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The Collective Integration of Technology (CIT) Model: Helping Teachers Incorporate Technology Meaningfully in their Everyday Work

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ABSTRACT

There is no consensus on how educational technology solutions should be integrated in practice. Although several related models exist, none of them covers how education digitalization should be implemented and managed in a collective manner at both organizational (school) and individual (teacher) levels, so that process improvements support teachers' daily work as well as school and education administration. In this study, one researcher organized the training program for 168 Namibian K-12 teachers to apply remote teaching during the COVID-19 pandemic. The researcher also discussed the program with trainers, and based on participatory observations, created the collective integration of technology (CIT) model through grounded theory. A second researcher collected related theories together, such as models for digitalization of processes; individuals', and organizations' IT innovation adaptation; change management, and organizational learning; among others, for literature review and model comparison. Both researchers evaluated the CIT model that was developed and found that it covers rather well several aspects of different existing models and theories, and, as such, can be considered as theoretically validated, although it still needs empirical validation. Based on the findings, improvements are proposed, and a new version is to be tested in practice.

Keywords: *Education digital transformation, remote teaching, organizational change*

INTRODUCTION

Due to digitalization, the education sector faces the pressure to change. As Attuquayefio (2019) pointed out, technology can support learners in several ways by helping them to be more creative, experimental and connected. With technology, students are able to find information and network outside of the classroom, and digitalization gives new possibilities for lifelong learning as well (Attuquayefio, 2019). In addition, the COVID-19 pandemic has caused a rapidly growing need for new ways to organize remote teaching in schools. In this situation, it is more important than ever to ask how change should be implemented and how to make sure that all teachers put the necessary educational technology (EdTech) solutions to use. In a normal situation, it is possible that only the most interested teachers (innovators) would employ new technologies and others would follow later (Goh and Sigala, 2020). However, in the prevailing times of COVID-19, many schools have been forced to change to remote teaching in a very short time, and there is no room for laggards; all teachers must change their processes at once.

How to make this change happen is an essential question for schools, and it affects whole societies. As Englund, Olofsson and Price (2017) pointed out, there is quite a lot of research about how teachers are using EdTech (Conole, 2014), but fewer studies about teachers' conceptions and approaches to teaching and learning with EdTech (Drent and Meelissen, 2008). In addition, there is a gap in the literature regarding the main steps of teachers for integrating EdTech solutions into their everyday work in schools, considering the influences of the teachers' interactions during the

integration process. Therefore, we see it as important to develop a theoretically founded and empirically validated model describing the actions by which schools and individuals achieve these steps.

While there are some models about the steps of digital change in education, too often these kinds of step models concentrate on how the EdTech is or should be used, rather than telling how the change should be implemented by the agents of change: the teachers (see e.g. Bass, 2011; Hadullo, Oboko and Omwenga, 2017). These kinds of maturity models, or stages-of-growth models, are based on identifiable organizational growth phases in utilizing and managing IT (Galliers and Sutherland, 1991). However, when unclear guidance is given, it is difficult for organizations to see which actions should be preferred to achieve the next level. As said, such models often concentrate on recognizable stages, assuming that every organization goes through each stage linearly. Not much attention is paid to the practical actions to be taken (Carvalho, Pereira and Rocha, 2018). Growth models have been criticized for the lack of empirical validation, as well as the linearity assumption the models make (Solli-Sæther and Gottschalk, 2010). Most of the maturity or stages-of-growth models are conceptual models, while theoretically founded and empirically validated models are rare (Solli-Sæther and Gottschalk, 2010; Carvalho, Pereira and Rocha, 2018), and in some cases there is neither theoretical foundation nor empirical validation (Hamilton, Rosenberg and Akcaoglu, 2016). The maturity models and stages-of-growth models can be used to define the current stage of an organization, as well as comprehensive discussion tools when strategic goals are set. However, organizational-level actions are not enough; in practice the individual level – and the interactions between individuals – must be taken into account as well (Kim *et al.*, 2013; Orlando, 2014).

