

Technology and Educational Leadership

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Abstract

This paper investigates the use of technology from the lens of educational leaders, focusing on technology and its shifting role in the classroom, as well as the professional development required to effectively implement technology use. This review of educational leadership and technology centers on the role that administrators play in promoting and implementing educational technology in their schools, along with the systems and processes necessary for the effective implementation and growth of an educational technology program in a school or district. This paper starts with a discussion of the theoretical background behind educational technology leadership and the various components behind the implementation and development of technology in a classroom, then discusses the ways in which strategic planning can provide a structure of support for students and the improved use of technology. Conclusions from this analysis point to the importance of school leadership assessing their current educational technology resources, including financial, material, and human resources. This paper also highlights the importance of strategic planning that includes technology implementation as part of its objectives and creates a structure for that implementation, and includes rigorous assessment as part of a strategic plan for technology implementation.

Keywords: Information technology, educational technology, strategic planning, educational administration and leadership, professional development.

الملخص

تبحث هذه الورقة في استخدام التكنولوجيا من منظور القادة التربويين ، مع التركيز على التكنولوجيا ودورها المُتحوّل في الفصل الدراسي ، فضلاً عن التطوير المهني المطلوب للتّنفيد الفعّال لاستخدام التكنولوجيا.

كما وتُرَكِّز هذه المراجعة للقيادة التربوية والتكنولوجيا على الدور الذي يلعبه المسؤولون في تعزيز وتطبيق تكنولوجيا التعليم في مدارسهم ، جنباً إلى جنب مع الأنظمة والعمليات اللازمة للتّنفيد الفعال ولنمو برنامج تكنولوجيا التعليم في كل مدرسة أو منطقة. تبدأ هذه الورقة بمناقشة الخلفية النظرية وراء قيادة تكنولوجيا التعليم، والمكونات المختلفة وراء تنفيذ وتطوير التكنولوجيا في الفصل الدراسي، ثمّ تناقش الطرق التي يمكن أن يوفّر بها التخطيط الاستراتيجي هيكلاً لدعم الطّلاب وتحسين استخدام التقنية.

تشير الاستنتاجات من هذا التحليل إلى أهمية قيام القيادة المدرسية بتقييم موارد التكنولوجيا التعليمية الحالية ، بما في ذلك الموارد المالية والمادية والبشرية.

كما وتسلط هذه الورقة الضوء أيضاً على أهمية التخطيط الاستراتيجي الذي يتضمن تنفيذ التكنولوجيا كجزء من أهدافها ويخلق هيكلاً لذلك التّنفيد ، ويتضمن تقييماً صارماً كجزء من خطة استراتيجية لتّنفيد التكنولوجيا.

الكلمات المفتاحية: تكنولوجيا المعلومات ، تكنولوجيا التعليم ، التخطيط الاستراتيجي ، الإدارة التربوية والقيادة ، التطوير المهني.

Introduction

Education in the twenty-first century has moved towards higher integration of technology as technology platforms become more accessible, affordable, and in more demand than ever before. Technology has become a focus in the classroom and within educational leadership as a tool to help learners gain twenty-first century skills and to assist educators provide a meaningful and more effective educational environment to students across the nation (Webster, 2017).

The purpose of this paper will review technology within from the lens of educational leaders, technology and its shifting role in the classroom, and the professional development required to make technology an effective tool. Finally, the cost of technology has been considered and the added burdens it may place upon a school and district to ensure that students have the appropriate tools to gain a complete education. The totality of this educational technology perspective can serve as a guide for educational leaders as they develop educational goals, establish support procedures within their schools and districts, and as they guide their stakeholders to support student learning in pursuit of advancing achievement levels based on the established goals and objectives.

This review of educational leadership and technology will center around two essential questions:

- 1) What role does the administrator play in the promotion and assistance with educational technology in their schools?
- 2) What systems and processes are critical to the effective implementation and growth of an educational technology program in a school or district?

Through providing information to answer these two essential questions, this review will allow school leaders to gain a more complete understanding of the expectations placed on them as leaders, responsibilities of the leader, and role within the system to promote an effective program, just as any other system or process within their school or district. Ultimately, this discussion will be aimed at preparing a leader to provide the most effective and beneficial educational opportunities for their students.

Following the discussion of the theoretical framework behind educational technology leadership and the various components behind the implementation and development of technology in a classroom, the district technology plan will be dissected and discussed in terms of its role in support for students and the improved use of technology. In the end, educational administrators must use high levels of leadership practices and organizational culture considerations to ensure that students receive the highest quality education and the use of technology has been conducted efficiently and effectively for maximized learning to occur within each classroom.

The Professional Standards of School Leaders

School leaders across the nation have a distinct responsibility in their role as school and district administrators. Over time, the components of the standards to which they are held to have changed; however, the core mission of the school administrator continues to be the same; maximize student achievement. In order to better understand the role of the school leader, this paper will consider the professional standards set forth in the National Policy Board for Educational Administration (2015), recently revised for the year 2020.

According to the standards in the National Policy Board for Educational Administration (2015), the center of the educational leader's role in a district or school is to promote, "Effective educational leaders develop, advocate, and enact a shared mission, vision, and core values of high-quality education and academic success and well-being of each student". This provides the foundational element for school leaders as they develop policies, systems, and support educators and students. It should be noted that technology in education could play a role in every segment of this standards.

Equity in education is a constant consideration and discussion, as leaders ensure that all students have access to and an equitable chance at gaining a superior education. This is embedded in the following National Policy Board for Educational Administration (2015) standard, "Effective educational leaders strive for equity of educational opportunity and culturally responsive practices to promote each student's academic success and well-being". Access to technology at home will be a consideration taken later in this review, and it is dependent on the school leader to understand the barriers and obstacles students face in terms of socioeconomic and cultural backgrounds. These factors remain as constants in the realities of the student, making it an essential task of the school and its leaders to provide equity from the standpoint of the educational institution.

The capacity of the school staff is the driving force of the capabilities of instruction students receive. Professional development for all staff is one way in which the capacity for instruction may be improved. A National Policy Board for Educational Administration (2015) standard addresses this component in the following, "Effective educational leaders develop the professional capacity and practice of school personnel to promote each student's academic success and well-being. Leaders must develop plans and people to enable an effective system for professional development. This involves strategic planning, personnel considerations, and a system of monitoring progress and achievements in the professional development and coaching model.

