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A Framework for Action: Intervening to Increase Adoption of Transformative Web 2.0 Learning Resources

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Abstract

Web 2.0 tools have emerged as conducive for innovative pedagogy and transformative learning opportunities for youth. Currently, Web 2.0 is often adopted into teachers' practice to simply replace or amplify traditional instructional approaches rather than promote or facilitate transformative educational change. Current models of innovation adoption do not adequately address successful diffusion of transformative educational technology. A new interactional model, called a framework-for-action (FFA), repositions 'success' on qualitative criteria and necessitates timely intervention by change agents at 'points of factor interaction' in the change process. These interventions engage potential adopters (i.e., teachers) in meaningful learning opportunities that reposition individuals or groups to make decisions leading to adoption of technologies that support transformative learning and teaching with web 2.0 tools.

Introduction

The social nature of learning and working is increasingly recognized in PK-12 settings while the proliferation of next-generation Web-based tools creates potential to support new pedagogies. Although these tools appear to meet a growing need and offer promising support for new learning initiatives, widespread diffusion has not yet occurred. Many current examples of these tools in practice highlight their use in replacing or amplifying traditional instructional approaches, whereas their transformative potential has been harnessed to a limited extent.

This paper highlights the potential of Web 2.0 as an agent of transformative educational change, illustrates existing models of innovation adoption, and describes ways that these models may not adequately address processes and factors related to transformative innovation with technology in school settings. A new framework-for-action (FFA) is presented that extends work by Rogers (2003), Fullan (2007), and Zhao, Pugh, Sheldon, and Byers (2002) and offers a revision of the ways that a variety of intersecting factors contribute to the processes of technology diffusion in school settings. Many contemporary change theories do not completely address issues of 'successful' innovation and often emphasize the goal of simple adoption. Our definition of 'success' serves as the foundation for our FFA and addresses the need for digital technology innovations to transcend beyond instructional replacement and amplification to more fully realize the transformative pedagogical potential of teachers and schools. Our view of 'success' is a necessary perspective transformation, a change in a frame of reference for teachers and school leaders, (Taylor, 2007) to achieve widespread adoption of Web 2.0 tools that support sociocultural learning activities among children. The FFA addresses the fluid and dynamic nature of the change process, describes how various confluences of factors represent key decision points in the adoption of innovations. These decision points represent moments of

opportunity wherein school leaders and practitioners who are well versed in the models of innovation adoption and who have developed trusting relationships with teachers, such as a "technology integrationist" (Hughes, 2004), can intervene to facilitate successful and transformative diffusion and implementation.

Web 2.0 Affordances for Innovative Pedagogy and Transformative Learning

Web 2.0 tools have emerged as conducive to innovative pedagogy and transformative learning opportunities for youth. Web 2.0 (McManus, 2005; O'Reilly, 2005) refers to web technologies that enable spaces where users and their content are shared with equal opportunity (Cormode & Krishnamurthy, 2008). Web 2.0-based applications emphasize rich user interaction, user-created open content, and social communities. Web 2.0 applications include blogs, wikis, social network sites (such as MySpace, Ning), remixing, or MashUps, of content and data, media creation and sharing (such as Indaba or Vimeo), content aggregation and syndication, and social bookmarking.

Sociocultural and sociohistorical theorists propose that learning is a social practice that involves participation in activities with others and the use of contextually- and culturally-relevant (i.e., global, community, cultural, and individual) artifacts across time and spaces (Cole, 1996; Engeström, 1987; Greeno, 1989; Vygotsky, 1978). These perspectives suggest the need for reformed pedagogy, learning, and curriculum. Following successful reform, the resulting pedagogy and learning can be considered 'transformative,' as a small minority of practitioners espouse and use such theory in-practice. Like many other educational resources, Web 2.0's affordances are compatible with a variety of approaches to teaching and learning; however, this paper is specifically focused on the affordances that support technology-supported

transformative pedagogy, a perspective transformation among teachers (Taylor, 2007) and sociocultural learning practices among children.