The models discussing education process digitalization can be applied to some extent. Process digitalization has been topical since the 1990s (Davenport and Short, 1990; Hammer, 1990), and process digitalization practices have been applied in the education sector as well. For example, Lagstedt, Lindstedt and Kauppinen (2020) presented an expert-oriented digitalization model (EXOD) for the digitalization of university processes. In their model they emphasized the special nature of lecturers as knowledge workers and experts, whose work digitalization is not so straightforward as more mechanical work (Davenport, 2010; Lagstedt, Lindstedt and Kauppinen, 2020). Although they give clear guidance for process and information system development and stress the expert point of view in digitalization, change management is discussed on rather a general level, concentrating mainly on organizational-level process change. Process change models, such as EXOD, can be applied when digitalization is planned and implemented, but they do not give very comprehensive guidance how the change should be communicated on different levels (Cooper and Zmud, 1990; Davenport and Short, 1990; Lagstedt, Lindstedt and Kauppinen, 2020). It seems that the EXOD model needs complementing regarding how EdTech solutions should be adopted and how changes happen at the interactional level of individuals (teacher) as a refinement of the organizational (school) level.

METHODOLOGY

As there are no acknowledged models of employing EdTech in schools, we found it essential to utilize a grounded theory approach (Strauss and Corbin, 1994) here. We approached the subject through participatory observation and dialogue with trainers supporting schools in digitalization. Based on the empirical findings, we formulated a Collective Integration of Technology (CIT) model, which was tested empirically and based on the feedback and participatory observations, it was refined. The refined version was verified against the existing literature about organizational learning, change management, technology acceptance and motivation. Based on the findings of the literature, the model was revised and updated.

The primary reason for selection of the grounded theory approach was the above mentioned lack of generally approved, validated models and theories of how to put EdTech solutions and practices into use at the individual and school levels. However, there was another reason for this approach as well. Due to the prevailing COVID-19 situation, the need for ways to make distance education and EdTech solutions usable has exploded (Azorín, 2020). We saw a grounded theory approach as a rapid way to combine the knowledge of the field and create working models for practitioners for further development.

In model development, we will follow the procedure for the stages-of-growth modeling process, presented by Solli-Sæther and Gottschalk (2010), shown in Figure 1 below. In their process, there are five steps: 1) suggested stage model, 2) conceptual stage model, 3) theoretical stage model, 4) empirical stage model and 5) revised stage model. The growth in their stages-of-growth modeling process means creating new knowledge and insights into organizational phenomena (Solli-Sæther and Gottschalk, 2010), and as such, we see their process as applicable in modelling of organizational development, such as digitalization of education. Therefore, we consider their modelling process as a useful guide for our research area.

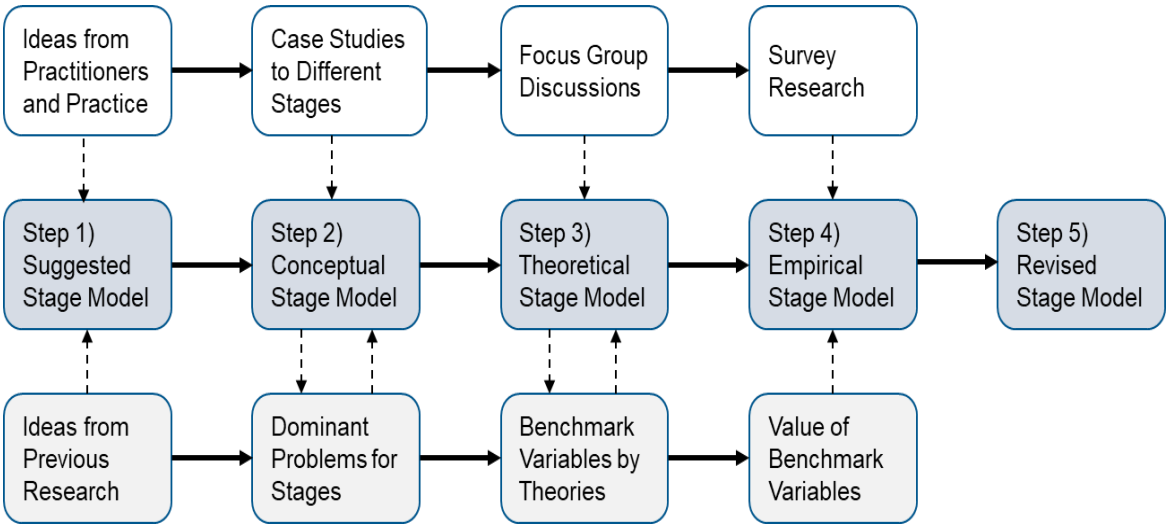

Figure 1: Stages-of-growth modeling process (Adaptation from Solli-Sæther and Gottschalk, 2010)