The next highlighted standard from the National Policy Board for Educational Administration (2015) was for, “Effective educational leaders manage school operations and resources to promote each student’s academic success and well-being”.

This standard addresses the need of administrators to assess the current status of where the school and district stands and what may be required for the organization to meet its goal to provide the maximized opportunities for students. This may include budgetary considerations, equipment adoption and acquisition, as well as provision of personnel and training to ensure that capacity is built and systems are sustainable for student achievement.

Further under the standard for operations and resources, it was noted in National Policy Board for Educational Administration (2015) that effective administrators will, “Seek, acquire, and manage fiscal, physical, and other resources to support curriculum, instruction, and assessment; student learning community; professional capacity and community; and family and community engagement”. This broad range of responsibility requires the administrator to view the entire school system in their control to ensure that it has the appropriate support to all extent possible. Technology in education has roots that can extend to nearly all aspects of this standard guide, making it imperative that the leadership always consider the status and role of educational technology within the organization

The standards seen within this discussion illustrate the broad range of responsibilities and expectations placed upon school leadership. Technology is an underlying element within education which grows in each passing school year. These standards from the National Policy Board for Educational Administration (2015) provide a further framework for the discussion which will take place in the following pages. Leadership is a driving force and guide to all the policies, systems, and processes which involve the school organization and educational goals set for our students.

The Necessity of a Technological Education

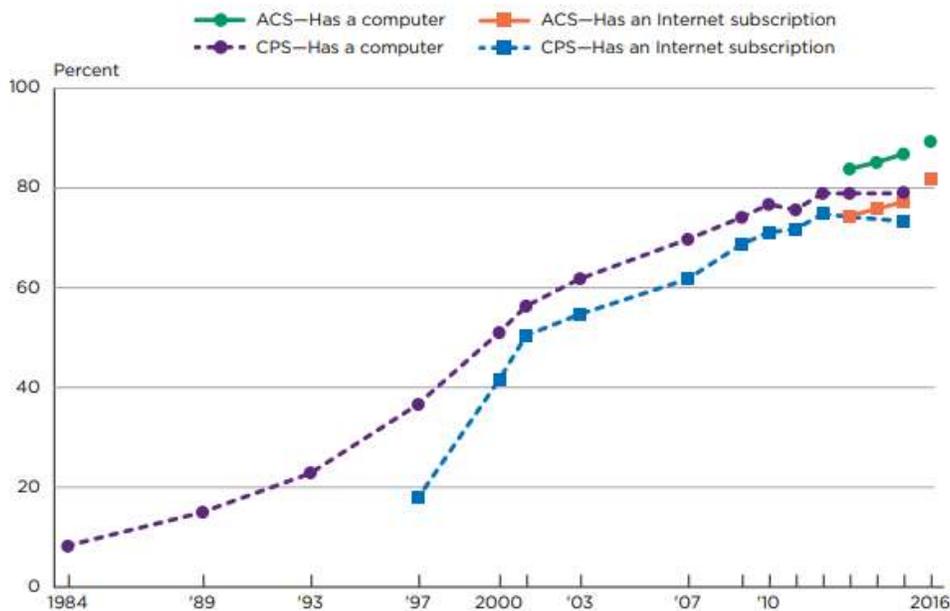
The presence of technology in the homes of the United States and society in general is a growing trend, as exemplified in the data collected by the United States Census. The following excerpt from the United States Census, 2016 American Household Survey, highlights some of the trends seen in the data collected from the households across the nation. Internet connectedness is a chief driving force behind the increased use and presence of devices and capacity for technology throughout the nation

The Internet has impacted multiple areas of our lives, from performing basic tasks like shopping or paying bills, to using social media to connect with family, friends, and the larger community. It has become an avenue to pursue both formal education as people take online courses to earn college degrees, and informal learning such as accessing “how-to” videos for everything from tying a necktie to remodeling your bathroom.

Figure One shows the growth of computer presence in households as well as the internet use and connections. Although the computer growth outpaced the internet connections, both have experienced large gains since the origins of the personal computer in the early 1980's.

Figure One. American Household Survey Technology Growth (US Census, 2016)

Percentage of Households With Computer and Internet Use: 1984 to 2016



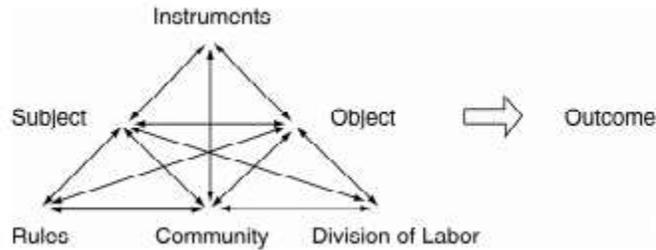
Theories of Leadership

Although there are numerous leadership theories and theories centered on technology implementation, one theory stands out which places classroom technology in its most effective role. Activity theory focuses on the role of technology as a participant in the education of the student, and not the central actor within the process. Activity Theory allows educators to see the computer and technology as a tool, while preserving the precious interactions between teacher and the pupil. According to Murphy and Rodriguez-Manzanares (2008), “From an AT perspective, the computer is simply another tool mediating the interaction of humans with their environment”.

The history and relationship with Activity Theory and technology goes back several decades. This characteristic is evident in the following statement on the research, “An important development in the application of the theory in studies of human uses of technology took place in the late 1980s and early 1990s, when activity theory started to be employed internationally to address new challenges associated with computers and information systems” (Kaptelinin&Nardi, 2018).

This early adoption of the theory in technology shows that the processes and perspective of the theory allow for accessible elements in the technology sector. The interactions within Figure Two illustrates the dynamics of Activity Theory, according to Engestrom (1987).

Figure Two. Activity Theory interactions (Murphy and Rodriguez-Manzanares, 2008)



It can be seen from the dynamics in Figure Two that the use of instruments represents a single aspect of the interactions of the community. Between multiple components within the system (rules, community, subjects, objects, and instruments), outcomes are yielded. The role of instruments, such as educational technology, are up to the school administrators as well as teachers as decisions are made to embed and utilize tools within the educational plan of the student.

Activity theory is centered around the dynamic and interactive nature of the elements which appear within the system (Figure Two). The motivation behind the elements of activity behind the components of AT is synthesized through a series of tensions and contradictions within the system, as interactions create varying outcomes. How are elements of the system controlled in order to arrive at a desired outcome after the interactions take place within the system? The elements of control within the AT system are contingent upon a few key areas of consideration: materials and equipment, culture, and change. All of these components are driven by the vision of a school or organization.

