      |
| Ease (EE)          | 3.34                   | .96       | 3.72                         | 1         | 6.44*             | .04      |
| Anxiety (ANX)      | 2.09                   | .95       | 1.79                         | .87       | 4.67*             | .03      |
| Self-Efficacy (SE) | 3.76                   | .63       | 4.06                         | .62       | 9.35**            | .05      |

*Note.* This table reflects teachers' years of experience using an LMS and the mean and standard deviation from the Likert scale (1-Strongly disagree to 5-Strongly agree) to two UTAUT constructs (benefits and ease of use), and two mediating factors (anxiety and self-efficacy). \* $p < .05$ . \*\* $p < .01$ .

### Discussion

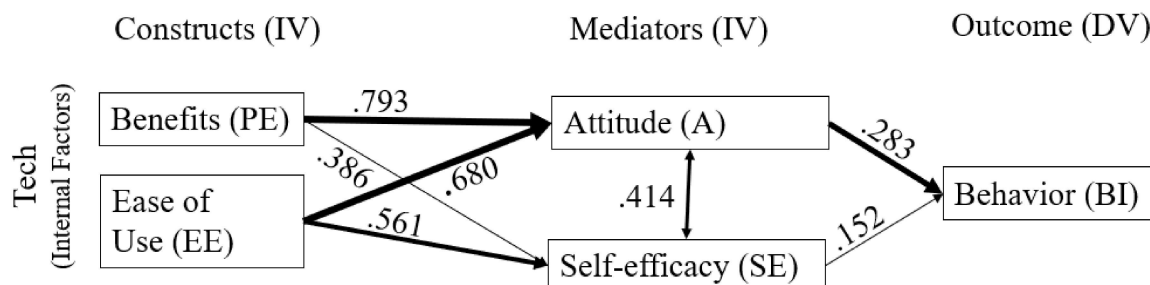
Based on our analysis, we can conclude several important outcomes. First, the UTAUT model applies K-8 teachers using LMS. Secondly, there are differences in our results compared to those of studies cited in our literature review. Finally, there are several key factors that are consistently and significantly related to teachers' LMS use.

#### *Internal Factors, Mediators and Outcomes*

In our first research question (SQ1), we asked: *How do technology attitudes and beliefs (internal factors) affect LMS usage?* we found that beliefs and attitudes (internal factors) have a clear and consistent relationship with both mediators (attitude and self-efficacy) and outcomes (behavioral intentions) (Figure 2). To put it simply, teachers' attitudes and confidence in using the LMS are more positive if teachers find that the LMS is easy to use and its benefits are clear. The impacts of internal factors are more pronounced for attitude than for self-efficacy. This effect is greater for those who teach higher grades (5-8) and have more teaching experience.

**Figure 2**

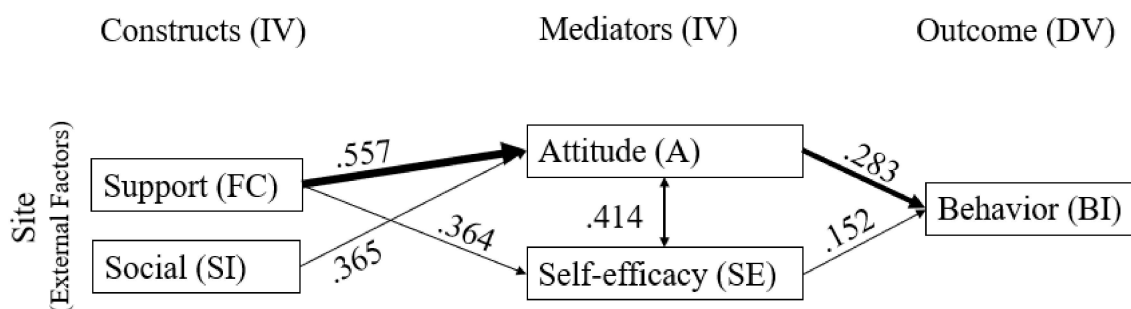
*Correlations between Internal Factors, Mediators, and Outcomes (N = 176)*