In this study, we only implement the first step of the Solli-Sæther and Gottschalk (2010) stages-of-growth modeling process, and developed a suggested stage model presented in this paper. The steps 2 to 5 will be implemented in subsequent studies. We have collected ideas from practitioners and practiced and developed the suggested stage model (step 1 in Figure 1). Furthermore, as Solli-Sæther and Gottschalk (2010) recommend, the research literature has been used to define the evolutionary aspects of the phenomenon.

Future studies will concentrate on the following steps of the stages-of-growth modeling process (steps 2-5). However, it must be stressed that unlike many other maturity and stage-of-growth models, we are not developing a model to be mainly used for defining the maturity level of an organization. Our main emphasis is to develop a model to be mainly used to guide the organization's agents of change implementation (teachers and teacher trainers) at different levels.

Since the idea of a grounded theory approach is that the researcher is not taking factors from existing theories into account but formulating the used theory based on empirical findings, it was seen as practical that in this study there were two researchers. The first researcher has experience in teacher training and strong knowledge of education-related theories, but was not so familiar with existing organizational learning, change management and technology acceptance models, while the second researcher was more familiar with those theories.

Procedures and participants

The first researcher was responsible for developing a training program for K-12 school teachers and administrators with the urgent need to implement remote education and management during the first semester of 2020 (April—July). The training program consisted of a series of three online workshops (six hours total) complemented by self-study materials, hotline chat sessions (two hours total), and feedback on the participants' work progress through communication channels such as Slack, email, and workplace. The main objective of the training was to help the participants to become familiar with secure software for form-based transactions. The software can be used, for instance, to create questionnaires, handle registrations, and organize assignments and eExams.

The training program was offered to K-12 schools in different regions in Namibia, from rural to urban areas, private and public, and with varying infrastructure and personnel conditions, reaching a total of 10 schools and 168 registered participants (the vast majority being teachers). Table 1 below shows the main characteristics of the schools.

Table 1: *Participating schools' characteristics*

Area of school	Type of school	Number of students	Number of teachers	Registered participants in the training
Township	Primary	302	14	14
Township	Secondary	1286	45	22
Urban	Secondary	1008	36	25
Rural	Primary	80	10	11
Township	Secondary	1286	45	22
Urban	Secondary	870	45	26
Urban	Secondary	794	41	20
Rural	Primary	102	8	5
Rural	Primary & Secondary	622	21	23
Urban	Primary	36	3	4

The first workshop program was offered by the first researcher. Based on the participants' feedback, the subsequent workshops were improved. From the second school that attended the

training program, the workshops were offered by two other trainers who had observed the first training sessions and learned how to organize and deliver them.

Based on observations and discussions that took place throughout the training activities, involving both participants and the other trainers, the first researcher developed the first version of the CIT model. Although involved in some training sessions, the second researcher was not involved in the development of the CIT model. Only after the CIT model was presented to the other two trainers and feedback was collected did the second researcher start to evaluate the CIT model against the existing literature. When the evaluation was done, both researchers discussed the findings and conclusions.

THE COLLECTIVE INTEGRATION OF TECHNOLOGY (CIT) MODEL (the suggested stage model)

When the teachers were faced with the need to rapidly integrate EdTech to provide remote education, it was observed that they entered a journey of changes involving different behavioral (strategies to deal with the changes brought by EdTech integration), emotional (feelings related to the changes), and cognitive (learning) processes. At the same time, teachers were being constantly influenced by the shared experiences of the school group and how leaders were guiding them through the processes of change. By leaders, we mean the trainers of the EdTech program and the teachers who adopted the new technology quickly, becoming facilitators of this learning for other teachers and, eventually, change agents. All these aspects were distinguished in four main states: shock state, negotiation state, empowerment state, and explorer state. Each of them is called a state – as opposed to a stage – because they are not linear or mutually exclusive. On the contrary, it was observed that these states can be experienced simultaneously by the group of teachers.