Materials and Equipment.

These represent the tangible component of the process and direction that a school or district will move in from a technology perspective. The availability of equipment and supplies, along with other factors, such as maintenance, determine the ultimate direction and capabilities of a system output. Ideally, the materials and equipment supplied and supported within the educational institutional must be aligned with the goals and objectives of the school or district in order to maximize the effectiveness of these resources. This hierarchical relationship is presented clearly in the work of Webster (2017) in the following research discussion,

Educational goals and curriculum should drive technology proceeds out of the broader philosophy Technology is a tool (instrumental view of technology), and from the perspective that technology is not an end in itself, but rather is a tool, a means to achieve educational goals and ends. (p. 33)

The research and framing of the technological hierarchy by Webster (2017) illustrates the importance of the driving forces in educational and technological decision making.

Based on the words above, the decision-making force within the educational setting must be the institutional goal and objectives. This allows the technology adopted by the institution to be a support to these goals and not a driving force. According to the research findings in Webster (2017), this positionality allows technology to be its most effective as a tool for instructional delivery and not an implement inside a classroom for the sake of having a technological presence for teachers and students.

Although the materials and equipment purchased and maintained by a school or district may be superficial in comparison to other aspects of activity theory, these are a driving force in the consideration of trajectory for student learning and outcomes. These materials and resources are borne out of the culture, organizational goals and objectives, and the change process that has been adopted at the local level. Over time, these aspects may change, as the technology changes. It is up to the educational leaders to understand their current technology, how it is being used, what changes need to come, and how the organization can support and provide these required changes in the educational technology commitments.

Culture. The culture of a school, district, or organization in general is often unique and slow to change. Ultimately, the culture of an entity will be a determining factor in the ultimate success of initiatives, visions, and goals. Leaders must have a firm grasp of culture in order to operate within its confines. If an organizational culture needs to be adjusted and shifted to a new position, a skilled leader must first understand the status and then take strategic steps to adjust the culture to the desired positionality.

Toom (2018) noted that, “well-being, agency and trust among and between teachers, students and principals contribute to learning, development and innovations in schools and beyond”. The presence of connection, trust, and a collaborative environment are essential ingredients to the culture that will support innovation and the implementation of technological advancements. If a cultural presence to support technology and innovation, the school or district makes adjustments to build this capacity. This aspect of an organization takes time to develop and change. Once completed, the culture will allow for the innovation and foresight to make the financial obligations, planning, support, and guidance to acquire and use technology in accordance with the district values, goals, and objectives.

Change. Ellsworth (2017) noted in their research that, “Change isn’t new, and neither is its study. We have a rich set of frameworks, solidly grounded in empirical studies and practical applications. Most contributions may be classified under a set of major perspectives or “models” of change”. Educational leaders must gain a firm grasp of change behaviors and tendencies in order to assist in the organizational behaviors and processes during the implementation of the change process. When considering educational technology and leadership, other theories are considered to play a role when the theoretical framework is constructed.

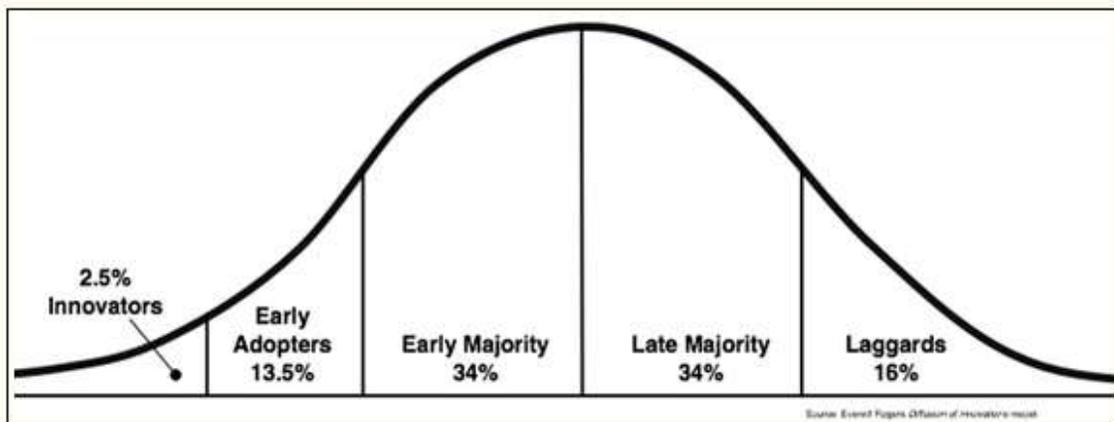
For example, Schrum & Levin (2016) view technology leadership within a framework of change due to the requirements of navigating often-difficult terrain of adjustments and developments in a rapidly changing environment. Thiers (2017) discussed an essential element within his work on change theories;

Collaborative professionalism is fueled by both good autonomy and good teamwork. Autonomy is not isolation. If you have good autonomy, it means that you're your own person; you're trying things. But you have to be connected and learn from the group; otherwise your autonomy won't get stronger. (p. 9)

Fullan (2017) distinguishes the difference in autonomy and the role of the collaborative process in this statement. The educational leaders must continue to ensure that the collaborative process allows for new ideas, innovation, and allowing the district and school efforts to provide the most cutting-edge advancements within the pedagogical arena. Many theories seen in educational research on change have their origins in other areas, such as business or other parallel sectors outside of education.

The bell curve depiction of change in Figure Three illustrates the typical distribution of change within an organization, education not differing from any entity.