Affordances of Web 2.0 for Innovative Pedagogy

The evolution of new media and digital technologies has fostered shifts in pedagogy and the creation of new or altered disciplinary perspectives. For example, conceptions of print-based literacy have shifted to media-based literacy. The role of teachers shifts from an all-knowing pedagogue to a supportive and knowledgeable facilitator of student inquiry. Within the context of learning communities (Dede, 2008; Greenhow, Robelia, & Hughes, 2009), conceptions of knowledge and authority (Cummins, Brown, & Sayers, 2007) are increasingly challenged. The audience and purpose for learning activities shift from a teacher audience to a global, diverse audience.

Affordances of Web 2.0 for Transformative Learning

The openness and social interaction inherent in Web 2.0 supports learners in generating and refining their understandings, as they read, reflect, and create new content to share with others. The organized social structures of Web 2.0 tools can be likened to the communities of practice described by Vygotsky (1978) in which knowledge and understanding are socially constructed and negotiated through talk, activity, and interaction. The rich user interactions of Web 2.0 tools can be combined with ill-defined problems to promote the development of metacognitive skills. Learners become producers, owners, and sharers of the information and knowledge that they construct independently and with others. Learners move from an acceptance model to a critical consumer stance in which they creatively and analytically consider ideas and knowledge. These socioculturally-based learning activities are transformative by drawing

children into critical reflection about ill-defined problems, developing trusting relationships for collaborative learning with peers, and providing chances to consider how one comes to learn.

A range of Web 2.0 tools are already widely diffused within the U.S. The popularity of websites such as MySpace, Facebook, Wikipedia, and YouTube illustrates the rapid diffusion of these technologies in non-educational settings. However, the social web's potential for learning has largely been overshadowed by their perceived potential for harm in school settings. Many schools discourage, if not actively block, many Web 2.0 technologies by employing Acceptable Use Policies or Internet filters that prohibit their use, which contributes to a system of have and have-nots called the "participation gap" (Collins & Halverson, 2009; Jenkins, 2006).

Young learners have multiple online identities and access and contribute to a range of communities whose artifacts can be considered knowledge repositories (e.g., FaceBook, MySpace, Flickr, Wikipedia, Twitter). Consequently, youth expect such experiences to be part of formal educational settings (Baird & Fischer, 2005; Barnes, Marateo, and Ferris, 2007). Consider one such web 2.0 technology – the wiki – and its affordances for collaboration and learning. Cress & Kimmerle (2007) persuasively explain a Piagetian view of how learning and collaborative knowledge building take place within wiki environments. Recursive internal and external assimilation and accommodation occurs in relation to posts and edits to Wiki articles, in which cognitive conflict reveals itself to individuals as they interact with collaboratively developed knowledge. Transformative collaborative learning have been demonstrated in proprietary environments like Knowledge Forum (Scardamalia & Bereiter, 1991; 1994) and now can occur within instructor-intentionally-designed, socially-created knowledge-building activities hosted in web 2.0, open-source, wiki technologies (Lin & Kelsey, 2009). Yet, many schools and teachers miss the transformative power of wiki technologies and hold negative views

about and concerns for accuracy (Peacock, Fellows, & Eustace, 2007) in knowledge building repositories like Wikipedia even though Wikipedia has been shown to be as accurate and inaccurate as Encyclopedia Britannica (Giles, 2005). The perspectives held by schools and teachers are highly consequential and impact the degree to which children are engaged in socioculturally-based learning with technologies.

Differentiating Successful Adoption

Educators have long sought to understand the impact of technology on teaching and learning. Early research (Becker, 1991, 1993) quantified students' use of computer applications to measure an effect. Measures such as the Total Cost of Ownership (TCO) (Consortium of School Networking, 2009b) and Value of Investment (VOI) (Consortium of School Networking, 2009a) were developed, among other purposes, as a way for educational administrators and practitioners to evaluate and measure the impact of technology. The focus of TCO and VOI is on calculating the degree to which a proposed project (or innovation) will impact a district's mission, goals, and mandates. These approaches reflect a tendency to isolate technology's role in *maintaining* or *enhancing* current, possibly non-progressive practice. Predominant views of calculating *worth* focus on quantifying technology's role in replacing or amplifying established teaching and learning practices. We need perspective transformations (Mezirow, 1978; Taylor, 2007) that shift the focus towards the quality of transformative practices, as described earlier.