Our second research sub-question (SQ2) asked: *Do the conditions at a school site (external factors), including support and social influence, affect LMS usage?* External factors such as tech support and social influence have a significant impact on the attitudes and self-efficacy that teachers possess towards LMS use (Figure 3). To a lesser degree, these result in behavioral intention to use the LMS. Support has a greater impact on attitude and self-efficacy. And self-efficacy has a greater impact on behavioral intention. Taken together the strongest chain of effect highlights the importance of increasing tech support for teachers to increase their attitudes towards LMS use which will consequently increase behavioral intention to use the LMS.

**Figure 3**

*Correlations between External Factors, Mediators, and Outcomes (N = 176)*

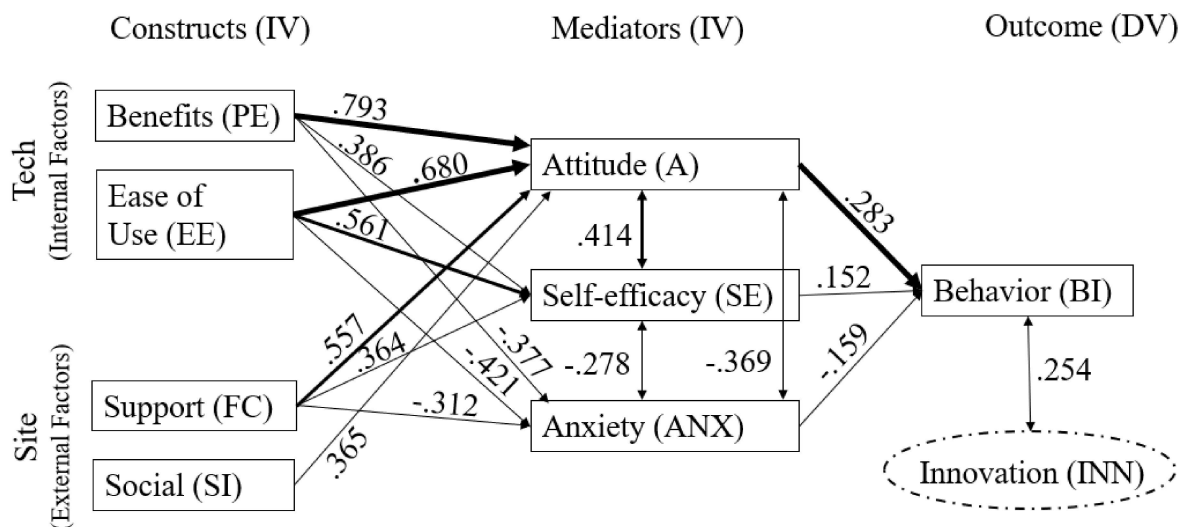


Our third research sub-question (SQ3) asked: *What other external and internal factors affect LMS usage?* As noted earlier, we find that those who teach higher grade levels and those who have more years of teaching experience have higher average responses on constructs, mediators, and outcomes.

The primary research question of this study asked, *What factors affect K-8 teachers' usage of a Learning Management System (LMS)?* Combining all of our results, we present a modified framework (Figure 4) based on the Unified Theory of Acceptance and Use of Technology (UTAUT). Our results confirm that the four original UTAUT constructs are positively correlated with behavioral intention (BI) as well as the mediators. In addition, we confirmed that the mediators of attitude (A), self-efficacy (SE), and anxiety (ANX) are to varying degrees influencers of behavioral intention (BI) to use the LMS. The internal factors of teachers' perceptions of the benefits (PE) of the LMS and the ease of use (EE) of the LMS had the most impact on teachers' attitudes, which had the most positive impact on Behavioral Intention (BI) to use the LMS. In other words, teachers who perceived that the LMS benefited their teaching performance had a more positive attitude using it and, therefore, were more deliberate in using it. Likewise, teachers who perceived the LMS as easier to use were likelier to have a better experience with it and use it intentionally.