Figure Three. Change distribution in an organization (Teaching and Learning Consulting Network, 2020)

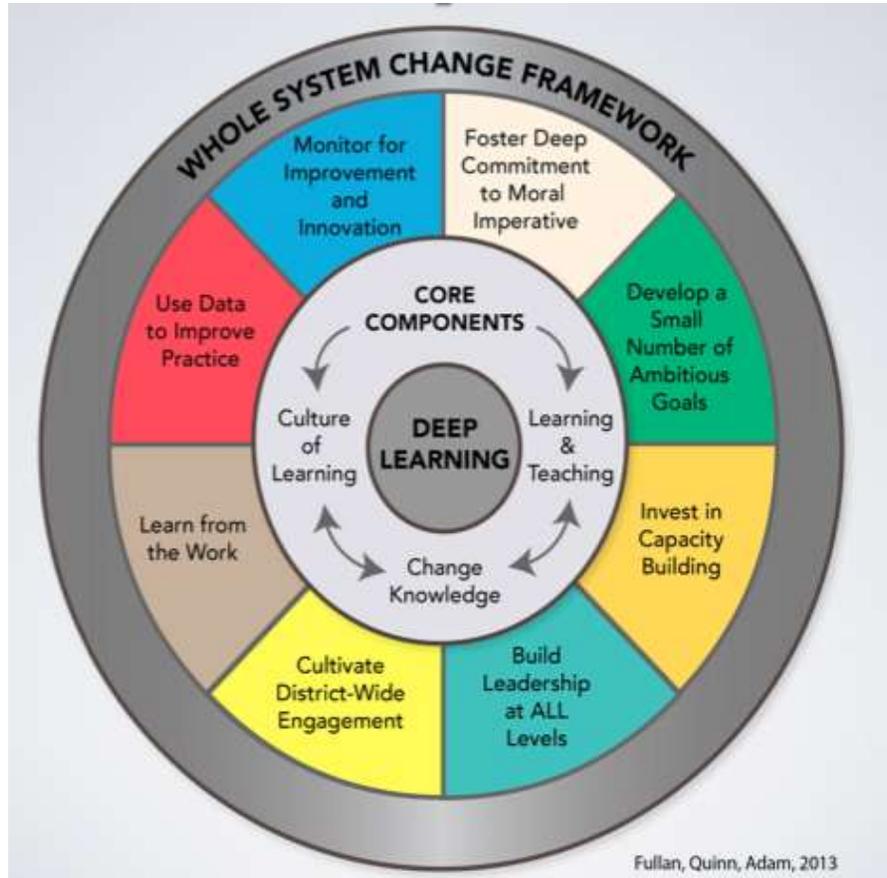


Innovators, as depicted in Figure Three, lead the change and innovation within an organization. These individuals may be represented in the organizational leadership, or be a member of the teaching ranks who have demonstrated informal leadership capacity. These individuals typically steer innovation and organizational change, and serve as the navigational unit of the organization. These are followed by the early adopters of the change. In total, these two lead groups represent an average of 16 percent of the organization.

Following the critical mass of the majority, laggards are slow and leery of the thought of change within the organization. These laggards are the target for specialized coaching and motivation to process through the changes of the organization to see the potential and rational for the change process.

This change process looks different for every individual within an organization, and for every organization as a whole. In general, the work of Fullan (2010) illustrates the basic tenants of change within an organization through a cyclic analysis of the stages of change. Figure Four examines the change cycle, and can be read from the green segment on the right side of the diagram. Through the development of goals, the driving force of change can be established as the catalyst for the need of organizational change. Over time, capacity, leadership, engagement, learning, analysis, improvement, and moral commitment all become integral segments of the continuous cyclical process of change. Organizational leadership must have a firm grasp of these change cycle principles in order to be able to lead and guide the organization through these stages.

Figure Four. Change process (Fullan, 2010)



Although the subject of the change can be interchangeable (e.g. technology, pedagogical techniques, simple policies, student behavior interventions, etc.), the process remains nearly identical. In the arena of technology, a closer look examines the processes behind the development of goals and the guiding processes in the implementation of the technology policy and practice. Without a firm foundational element within the goals and objectives of the organization, the process of guiding, implementing, monitoring, and adjusting the endeavor would be lost. Through the use of the principals in the Activity Theory, the remainder of this review will examine the stages of educational leadership's role in technology in accordance with the change theory of Fullan (2010). This is conducted while being mindful of the dynamic elements of a school and district culture and the matching of technology with the goals and objectives of an educational institution.

Technology as an Instructional Tool

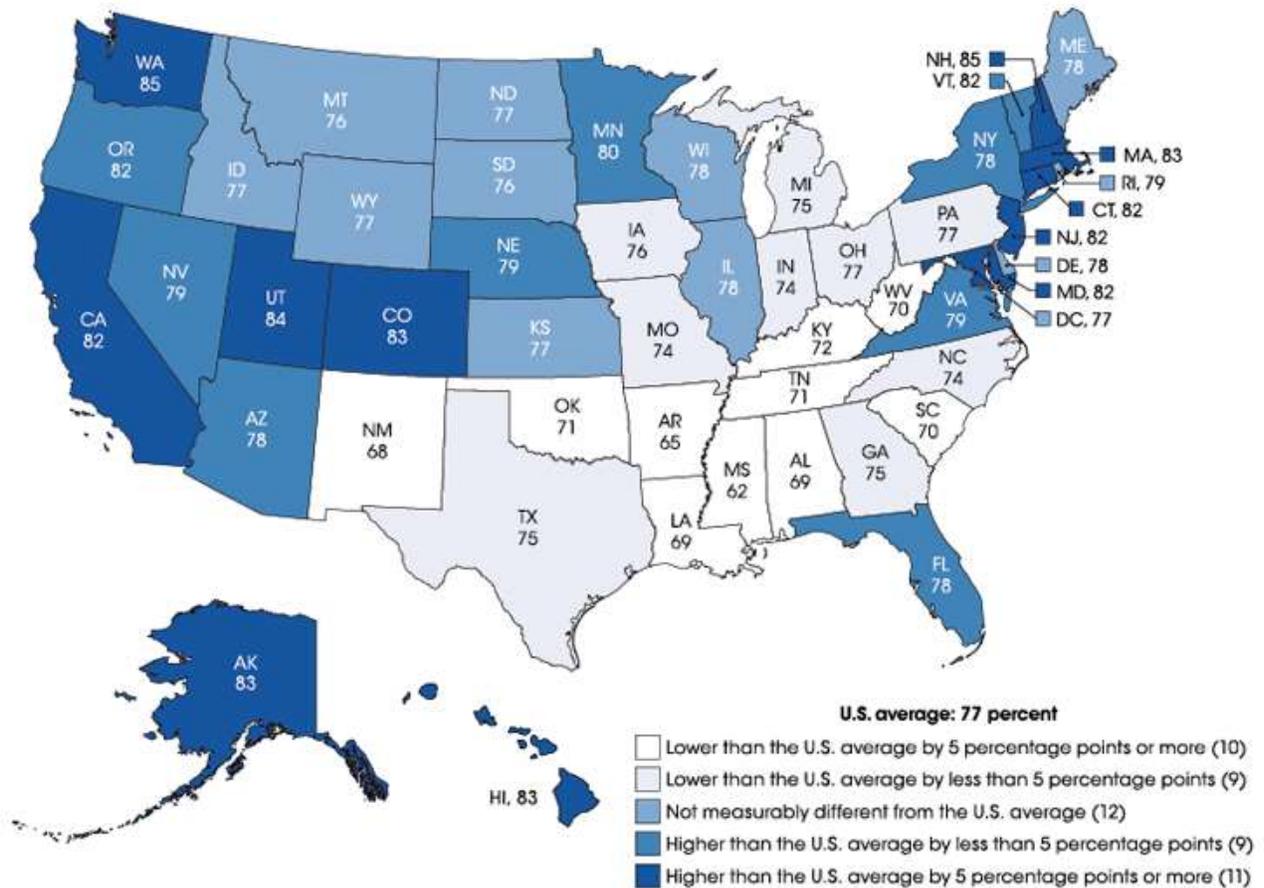
Educational technology is a relative term, and one that has a fluid definition, based on the conditions of society and the development of the availability of technology for society in general. For example, the advent of the personal computer led to a new wave of educational practices as compared to the technology available before the PC. The development and spread of the internet and World Wide Web capability again changed how business is conducted in schools and classrooms. As a current example of educational technology, interactive classrooms and meeting spaces are common for online schooling options and through alternative educational experiences. In the outbreak of COVID-19 in 2020, educational platforms existing online nearly completely supported the learning of students in the k-12 setting as well as the college and university setting around the United States, and beyond.