Hughes' (2005) Replacement-Amplification-Transformation (RAT) model assists in illustrating qualitative differences in types of technology use perspectives that teachers possess when adopting technological innovations. Three use categories were theoretically defined: (a) Technology as Replacement; (b) Technology as Amplification; and (c) Technology as Transformation. To determine if a particular technology use replaced, amplified, or transformed

practice, each instance of technology use is assessed systematically to ascertain the degree of impact on dimensions of the instructional event in which the technology use is embedded, as related to: (a) instructional method (including teacher's role, interaction with students, assessment of students, professional preparation, and administrative tasks), (b) student learning processes (including the activity's task(s), mental thinking processes, task milieu, motivation, student attitude), and (c) curriculum goals (disciplinary knowledge and experiences to be gained, learned or applied).

A qualitative assessment is conducted to determine the degree to which any dimensions were replaced, amplified, or transformed. Replacement use of technology serves as a different means to the same instructional, learning, and curricular end. For example, a teacher created a worksheet on the computer for instruction or read/lectured from notes within a PowerPoint presentation– all of which do not change the teacher's instruction as compared with typical worksheet or overhead projector notes.

Amplification with technology has a "quantitative" or "intensification" dimension yet does not change the basic structure of the focus, such as learning, curriculum, or teaching (Cole and Griffin, 1980; Pea, 1985). Increased efficiency, productivity, and streamlining are major effects (Cuban, 1988). Tasks, structures, and beliefs stay the same (Ertmer, 2005; Pea, 1985; Waters, Marzano, & McNulty, 2003).

Transformation through technology implies restructuring or reorganization of mental processes, new roles or participants in educative processes, and access to or development of new disciplinary knowledge (Pea, 1985). Teachers adopt new beliefs that shape novel learning approaches through problem solving, and ultimately the environment, resources, tools, and people create "new possibilities of thought and action" (Pea, p. 175) that are ultimately perceived

as indispensable and permanent (Cuban, 1988; Ertmer, 2005; Hartman, 2008). Evidence of widespread instructional, learning, curricular, or other transformative uses of technology within PK-12 settings has been persistently rare (Blin & Munro, 2008; Cuban, 1998, 2001; Laferriere, Lamon, & Chan, 2006). Understanding how teachers come to adopt new technological innovations is crucial in rethinking how to increase diffusion of digital technologies for transformative learning and instruction.

Current Models of Innovation Adoption

Existing models of diffusion and educational change (e.g., Rogers, 2003; Fullan, 2007; Zhao, Pugh, Sheldon & Byers, 2002) offer perspectives on the factors and processes involved in technology integration in schools. Rogers (2003) proposes a five-stage adoption process that describes how various factors influence the rate and scope of diffusion, characterizing innovation as a process that takes place over time. A decision maker first develops *knowledge* surrounding the affordances of a particular innovation. During the *persuasion stage*, the decision maker forms an opinion (either favorable or unfavorable) regarding the innovation. Third, the decision maker chooses to adopt or reject the innovation, thus making a *decision*. During *implementation*, the decision maker begins to actually use the innovation. *Confirmation* occurs during the fifth stage, as the decision maker evaluates their decision and seeks reinforcement support. At this stage, decision makers may reverse their decision if new information creates dissonance, leading the adopter to question an earlier decision (Rogers, 2003). Roger's model is linear and unidirectional; decision makers may enter the process at different points, but they move only into higher stages, if they move at all.