Shock State

- *Behavioral, cognitive, and emotional aspects:* teachers go through intensive learning about the new technology. It is common that teachers' EdTech stereotypes loaded with emotional overtones are activated at this initial moment, such as fear of using technology, excitement for learning about it, or feeling exhausted for having one more thing to deal with. While teachers are learning about the technology, they start to create a more realistic image of what it is and how it can be employed in their teaching, paying special attention to how it can support them in delivering lessons, assigning homework, and assessing learning. In addition, teachers' work routines would be disrupted by the technology, leading them to re-create work practices, and spend considerable time and energy to learn about the EdTech solution. They need to adopt new competencies to integrate the new technology into their previous work routine.

→ *Social (collective) experience:* This state demands intense support of the trainers and official school leaders (heads of office, principals) regarding teachers' learning, so the teachers can have the needed conditions for it (including reserved time, needed materials, and Q&A sessions). Some teachers eventually expose their attitudes towards technology during collective and/or individual training sessions. Trainers should be aware of how teachers feel about the technology and open different channels for teachers to ask questions. It is important to give immediate feedback on teachers' questions, doubts, and progress during this stage, so they can be engaged as much as possible to learn. Also, it is important to reward teachers (with positive feedback and recognition) for their attempt at learning – even if they try and fail on the technology – instead of praising only the ones who learn it fast. In addition, the teachers' emotional load on technology can be amplified, reduced, or repressed, depending on how participants relate to each other and the trainer, and how

successful the trainer is at discussing these factors in the group/individual meetings. In case the level of familiarity of the teachers with technology in general is too low, an initial kick-off workshop is recommended in which teachers are intensely exposed to hardware and software gadgets so they can start feeling confident enough to try them out – pressing buttons, making mistakes, and debugging the mistakes.

Negotiation State

- *Behavioral, cognitive, and emotional aspects:* Teachers get familiar with the new technology. Based on the teachers' personal and collective experiences of integrating the new technology into their working process, they go through two types of negotiation processes:

o Negative negotiation: Teachers negotiate with their preconceptions of technology in a way that makes them feel they are losing time and energy with it, negative stereotypes are reinforced, and frustration and anger are predominant feelings. They end up adopting technology inefficiently. For instance, they do not understand how to properly use the software features of a survey and they end up not benefiting from the data analysis that the proper use of its features would allow. Teachers just try to replace basic manual work practices with the new technology, not really improving work performance. In the worst case, teachers are still employing manual paper-and-pen processes and in addition, they have manual digital processes as extra work. Therefore, the increased workload for learning about the EdTech solution does not compensate, because the digital work is not used to truly enhance work outcomes. If leaders, such as the trainers, do not change this, teachers might completely disengage or strongly resist EdTech integration.
o Positive negotiation: Teachers negotiate with their preconceptions of technology in a way that makes them feel they are winning by investing time and energy on using the technology now, which will be compensated in the future. In this case, teachers adopt technology efficiently by not only automatizing but by improving work practices with the new technology. In this way, teachers start to integrate technology into their work, such as curating online resources for a better lesson delivery, creating dynamic homework with the new technology, increasing the motivation, and learning of students by using EdTech features effectively. In this state, the increased workload is felt by the teachers to be worthwhile because the EdTech integration enhances work outcomes and saves the teacher energy and time later.

→ *Social (collective) experience:* In this state, the trainers must be very active in identifying which kind of negotiation the teachers are engaging with. After identifying whether the teachers are inefficiently replacing manual paper-and-pen processes or starting to enhance work processes, it is important that the trainers act immediately, suggesting in the first case a change of perceptions and practices regarding how the technology can enhance work practice, or in the second case suggesting how EdTech can speed up the work performance even more. It is important that all teachers go through the positive negotiation phase.