Aspects of the transition to distance learning models during the pandemic have highlighted the need for several areas of enhancement. First, many teachers around the nation have not had appropriate professional development in the area of distance learning and learner engagement. In addition to the inadequacy of teacher professional development, issues of equity and access are seen throughout the writings of federal and state governments. The California Department of Education noted (2020) that schools, “ensuring students with disabilities (SWD) receive a free appropriate public education (FAPE) consistent with their individualized education program (IEP) and meeting other procedural requirements under the Individuals with Disabilities Education Act (IDEA) and California law”. Even within pandemic conditions, the aspects of federal law prevail, and the technological media used to convey the curriculum and instruct students must be able to support these conditions within the student IEP to ensure that all students are learning, just as they would within the physical classroom setting.

Technology concerns during the COVID-19 pandemic were not centered solely on individuals with disabilities. Individuals with limited access and/or resources also highlighted another issue throughout the nation. It was discovered early in the COVID-19 outbreak that many schools could provide devices to allow for connection of students from homes across the nation; however, internet connectivity proved to be another major obstacle in students acquiring access to their teachers and coursework. In order to provide equity and counteract this disparity in access to technology (and school), various internet providers allowed for free internet access and Wi-Fi zones for connections. In addition, many schools also provided mobile hot spots that allowed for student devices to connect to the internet, regardless of the financial conditions of the student’s families (City of Boston, 2020).

Figure Five provides an illustration of households with internet access throughout the United States. The data within Figure Five is provided by the National Center for Educational Statistics from the 2015 American Household Survey. Based on the illustration, the lack of access to the internet is regional, with the south being dominantly in a deficit without internet access, while the west and northeast have higher concentrations of internet access.

Figure Five. Percentages of US Households with Internet Access (NCES, 2015)



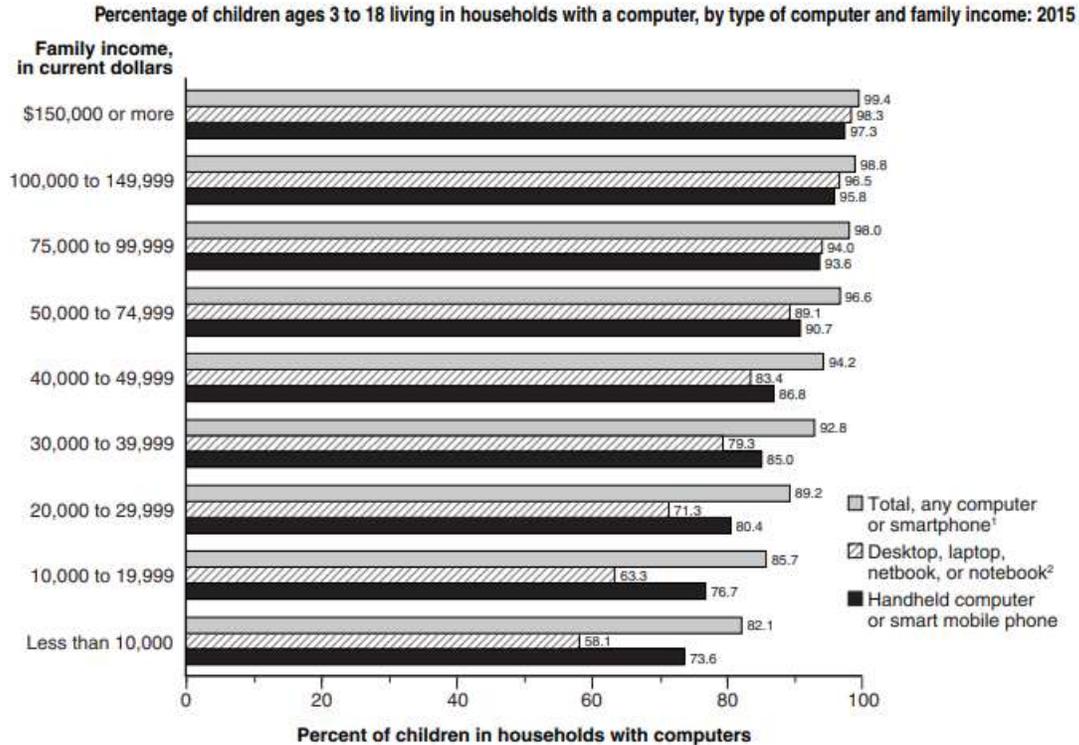
The NCES (2015) highlighted some of disparities in access to the internet in the following statement, “in remote rural areas 41 percent of Black students and 35 percent of students living in poverty had either no internet access or only had dial-up access at home”.

This shows that two student groups in the nation are at a significant disadvantage to students in higher levels of socioeconomic groups and different race and ethnicities. Why is this disparity important? It was also noted by the NCES (2015) that, “Students without home internet access had lower assessment scores in reading, mathematics, and science across a range of national and international assessments”.