**Figure 4**

*Correlations between UTAUT Constructs, Mediators, and Outcomes (N = 176)*



*Note. All correlation coefficients shown are significant to either  $p < 0.05$  or  $p < 0.01$ .*

### Conclusion

Internal factors of technology use, particularly the benefits (PE) and ease of use (EE) of the technology, are important predictors of K-8 teachers' usage of an LMS. Therefore, the findings of this study present some important implications, particularly for leaders in an elementary or middle school environment looking to implement an LMS or increase teacher self-efficacy in using an LMS. School leaders should implement practical strategies that focus on internal factors that include:

- A vision to establish and communicate the benefits (PE) of the LMS for teachers and students, plan for short-term and long-term training and support, implement plans with fidelity and flexibility, and evaluate the LMS implementation to identify strengths and create new goals for growth (Amick, 2019; Harris et al., 2016; McConnell, 2021; Sell et al., 2012; Sutton, 2015; & Valiente; 2010).
- Meetings with grade-level teams to increase teachers' knowledge of the LMS at that grade level and communicate the benefits (PE) of the LMS for teachers and students at that particular grade level (Buabeng-Andoh, & Baah, 2020; Garone et al., 2019; Heath, 2017; Palak & Walls, 2009; Yeung et al., 2012).
- Grade-level pilot teams to experiment with different LMSs to allow for teachers' voices in determining a user-friendly infrastructure to make sure that it is perceived as relatively easy to use (EE), learn, and navigate (Buabeng-Andoh & Baah, 2020; Garone et al., 2019)

After addressing internal factors that affect the usage of an LMS, leaders in an elementary or middle school environment looking to implement an LMS or increase teacher self-efficacy in using

an LMS should focus on the external factors that affect the use of an LMS, including school site support (FC) and opportunities for social influence (SI). School leaders should implement practical strategies that focus on external factors that include:

- Professional Learning Communities (PLC) where dedicated time is embedded in the school day where teachers can learn from each other and share best LMS practices (Buabeng-Andoh, & Baah, 2020). *Social influence (SI)*.
- Ongoing LMS professional development, including different types of training sessions and varying levels of training sessions that meet teachers' needs through workshops, coaching, and an LMS-integrated planning cycle (Fathema & Akanda, 2020; Joo et al., 2018; Thoma et al., 2017). *School site support (FC)*.
- Training sessions that focus on building teacher capacity in using an LMS, using it efficiently and effectively, valuing teacher's voices, and aligning the LMS to student-centered practices (Buabeng-Andoh & Baah, 2020; Garone et al., 2019; Heath, 2017; Palak & Walls, 2009; Yeung et al., 2012). *School site support (FC)*.

Finally, there are innovative (INN) ways in which teachers can use and implement an LMS. Administrators can support the innovative use of an LMS by providing tailored professional development that focuses on the LMS features that contribute to innovation. As one participant stated, "currently, we are not using the LMS to its full potential." This research revealed that following teachers' regular usage of an LMS, teachers are looking to find innovative ways to incorporate an LMS into their teaching practice to engage students at a deeper and more personal level. Teachers could implement LMS strategies that focus on innovation, including:

- Blended learning: Powell et al. (2015) described blended learning as a method that combines the best features of traditional schooling with the advantages of online learning to deliver personalized, differentiated instruction across a group of learners. Teachers could use the blended learning station rotation model and include a teacher-led station, independent station, technology station, and collaboration station. The technology station could incorporate the LMS to differentiate content, allow for student choice in sharing knowledge of a topic, and provide a means for student collaboration using discussion groups and other collaborative LMS features. In addition, teachers could use the LMS to house videos for flipped instruction allowing students to learn at their own pace.
- Differentiation: Teachers could use the LMS to incorporate various multimedia elements, including audio recordings, music, video, text, and animations for different learning modalities. In addition, teachers could use the LMS to allow students to use different forms of multimedia to demonstrate their understanding of the material.
- Personalization: Teachers could use the LMS to tailor instruction and assessments to each student's unique needs and preferences by using advanced analytics to identify students' skill levels to curate content and assessments based on their needs (Howton, 2021). In addition, LMSs could be used as a platform to create learning paths that "provide students with sequences of educational content and assessments, which students must go through at their

own pace to learn new topics and acquire new skills” (Solea, 2022, Learning goals and personalized paths section).