Wolff (2008) argues that linear models, such as Rogers', "discount the feedback, revision, and constructive communication that take place among actors in the real-world

processes of developing an innovation" (p. 1186). The adoption of an innovation, according to Wolff, is cyclical in nature. It is recursive rather than linear, and decisions made at one point in the process can be reversed at another point, based on new information or new factors. The process can begin, end, and begin anew, independently, for each participant involved. Rogers' model acknowledges entrance at any point but does not accommodate the recursivity described by Wolff.

Rogers' (2003) model also describes characteristics of an innovation that can affect the likelihood and rate of adoption. These attributes include trialability, observability, complexity, relative advantage, and compatibility. Trialability involves the opportunity for potential adopters to try out the innovation. The more opportunity for hands-on experience with an innovation, the more likely it is to be adopted. Observability is characterized by the opportunity to see an innovation at work. Similar to trialability, an innovation with high observability is more likely to be adopted and has a higher rate of diffusion.

Complexity refers to the ease with which a potential adopter can understand the innovation, relative to other tools with which the adopter is already familiar. Innovations with high complexity are less likely to be adopted. Relative advantage represents the extent to which an innovation offers an improvement over current methods or tools. Innovations that potential adopters perceive as having a high relative advantage are more likely to be diffused. Compatibility describes the ways that potential adopters' existing attitudes, beliefs, and practices correspond with the innovation itself. An innovation that requires a dramatic shift from adopters' current beliefs and practices is much less likely to be adopted (Rogers, 2003).

Rogers' linear model characterizes these factors as static and unchangeable. In a cyclical change process however, the attributes and influence of various factors may shift over time. For

example, as more decision makers within an organization choose to adopt an innovation, both observability and trialability increase. Establishing training or pilot programs might reduce complexity, and steps can be undertaken to facilitate shifts in beliefs, attitudes, and practices, thus reducing incompatibility. Because Rogers does not characterize factors within the change process as fluid and variable, change agents may not consider manipulating variables during the change process itself.

The work of Fullan (2007), unlike Rogers' more broadly applied theory, focuses specifically on processes of meaningful *educational change*. Fullan conceptualizes a continuous change process that happens over a long period time. Further, Fullan states that change in schools is difficult at best, happens infrequently, and is often impermanent and superficial in nature (Fullan, 2007). "Real change" involves a triad of outcomes: change in tools or resources, change in practice, and change in beliefs (Fullan, 2007).

Fullan acknowledges the unique nature of both the process and the participants' subjective perceptions in each change effort. There can be negative consequences of failing to consider the unique setting in which change efforts take place (Fullan, 2007).

Fullan's model also identifies distinct and important roles that participants play during the change process, describes the nature of each, and states that success is dependent upon collaboration among participants. Leaders throughout the school community, not just in administration, are essential in the change process (Fullan, 2007). This leadership must come in the form of both support and pressure (Fullan, 2007). Leadership in the form of pressure from the administration, the district, the government, parents, or the community, without requisite and complementary support may lead to little or no educational change. Support from the same

entities without pressure may fail to yield productive activity on the part of the adopters (Fullan, 2007).

Though Fullan describes an iterative process with distinct participant roles, he treats each factor and role with equality. Though Fullan clearly regards the importance of recognizing and understanding each factor and role, the idea that these identified factors can gain or lose influence during the change process is overlooked. Likewise, his idea of leadership as distributed throughout an organization provides little guidance as to the timing and source of effective leadership.

Zhao, Pugh, Sheldon, and Byers (2002) propose a change model, specific to adopting technology innovations in classrooms, that divides crucial factors into three domains: the innovation, the innovator (teacher), and the context. The factors within this model are described in terms of distance and dependence. Change efforts in which there is high *dependence* on inadequate social support, technological support, or infrastructure are unlikely to be successful. Similarly, high *distance* from current practice, current infrastructure, or current school culture reduces the likelihood of success. Factors such as teacher technology proficiency, pedagogical perspectives, and social awareness are highly pertinent when attempting to assess distance and dependence. Contextual factors such as human infrastructure, technological infrastructure, and level of peer support and collaboration are similarly influential on distance and dependence.