Opportunity for advancement and achievement can be linked to the lowered availability of resources. This disparity occurs with or without a pandemic, and educational leaders must learn from this exposure to these issues and provide sound solutions to bridge the gap for all students to have a chance to persevere and have success in their educational endeavors. It was noted in the research of Gonzales, McCrory, Calarco, and Lynch(2018) that, “Policy solutions that address frequent disconnection are therefore essential as reliance on technology increases and disparities in maintenance continue to grow” (p. 29). In addition, this Gonzales et al. (2018) also found that, “low-SES students are often reluctant to ask for help or accommodations when they encounter problems in school” (p. 29). This illustrates that there are disparities between the socioeconomic strata of families and students, and these disparities may not be apparent unless educational leaders seek the data that reveals the problem and enact processes to counteract the gaps in access to these critical educational tools for the students in the most need.

The NCES (2015) further provided direct data illustrating the correlation of family income to technology availability at home in Figure Six. Through this analysis, it can be seen that families who make more money annually are more likely to be able to provide technology equipment as well as access to the internet and resources. This trend would assist students in their academic pursuits at higher levels in higher income brackets, without the extended assistance of the school and state provided resources, such as a computer and mobile hot spots for internet connectivity.

Figure Six. Family income and access to technology (NCES, 2015)



The unanticipated shift to digital education to assist schools in keeping students safe at a distance from school environments was not anticipated at this scale. As of this writing, many schools have moved from an initial proposal of a three-week shutdown to extending the school closures through the end of the 2019-2020 school year, for many totaling a ten-week closure of their traditional in-person school doors. Administrators at the school and district level have shifted into a role of technology facilitator, coach, and motivator at a distance. Often, the administrators themselves, learning new platforms such as Zoom and Canvas to assist teachers and students connect and maintain the rigor and forward motion of curriculum and instruction for their schools.

Although the COVID-19 pandemic forced schools into this modality of learning, the capacity of technology and the market allowed this to be a possibility. Most technological advances are not through force of hand, such as the pandemic experience, but through a natural need and development of new educational strategies that require the assistance of technology to enhance and make the educational delivery richer and more beneficial for the student.

Instructional Leadership and Technology

Effective instructional leadership is a critical component of school leadership attributes and abilities. Evidence of this statement is seen in the work of Shepherd and Taylor (2019) through their research findings;

Digital school environments do not carry any innate impact on their own; rather they must be paired with effective pedagogy to be digital instructional leaders who are knowledgeable and confident in the role.

Over time, the school leader must also be the instructional leader to ensure that teachers and staff have a firm foundation of instructional models and a concept of appropriate techniques with students in all areas, including technology education. It has been noted in educational research that, “Despite research showing that administrators’ leadership is critical for promoting use of technology, there remains a gap in research surrounding administrators’ readiness to lead in such a digital learning environment” (Shepherd & Taylor, 2019). This statement acknowledges the importance of administrative leadership; however, the capacity of many school administrators do not possess the skills to lead teachers through instructional leadership areas of educational technology.

Shepherd and Taylor (2019) provided an outline of the most effective educational technology instructional leadership attributes. The foundational attribute which has been shown in their research to be at the forefront of importance is, “high school administrators leading within a digital school environment should reflect on their current knowledge and confidence to act as digital instructional leaders, as both perceived knowledge and perceived confidence are important”. This allows teachers to work in an environment of confidence and one that will support their learning endeavors as they often move into uncharted waters with the guidance, confidence, and support of their school administrators. In addition to the confidence and momentum created by the school administrator, Shepherd and Taylor (2019) also found that;

Current and aspiring administrators should seek out opportunities ranked as most influential: professional development opportunities, knowledgeable and confident colleagues, and opportunities to supervise others.

This eagerness to be able to be an administrator who can coach and lead teachers in a digital environment lowers the burden which stress and unease can place on a school and the teaching staff. In addition to the feelings of ease that this can place on the staff, it also continues to foster the atmosphere of coaching and support which the professional development process establishes inside the school. Over time, these actions from the school and district administrators shifts the climate and the culture in the school in terms of its stance towards the role of educational technology and its support of student learning in this area.

Technology as a Leadership Tool

Technology, as with any educational initiative, must be carefully planned and have goals and objectives which are appropriate for the setting. The development of these goals and objectives is a delicate process that should be done from a stakeholder approach to avoid a top-down directive. This grassroots stance on the development of goals and objectives will increase the buy-in from most parties and transition away from a directive-like stance on the instructional practice. It was noted in the research of Ferrero-Ferrero, Fernández-Izquierdo, Muñoz-Torres, and Bellés-Colomer (2018) that, “engagement should promote a real dialogue and consider stakeholders that are not necessarily directly represented in the decision-making bodies”. These dialogue examples may be the combination of all staff members voicing their thoughts on the expected learning outcomes for students, parents with input and desires recorded for their students, and students, to gauge and monitor their needs and desires for expectations in educational outcomes. The process of seeking input is invaluable, as the goals borne from this process allow for meaningful content and a direction within the school setting which is seen as a community desire and not a directive from the school administrative staff.

Following the engagement of and the input of the stakeholder group to establish a culture of institutional buy-in, the development of the goals is important in terms of how they are framed and their sustainability. The acronym SMART is a popular trend in education for over a decade in the framing of goals and objectives. The acronym stands for specific, measureable, assignable, realistic, and time related. Broken into practitioner language, these goals have a concrete and specific nature to them, rather than being a vague entity in which any individual may interpret them differently. Secondly, the goals have a quantifiable nature in which data can be collected, analyzed, shared, and used to shape future practice and potentially updating the goals from year to year to modify or setting new targets for the educational community. Next, the assign ability of the goals is critical in that every organization needs to have specialists or responsible parties to take ownership of portions of or all segments of an educational goal. The realistic nature of the goals is of paramount importance, as goals set out of the realm of reality can cause discouragement and an atmosphere of disheartening helplessness. Lastly, every developed goal should have a timeline in which the stakeholders understand and can follow. This timeline may be a school year for summative goals or portions of a year for benchmarking purposes of formative monitoring systems.