Empowerment State

- *Behavioral, cognitive, and emotional aspects:* Teachers feel confident in experimenting; they are excited about the EdTech and the work progress it can bring. In this state, teachers learn and deepen their knowledge about the new technology by trial and error, on their own initiative. They might even end up developing new work practices that the new technology supports. By extensively trying the new technology, they get well acquainted with most (if not all) of the features they need from the EdTech solution.

→ *Social (collective) experience:* At this point, trainers can focus on identifying the teachers who are in this state and invite them to support other teachers who are lagging behind. It is important to create some sort of collaborative and serving leadership culture at this point, so the empowered teachers feel motivated to support their peers and become change agents. For that, the trainers can arrange with the school leaders (heads of office, principals) learning and integration organizational targets; if all teachers achieve them, the group receives some sort of compensation – and the change agents who helped other teachers are also rewarded.

Explorer State

- *Behavioral, cognitive, and emotional aspects:* Teachers in this state feel the need to expand the features of the new technology and they start conceiving of innovative ways to use and further develop the EdTech solution. Here, the transformation is not brought by the technology to work practices, but rather the teachers expand their views on their work practices and develop a demand for new technology to support them.

→ *Social (collective) experience:* In this state, trainers and school leaders should create an effective forum for teachers to share their ideas and opinions on how the EdTech solution can be improved. The teachers should feel that their opinions are truly listened to and implemented in the software development process.

In Figure 2 below, the CIT model is presented on a general level. The shock and explorer states represent the opposite sides of the **activation spectrum**, in which teachers move from an immobilized or passive condition on the left to a very active and innovative momentum on the right. In addition, the (negative) negotiation state up to the empowerment state represents the extreme sides of the **consolidation spectrum,** in which teachers strengthen (and even crystallize) assumptions, attitudes, and practices regarding EdTech integration.