This model, which offers the most specific treatment of change and adoption of learning technologies in school classrooms, represents factors as interrelated and equal in influence. It does not fully describe how the influence of these factors might wax and wane during the process of change (Zhao et al., 2002). The teacher is central in the model, but no strategies are suggested for increasing teacher knowledge and readiness or addressing pedagogical beliefs in order to

decrease distance and dependence. In cases of low teacher readiness or high pedagogical incompatibility, the model suggests only that the diffusion of such innovations will likely be unsuccessful.

As in the other models, '*success'* depends on choosing the innovation most likely to diffuse in a specific setting with a set of variables that theory indicates do not change much if at all. Thus, most Web 2.0 learning resources with affordances for sociocultural approaches to learning (our definition of transformative learning among children) fail in adoption processes due to their technical complexity, distance from current pedagogy, incompatibility with teacher beliefs, and the few chances for teachers to observe these resources used in practice. The most "adoptable" innovation is not necessarily the most "transformative" in terms of learning and instruction.

Our proposed FFA emphasizes the quality of educational transformation above the quantity of adoption. The reviewed models suffer from a definition of success based on quantity rather than quality (Wolff, 2008). Despite the semblance of success, highly compatible and broadly diffused innovations that replace or amplify current practices are not transformational. Fullan (2007) would suggest that this is not real change; it lacks a change in beliefs. There is no mechanism within these models that assists in increasing school or teacher awareness of transformative uses of technology or ways to increase such use within a system. The potential benefit of an innovation should not be judged solely by its likely adoption, but on the basis of its potential to promote transformative shifts in educational practice.

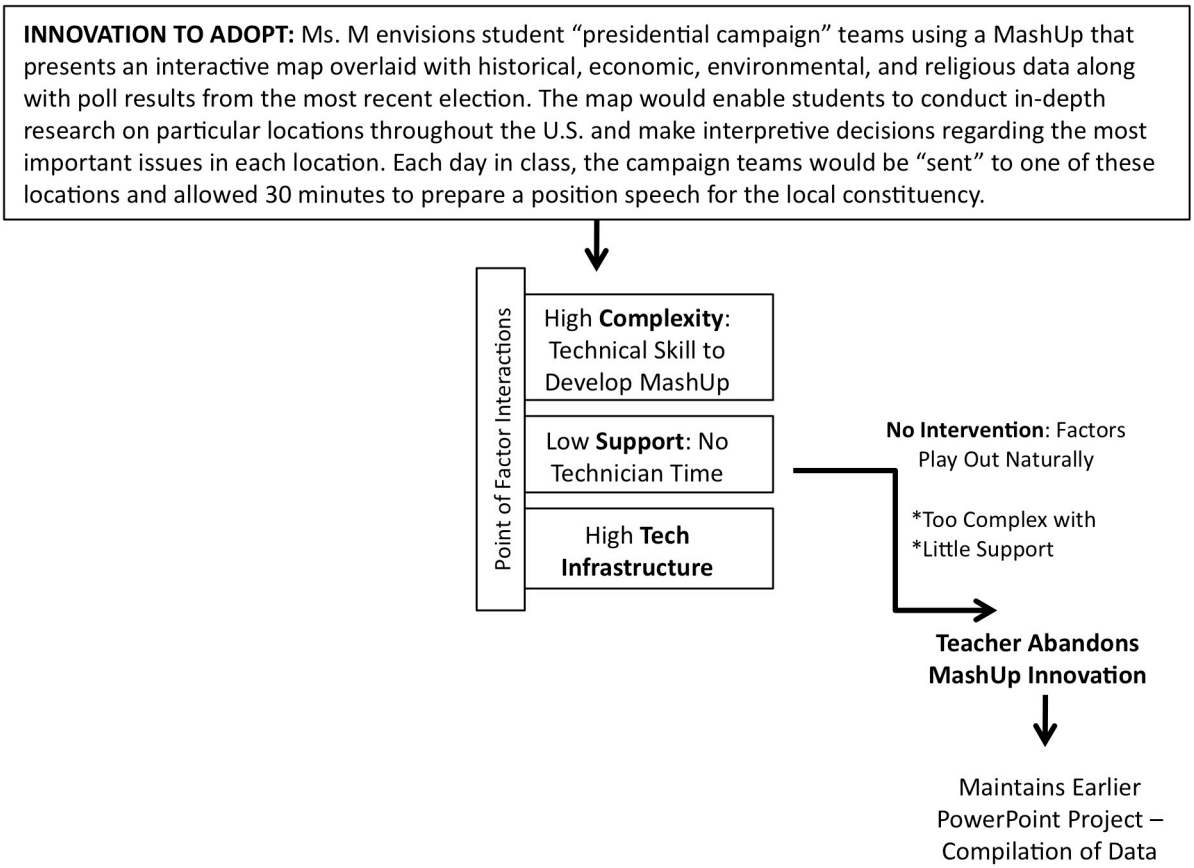
Our framework-for-action (FFA) shifts educational change theory toward building blocks for actionable guidance that yield adoption of transformative digital innovations – namely, 'successful integration' from our perspective. This shift capitalizes on (a) a dynamic, cyclical