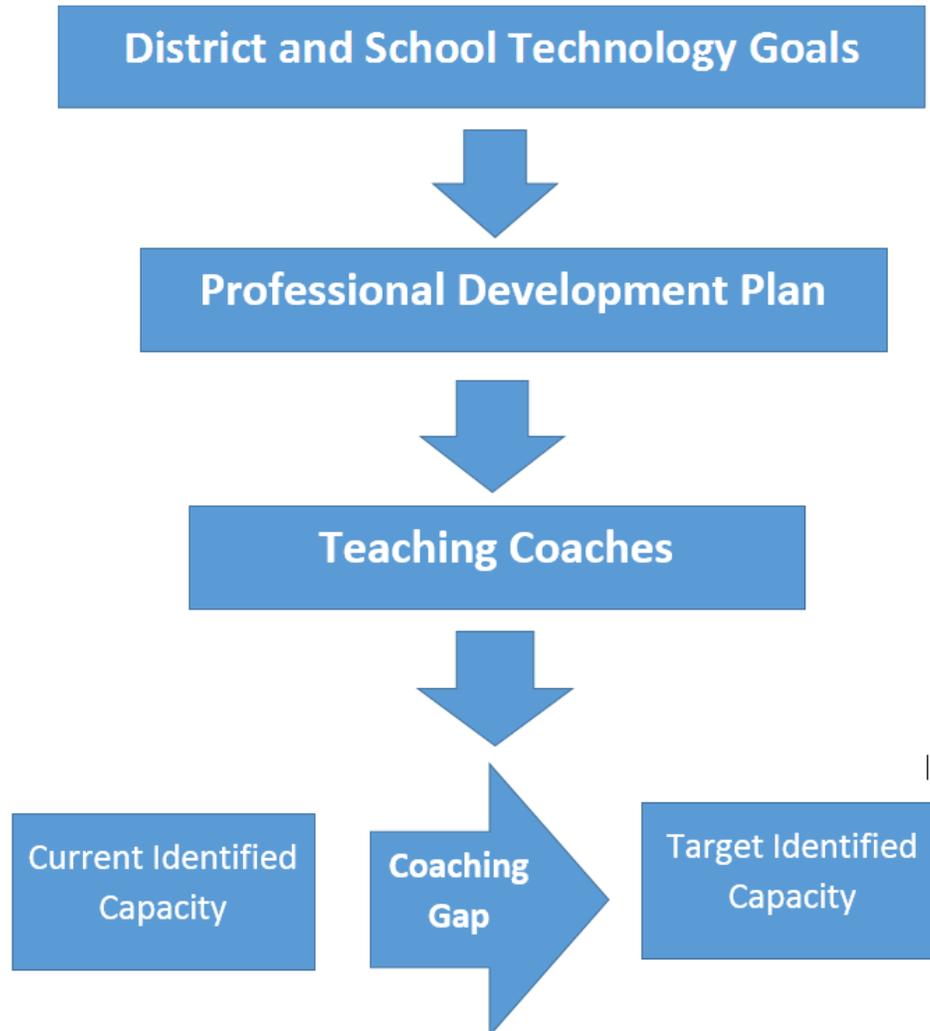
The process of using SMART goals allows for the clarity of an organization's mission or overall direction. The goal structure allows for the goals to have ease in communication for all stakeholders. Lastly, the goals allow for the ease of follow-up throughout the year to check on its status and attainment.

This follow up is essential as the school and district can be guided as the year progresses and adjustments are made for strategy implementation. Educational leaders are responsible for the establishment of the goals (based on stakeholder engagement), the communication of the goals, the follow through and monitoring of the goals, and finally, the process of revisiting the goals to refine and adjust after a specific period of time and data collection. This process is living and cyclic in nature as the goals are being used to guide instruction, data is collected, and the goals are then refined on an annual or semi-annual basis.

Professional Development and Technology

Professional development for teachers is an essential element for the successful implementation of a technology plan. Once a plan is developed, professional development is critical to build capacity in the teaching staff to translate the learning outcomes to the students of the district. School and district leaders must ensure that teachers are supported and that this support is evidence-based and strategic for the benefit of all staff, teachers, and students. Figure Seven, adapted from Aldosemani (2019), illustrates an ideal pattern for a professional development plan model within a school district.

Figure Seven. Technology Professional Development Plan and Coaching Roles



Every professional development model should always follow the articulation of the goals and objectives of the district and school. The professional development process should be a direct articulation of the goals set by the organization, stakeholders, and leadership. Over time, these professional development processes will adapt with the changing trends of the goals, as they are adapted and modified from year to year.

In addition to the goals and objectives supported by teacher coaches, an assessment of current need should be assessed as well as used within the coaching plan for the teachers providing support. The gap in the identified capacity to the targeted capacity fuels the work for teachers providing support for the general teaching staff members.

Financing Technology

The financial aspects of technology are often daunting for a school or a school district. These commitments to technology come in four main components. First, there is an initial commitment to both the initial purchase of equipment and the replacement schedule of equipment as pieces become obsolete or they are broken through use. Second, there is a component of professional develop for staff to ensure that the technology is being appropriately used and that teachers are supported. Third, most schools and districts must have a layer of repair that can be offered for damaged equipment that does not have to be replaced. In addition to the increased levels of repair and maintenance, district and school officials are also responsible for the upgrades and updating of systems and browsers to fit the local needs. Finally, technology is also beyond the physical devices that are used by the teachers and students. These ongoing annual expenditures include program and system subscriptions which are typically done on an annual basis and are typically contingent upon the per student count for a school or a school district.

School and district budgets have development cycles repeating annually, and are considered in terms of their term of one-time funds or an annual expense. Often technology can be seen as a one-time expense; however, chief business officials must consider the practicality of this assumption and the intricacies of the resource needs within the school. First, technology is a significant expenditure; however, there may be need for ongoing funds to be scheduled as new devices are purchased as devices break or become obsolete for student use. One example of this intricacy is in the average lifespan of a Chrome book. Although the Chrome books are readily affordable, their lifespan in terms of functionality with browsers can be finite as it comes to the needs for state assessment platforms. Due to this, these devices must be considered for a replacement cycle as the obsolete characteristics render them useless.

Additional budgetary considerations for technology are annual subscription rates and the average rate for subscription increases. These subscriptions for services and programs have a significant impact on the various programs and goals that the technology assists and supports. These ongoing expenses are important to regularly revisit to ensure that they are used and meeting the needs of the students of the district.

In addition to the budget requirements of devices and technology products, personnel expenses must be available to support the implementation of the technology. This includes classified employee support for repairs and maintenance as well as certificated support in the realm of teachers on special assignment to provide professional development to the instructional staff.

Leadership must consider the number of full time equivalent employees are required to ensure that technology needs are met for the district and school. This includes an appropriate number of computer technicians who can provide timely support for repairs, maintenance, and required updates for the devices. In addition to these classified employees, teacher support must be considered for professional development needs and schedules.