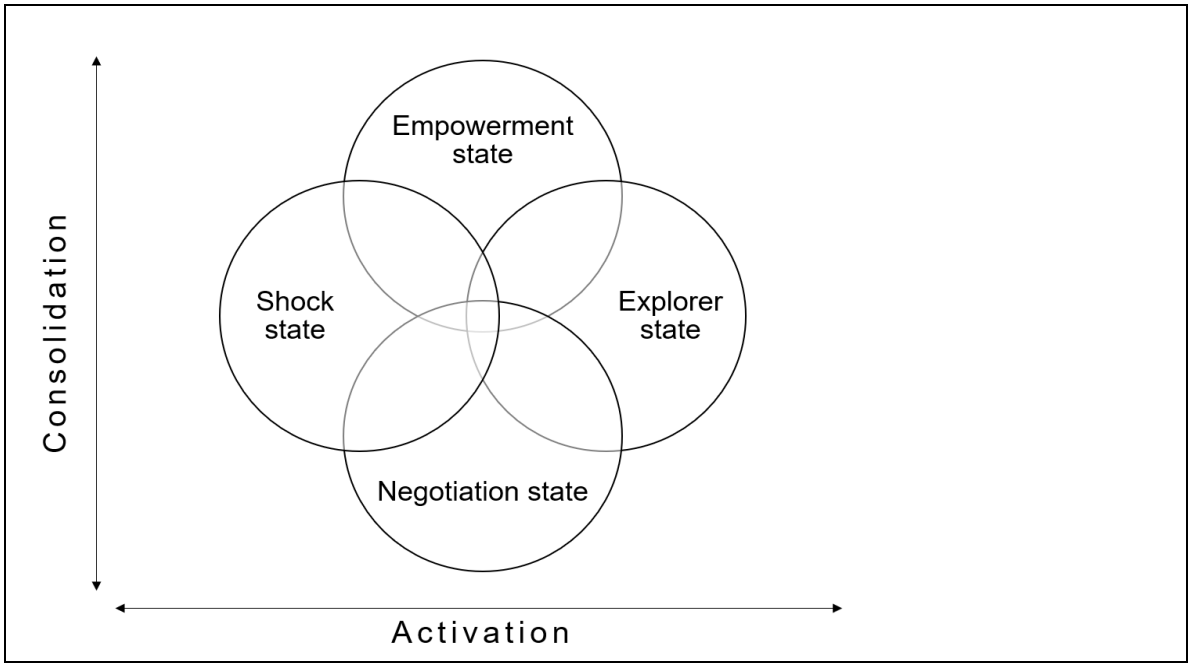

Figure 2*: The main states of the CIT model*

RELATED LITERATURE

It seems that there is no widely accepted (and scientifically valid) model or theory of how education digitalization should be done, and especially how the change should be managed both at the organizational (school) and individual (teacher) levels. Furthermore, as Englund, Olofsson and Price (2017) stated, this question hasn't been studied much. However, we do not consider this totally unstudied phenomenon. Instead, we see that there are several well-known theories and approaches regarding the phenomenon, and they can be combined and applied here. In this section, we present the main ideas of these theories, and in the following section we discuss how these theories are in line with the developed CIT model.

Setting goals for using EdTech solutions

Change does not have value in itself, and when the EdTech is put into use in schools, it is important to know the objectives of the change. There are, of course, school - (organizational) level objectives, but it is essential to remember that there should be teacher- (individual) level objectives as well, otherwise no real change will actually happen (Cameron and Green, 2009). In addition, Cooper and Zmud (1990) found five major contextual factors which impact technology diffusion: characteristics of 1) the user community, 2) the organization, 3) the technology being adopted, 4) the tasks to which the technology is being applied, and 5) the organizational environment. These factors set the stage for whether EdTech integration will be successful (or not).

At the organizational (school) level, different kinds of education-related maturity and state-of-growth models exist (see e.g. Gu, Chen and Pu, 2011; Solar, Sabattin and Parada, 2013; Rossi and Mustaro, 2015). As mentioned in Section 1, these kinds of models rarely give clear guidance how the change could be implemented (Solli-Sæther and Gottschalk, 2010; Carvalho, Pereira and Rocha, 2018); however, with their descriptions of different development stages, they can be used as a tools for evaluating the starting point and setting the goals for development. They also provide criteria for evaluation of maturity levels of organizations (schools), and such criteria can be applied in goal setting as well.

Different kinds of IT innovation adoption models can be used for evaluating the current situation in an organization, identifying problematic areas, and setting the goals of change (Haneem, Kama and Bakar, 2019). One of the most prominent models is the unified theory of acceptance and use of technology (UTAUT), which unifies the main ideas of previous models. According to the UTAUT, the user's aims with use of a new technology depend on: 1) performance expectancy, 2) effort expectancy, 3) social influence, and 4) facilitating conditions (Venkatesh *et al.*, 2003). All these direct determinants of user acceptance and usage behaviour should be evaluated and taken into account in goal setting. In addition, UTAUT recognises four key moderating variables to be taken into account: experience, voluntariness, gender and age, that affect the above mentioned four direct determinants of user acceptance and usage behaviour (Venkatesh *et al.*, 2003). The model is depicted in Figure 3 below.