- **Gamification:** Teachers could use the LMS to create a challenge or a goal that determines what a student needs to master to win and includes some obstacles and ways to earn rewards in the form of badges or points (Mardinger, 2023). Creating game-like situations in the classroom can increase student engagement, motivation, and achievement (Turan et al., 2016).

### **Limitations**

There are limitations to this research study, including the study’s limited geographic networking constraints. A broader geographic network could enhance the generalizability of this study. In addition, a balanced representation of school systems that include public, private, charter, and home school systems could strengthen this study as well.

A Pearson linear correlation and one-way ANOVA test were used to analyze the data. According to Pallant (2013), a significant limitation of the Pearson linear correlation is that it cannot distinguish between independent and dependent variables. The Pearson  $r$  value cannot determine which variable was the cause and which was the effect. A limitation of the one-way ANOVA is that it assumes that the data in the groups are normally distributed (Pallant, 2013). More advanced statistical tests could provide insight into clusters of user groups that would then describe usage behaviors (Garone et al., 2019; Pynoo et al., 2012).

A final limitation of the research was the time period in which the research was conducted. The research was conducted two years after the 2020 pandemic, which forced all schools to distance learning, including elementary and middle schools. As a result of distance learning, many elementary and middle school administrators saw the need to implement LMSs to continue the learning process. LMSs were implemented in a short amount of time, which brought much stress to teachers because they had to learn the system quickly, in addition to how to implement the LMS effectively. The time period of this research study was unique in that many LMSs were implemented at the K-8 level as a reaction to the state of education and the forced distance learning model for all schools. After COVID mandates were less restrictive, schools transitioned back to in-person learning, and LMSs were still used, but without specific training on how to use the LMS in different learning environments that included in-person blended learning, hybrid learning, and distant learning.

### **Recommendations for Further Research**

While this study focused on the factors that affected K-8 teachers’ use of a Learning Management System (LMS), future studies could add to this research by including different geographical locations, various approaches for qualitative data collection, longitudinal studies, and narrowing the focus to a specific LMS. First, participants were limited to the researcher’s geographic location and social media networks. Future research could include participants from a broader range of locations. Additional studies focused on K-8 teachers employed in a specific state or region would enhance validity and, therefore, the findings’ generalizability. In addition, future research could include geographic location as a demographic factor in the survey. Secondly, this study used a

convergent parallel design and used a survey to collect quantitative and qualitative data at one single time.

Future research studies could use a variety of methods (e.g., interviews, qualitative methods, case studies) to understand K-8 teachers' use of an LMS and supports needed to build teacher self-efficacy to confirm and triangulate the findings. Thirdly, this research study was conducted over a period of two months. Further research could implement longitudinal studies to collect data from participants to understand the factors that predict K-8 teachers' use of an LMS and intention to use it over time. Fourthly, the study was not limited to one LMS; future research may replicate this study focusing on a specific LMS or correlate the resulting data to the specific LMSs used. Finally, future research studies could expand on innovative ways K-8 teachers are using an LMS to accommodate different learning environments, specifically a blended learning environment.

### **Implications for Artificial Intelligence and other Technologies across K16+**

Though the research presented here successfully evaluates the UTAUT framework on LMS use for K-8 teachers, the implications for wider technological innovation and change across K12 and university levels are compelling. With the advent of Artificial Intelligence in the educational world, we are quickly realizing the need for building relevance (PE), empowering practitioner expertise (EE), resourcing support systems (FC), and creating communities of practice (SI) that are not afraid to try, experiment, learn, and even fail. These will inherently promote an attitude (A) of embracing and reducing anxiety (ANX) and establishing self-efficacy (SE) so that each educator will not only intend to use (BI) but will efficaciously and faithfully put educational technologies like AI and LMS to use for the good of the students they teach.

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