process where the influence of individual factors intersect at different points throughout the process and (b) "success" that is primarily defined in terms related to quality of the innovation and secondarily, in terms of quantity. This new perspective can be used to identify points in the process where change agents can influence the process to channel it toward a direction of desired success. Our FFA, as described below, engages teachers and other school staff in a transformative learning process (Taylor, 2007) by (a) facilitating critical reflection, (b) tapping into trustful relationships among school staff, and (c) ultimately achieving perspective transformations among teachers. The ultimate outcome of this process, then, is socioculturally-rich, Web 2.0-enhanced learning among children.

The Framework-For-Action (FFA): Focus on Reflection, Interpretation, and Intervention

The insufficient emphasis on the interaction of factors in the current change models, the lack of recognition of transformative learning or instruction as ultimate success, and the fact that these change models do not adequately address the unique nature of Web 2.0 technologies, lead us to describe a new framework for action that supports Web 2.0 adoption in PK-12 schools. The FFA suggests that deep knowledge of the change factors allows educators to begin *using* such knowledge to move change in the desired direction, toward transformation. Reflective observation during the change process will yield unique opportunities to leverage directional shift(s) when change factors interact. Observation of this kind involves knowledge of the change factors but, more important, awareness of how these factors may take hold or interact specifically in the department, school or district in which the change effort is to taking place.