Brining it All Together: Technology Plans

Educational technology plans are often documents created through mandate for districts across the United States. Once created, these documents are frequently collectors of dust on a principal's shelf; however, these plans can serve as the driving guide for all technology innovation and use within the district. Although plan requirements may vary between states, the sampling of one state's plan template will allow educational researchers to understand the anatomy of plans and the importance of the structure in the guidance of school district endeavors to ensure that students receive the highest levels of education using technology within the classroom. The elements of the technology plan, highlighted in the forthcoming paragraphs, all reflect the elements of the Activity Theory in terms of the components of resources systems interaction and the outcome yield.

Arizona Department of Education Technology Plans begin with the presence of a needs assessment of the district and its schools. This allows for the analysis and outline of needs in terms of equipment, training, and the presence of technology within the curriculum of the district. Technology integration is a federally mandated component of the technology plan, as noted in the following instructional language, "Arizona's definition for fully integration technology is LEAs who have embedded appropriate technology to support student learning across all curricular areas" (Arizona Department of Education, 2020). This analysis and explanation requires district and schools to examine technology throughout their school curriculum and rate the areas of technology integration under staff proficiency, classroom level integration, professional development elements and activities, instructional support, availability of technology, and technology funding and priority within the organization.

Student learning provides an area for the provision of expected student leaning outcomes and metrics that are used to measure these outcomes. The school must provide a method for the development and use of innovative strategies for the delivery of curriculum through the use of technology. In addition to the delivery of the instruction through technology, the school must also provide an analysis and explanation of how technology have been used within the district and school to promote increased and heightened level of parental involvement and student engagement.

Diving deeper into the curriculum delivery to students, an effective technology plan adds to the context of providing multiple opportunities for authentic learning, increased collaborative opportunities and the enhancement and development of student's communication skills, and the refining and development of problem-solving strategies and techniques demonstrated by students in exemplar technology assignment artifacts. Student learning needs assessment takes the technology plan an additional step to provide a context of the needs of students in terms of their status versus the gap to where the district and school learning outcomes are established.

The analysis of current reality and needs for technology instruction is followed by an analysis of the necessary leadership role and attributes. This includes leadership goals and objectives, an explanation of the current uses of technology to support school and district administrators and their leadership responsibilities, the process of administrative promotion and evaluation in the effective use of technology by teachers through either modeling or evaluation processes, and the administrative role in providing access to technology.

The next segment of an educational organizations technology plan is to provide an overview of the professional development and support for increased staff capacity to support students and their learning outcomes. Linmei, (2010) noted that;

Just as leveraging technology can help us improve learning and assessment, the model of 21st century learning calls for using technology to help build the capacity of educators by enabling a shift to a model of connected teaching. In such a teaching model, teams of connected educators replace solo practitioners and classrooms are fully connected to provide educators with 24/7 access to data and analytic tools as well as to resources that help them act on the insights the data provide.

The framework described in the above excerpt illustrates the need for teachers to form professional networks to support the capacity-building processes of all educators. This involves a facilitated transition from teachers working in isolation to collaborative efforts of teams to extend learning outcomes to students.

Technological infrastructure is the platform upon which all aspects of the plan reside. Without an appropriate, reliable, and effective infrastructure, educational progress and student outcomes will be hindered. It was further explained by LinMei (2010) that;

An essential component of the 21st century learning model is a comprehensive infrastructure for learning that provides every student, educator, and level of our education system with the resources they need when and where they are needed. The underlying principle is that infrastructure includes people, processes, learning resources, policies, and sustainable models for continuous improvement in addition to broadband connectivity, servers, software, management systems, and administration tools. Building this infrastructure is a far-reaching project that will demand concerted and coordinated effort.

Infrastructure as identified in Linmei (2010) includes equipment, networks, people, and a support network. These elements provide the context upon which all other portions of the plan rest and have positive impacts on student achievement. These elements are out of the control of individual teachers and must be incorporated into the consideration of the building level principal or district administrative officials.

Conclusion

Systems and people are shown to be at the heart of an effective plan to embed educational technology in a student's curriculum to assist it in delivery and bolster 21st century learners. School leaders are at the heart of both of these aspects and must keep technology in their mind as plans are developed and implemented throughout the school system. Over time, the need for technology in education will continue to grow and dominate the landscape for leaders of the future. This discussion also comes at a time of paramount importance for access to and use of technology through the presence of a global pandemic. Innovative leaders have been seen to be ahead of the curve in the application of technology, while others (laggards and late adopters) have been hindered by the sudden shift in instructional expectations and the migration to distance learning.

Educational technology and leadership can lead to dynamic discussions and considerations of organizational structure, processes, culture, and desired outcomes. To better understand the role of leadership in educational technology, one must have a firm grasp of an organization's structure, culture, status, and desired outcome and destination. Over time, effective leadership can assist in the steering and development of the desired outcomes in order to place technology in the appropriate status to maximize the learning experienced by the students.

An effective stance on educational technology leadership has been shown to reside in several aspects of the district and school community. The findings of this review can be summarized by the following points:

- School leadership must make an assessment of the current educational technology status in terms of goals and objectives, staff capacity, current professional development strategies, and budget status.
- Materials and equipment must be inventoried and assessed for relevancy and being current to fit the needs of the district in the current plan being developed.
- Stakeholders must be involved to allow for grassroots efforts to develop and synthesize goals and objectives for educational technology endeavors.
- Professional development plans must be developed to consider the current staff status and plan for the attainment of the school and district goals and objectives.
- The budget must be formed to adhere to and support the current and ongoing needs of materials, subscriptions, and personnel efforts to support the technology needs of the district.
- The educational technology plan must be developed to capture the operations and processes of the district towards educational technology.
- School leaders must examine their role and continuously reflect on personal practices in accordance with standards to ensure that a high level of attention and dedication are devoted to educational technology.
- Data should be collected for analysis and reflection of progress towards goals and objectives. From these findings, plans, and revisions can be made to the goals and objectives.

An area foundational to all of the other areas of responsibility is to establish effective goals for educational technology and the student learning outcomes. Without this driving force behind any initiative, the processes which are developed will be without any concrete direction. Secondly, the organization's budget must currently support and continue to support educational technology in the out years. Next, the school and district must have an effective professional development and support staffing plan to ensure that devices are functional and effective and that the teaching staff is equipped to provide appropriate instruction to the students using the adopted technology.

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