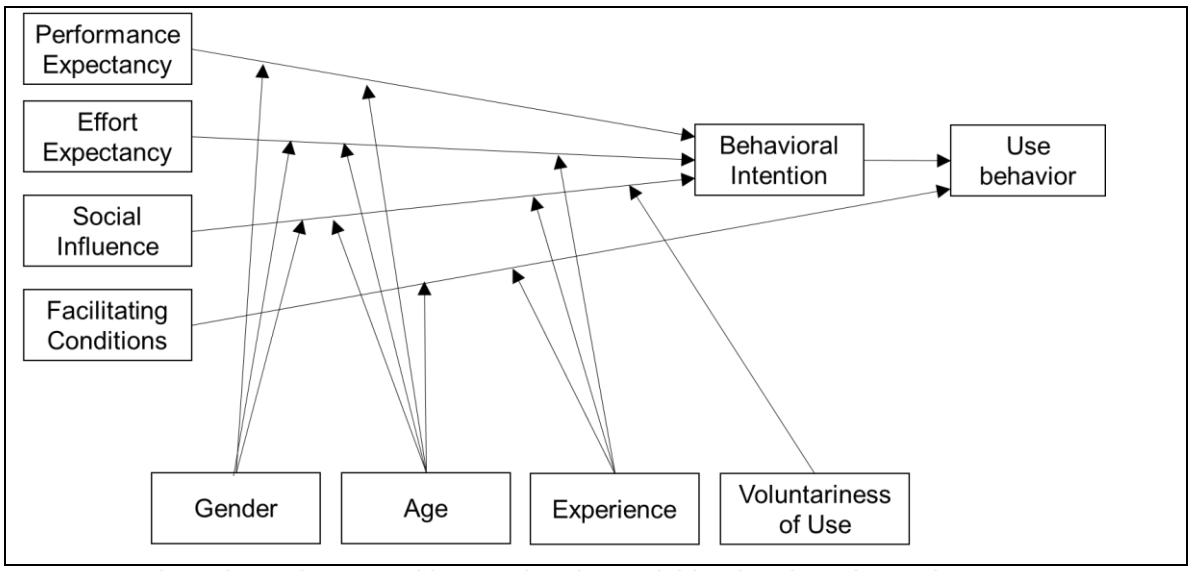

Figure 3: Direct determinants and key moderating variables (Venkatesh 2003)

When individual-level goals are considered in the education context, it is important to understand what kinds of development targets should be set for teachers, and in which knowledge areas. According to Mishra and Koehler (2006), the teachers' professional knowledge consists of content knowledge, pedagogical knowledge, and technological knowledge. As presented in Figure 4 below, these knowledge areas are somewhat overlapping, and the optimal knowledge area for efficient teaching, technological pedagogical content knowledge (TPACK), is where all three areas intersect.

Where the use of EdTech is concerned, the improvement of technological knowledge (TK) of teachers is at the heart, but it is important to see that it is not enough. The two other knowledge areas, pedagogical and content knowledge, must be considered as well, which affects, for example, curriculum. TPACK model-based evaluation tools such as proposed by Valtonen, Sointu and Mäkitalo-siegl (2015) can be used, when the current stage of teachers is evaluated and individual-level goals are set.