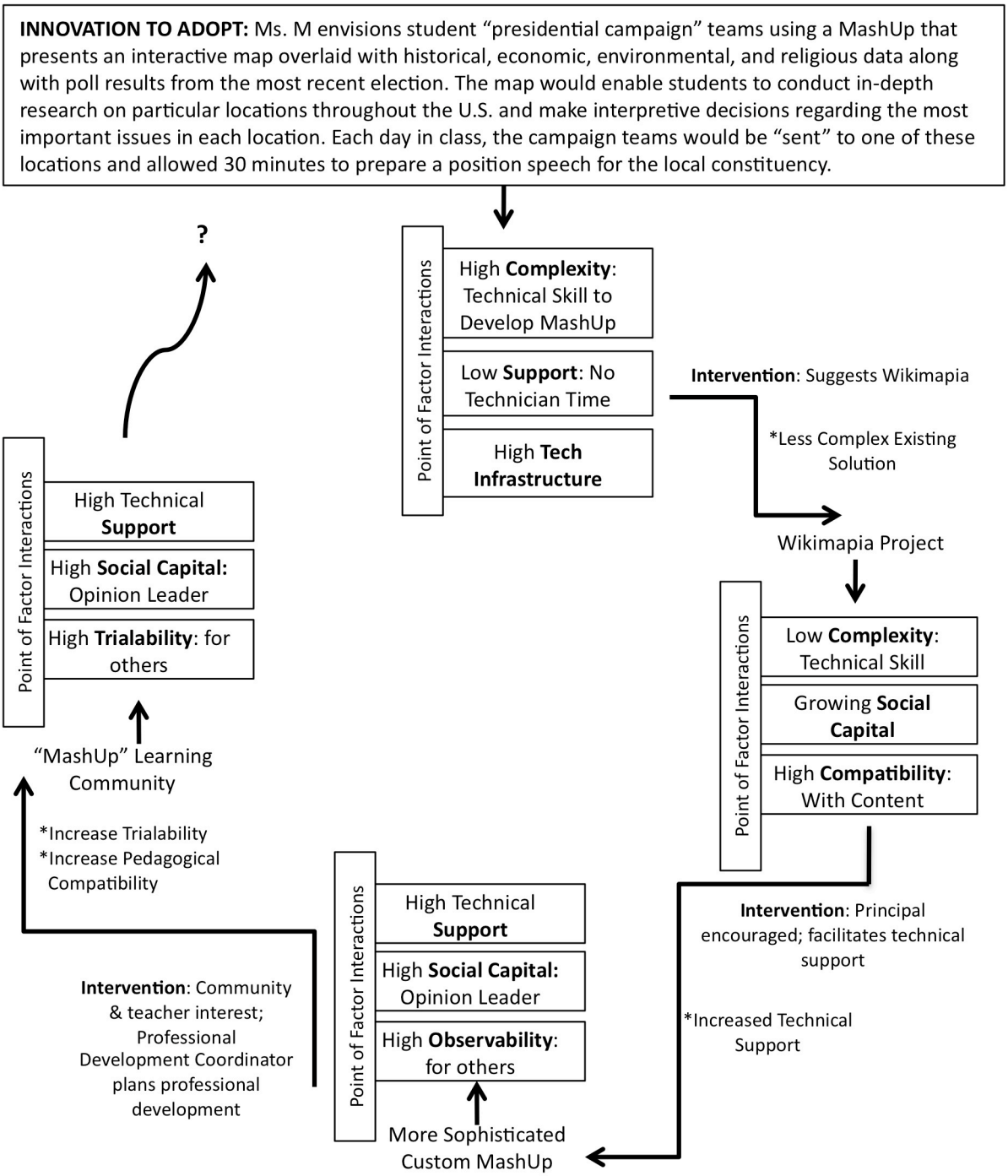
Figure 1: Process of Adoption of Digital Innovation, as Predicted by Past Models



The FFA assumes that factors have unequal influence. The goal of the FFA is to manipulate the outcome of technology adoption toward transformations in curriculum, instruction, and/or learning. Our paradigm acknowledges the importance of understanding theoretical change models, such as those reviewed in this article. Individual and organization interpretation of the process and factors and the ability and willingness to identify the nature of the factors at play at different points in a particular process enables enactment of our interventionist-oriented paradigm to effect change. During a change process (see Figure 1), there are complex *points of factor interaction* in which the earlier models of change theorize that potential adopters abandon adoption efforts due to the strength of certain factors (e.g., if the innovation is highly complex or requires significant technical support, the potential adopter

abandons adoption of the innovation). Our frame acknowledges that it is also at this *point of factor interaction* where adopters persist towards adoption only by choosing paths that lead to replacement or amplified technology uses even if the innovation is designed for transformation, as illustrated in Figure 1. It is at this precise *point of factor interaction* where an opportunity surfaces in which a change agent may intervene and leverage change within factor(s) to shift the change path toward a transformative outcome (see Figure 2). Intervening in the process involves action by the potential adopter and/or a change agent (e.g., a technician, principal, technology integrationist, instructional technologist, or professional developer as in Figure 2) to manipulate social, political, financial or contextual factors with the aim of leveraging the factor(s) at the point of interaction. Such manipulation is called an "intervention," for it often involves factor(s) being manipulated or acted upon to stop or counter the trend toward rejection or replacement/amplified adoption. Deep understanding of the factors, the relationship between factors, and shifts in factors during the process, can help change agents and leaders (e.g., technology directors, principals, technology integrationists, and professional developers) plan for and enact interventions (e.g., identifying less complex innovations, providing more technical support, or increasing opportunities for teachers to learn as in Figure 2) *at the initiation of a specific change process* or *during naturalistic change processes* to overcome potential disappointing failures and costly impediments. It is not simply intervention that is important, but rather deliberate interventions purposely designed to move the process towards both diffusion and transformational use. It will necessitate perspective transformations among teachers, as teachers must ultimately agree with the assumptions of the transformative practice that will be enacted. This requires mentorship, discussion, and reflection between trustful colleagues.

Figure 2: Process of Adoption of Digital Innovation, as Predicted in the Framework-for-Action



Discussion

Web 2.0 technologies are widely used by youth in society – predominantly outside of school contexts -- such as in their homes and in after-school settings (Jenkins, 2006; Spires, Lee, Turner, & Johnson, 2008). Teachers, however, are generally slow to adopt Web 2.0 technologies within formal school-based learning contexts. Current technological adoption and diffusion theories (e.g., Fullan, 2007; Rogers, 2003; Zhao et al., 2002) explain that low adoption rates may be partially due to Web 2.0's high complexity, low perceived relative advantage over current educational practice, insufficient chances to observe or try the technologies for educational purposes, and incongruence with current pedagogical practices. Yet, current theories do not provide strategies to increase adoption of Web 2.0 technologies. Likewise, traditional success measures do not differentiate outcomes in terms of quality. Our FFA capitalizes on reflection, interpretation, and intervention. Reflection is necessary for adopters and change agents to recognize their own change effort and interplay of factors as described by current theories of change and diffusion. Interpretation is necessary for adopters and agents to identify a point of interaction among these factors that represent a point in their process where adoption could stall, be aborted, or result in replacement or amplification. In order to shift the change process toward transformative purposes, the adopter and/or the change agent, informed by knowledge of the change process and aware of the factors at play in their own change effort, will be prepared to intervene in the process at the appropriate point. Our FFA does not negate the earlier change and diffusion theories but aims to help create a strategy to increase diffusion of Web 2.0 technologies that, specifically, and more generally, leads to change that represents transformative practice in instruction, learning, and/or curriculum. In fact, our model necessitates deep knowledge of the diffusion and adoption theories that already exist.

Practically, the FFA offers guidance for leaders and change agents in increasing the diffusion of educationally-transformative Web 2.0 technologies. To achieve such an outcome, we see the following understandings and abilities as crucial for school or district leaders and change agents:

1. A culture of trust and respect among teachers and staff.
2. An understanding of transformative learning and instruction.
3. An understanding of Web 2.0 digital tools that offer educative value.
4. An understanding of the change, adoption, and diffusion processes and the involved obstructionist and supportive factors.
5. An ability to reflect on the change process in situ, enabling the identification of *points of factor interactions* specific to one's own context that represent apt moments for *intervention*.
6. An ability to interpret the most appropriate *intervention* techniques to shift pathways away from rejection or simple adoption (i.e., replacement and amplification) toward transformative outcomes.
7. An ability to intervene in the process (e.g., have the necessary resources, connections, and power).

Because teachers are the crucial key to technology adoption, they also need to be familiar, at least, with the RAT framework so they understand the potential for technology to play a role in transformative pedagogy and learning. If teachers are also familiar with the adoption processes, they may know when to seek assistance and rally for more support. Change agents are so important because it is not feasible to expect all teachers to possess such knowledge, so we recommend all schools employ a technology integrationist or instructional technologist who has

the understandings and abilities noted above and whose professional responsibilities include working collaboratively with all the school's teachers as they pursue technology adoptions. While we cannot guarantee that every intervention may culminate in technology-supported transformative pedagogy and learning, we guarantee ignoring the understandings and abilities noted above will lead to little to no possibility of transformative web 2.0 technology use for pedagogy and learning.

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