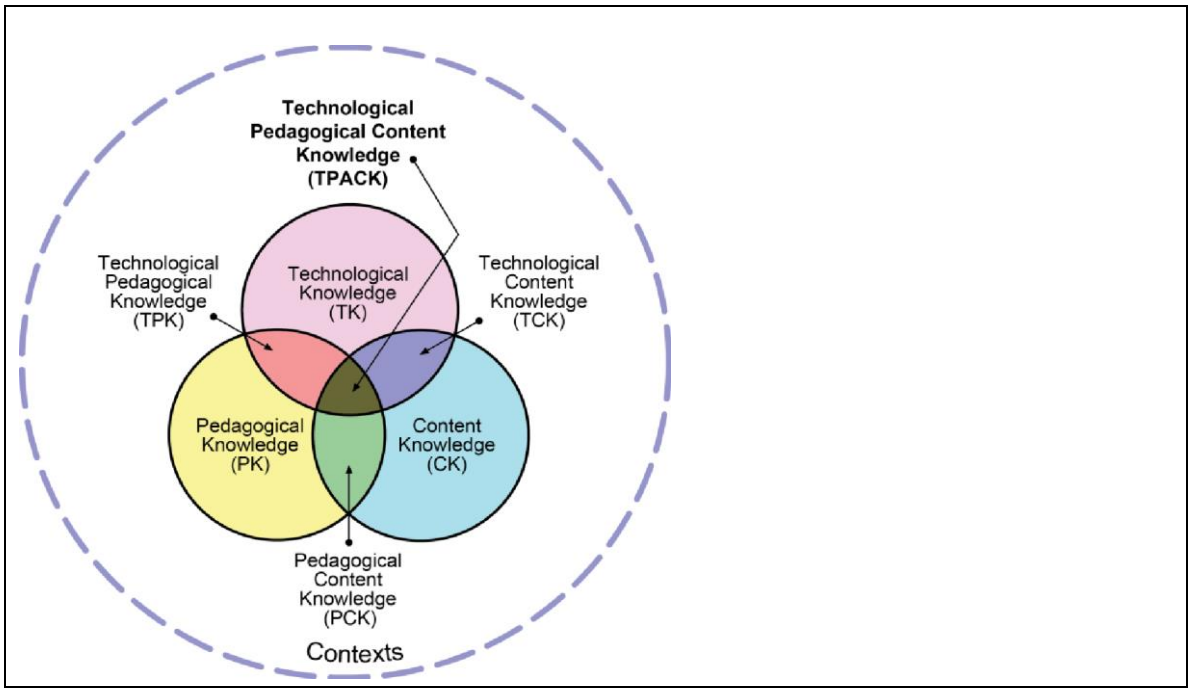

***Figure 4**:* TPACK model (Mishra and Kohler, 2006). Reproduced by permission of the publisher, © 2012 by tpack.org

Managing the change

If a teacher does not see an EdTech solution as useful and easy to use and if the use is not facilitated by the organization (school), the systems are not employed (Ghasia *et al.*, 2020; Kayanda, Busagala and Tedre, 2020). Dwivedi (in Kayanda, Busagala and Tedre, 2020) has noted that the technical quality of a system does not guarantee that it will be used. There must be supporting and encouraging management, quality technologies, skilled and empowered people, and procedures to direct the people (Ghasia *et al.*, 2020).

Furthermore, the potential benefits of employing the EdTech solution do not guarantee that the change will automatically be welcomed; when new practices are in use, change resistance must be considered (Cooper and Zmud, 1990; Cameron and Green, 2009). To overcome change resistance, the process of change must be understood clearly, and it is important to manage both organizational and individual levels of change when schools are adopting EdTech solutions.

Organizational-level change can be considered the top level of change, and organizational learning is a suitable concept for discussing how new knowledge practices are created and spread across an organization. When we discuss the collective process of knowledge building, the basic ideas of Nonaka (1994) can be used as a background. In his seminal text, Nonaka (1994) stated that the tacit knowledge of a few should be crystallized and changed to explicit knowledge of the whole organization. According to Nonaka (1994), the individual members of an organization are the prime movers of knowledge creation, and he proposed a “middle-up-down” model, where self-organizing teams are the agents of knowledge creation, and middle management has an essential role to synthesize the teams’ knowledge to top management knowledge (Nonaka, 1994).

The importance of self-organizing teams is in line with Brown and Duguid's ideas of communities-of-practice (Brown and Duguid, 1991). Communities of practice are informal, self-managing groups of experts sharing their experiences and creating new solutions to the problems of their work. According to Brown and Duguid (1991), these groups are a remarkable source of innovation in organizations, but being informal, self-managing and outside of the official command chain, communities of practice are difficult to set and steer (Brown and Duguid, 1991; Wenger and Snyder, 2000). However, organizations can nurture communities of practice successfully; it is possible to bring the right people together and provide structures, practices and infrastructure to support this kind of innovative activity (Wenger and Snyder, 2000).

To make digitalization change happen at the school level, the actual practice (Brown and Duguid, 1991) – that is, what is really done (formally or informally) – must be changed. After that, thanks to middle management (for example, principals), actual practices become the official espoused practices (Brown and Duguid, 1991; Nonaka, 1994; Wenger and Snyder, 2000). It is important to understand the difference between actual practices and espoused practices, and how actual practices can be developed and processed to become espoused practices. If this is not done successfully, there is a risk that, as Argyris (1977) pointed out, people report totally different actions than they are actually doing, which inhibits organizational learning. Therefore, it is important to encourage learning in informal expert groups and to promote the learning culture, so these groups are willing to test and learn about EdTech integration into school practices. Additionally, organizational-level knowledge sharing and the informal expert groups support the idea of change agency (Nonaka, 1994; Kotter, 1995; Cameron and Green, 2009; Lunenburg, 2010; Westover, 2010). However, contrary to the rather common idea to use middle management as change agents (Nonaka, 1994; Westover, 2010), one can ask if selected teachers (with the support of principals), as experts in their area, are actually the most efficient change agents in schools.

Business process management (BPM) gives some ideas and tools for actual process change. Hammer (1990) as well as Davenport and Short (1990) pointed out that re-engineering the processes by enabling technological solutions is much more beneficial than just automatizing the processes. Therefore, teaching processes should also be questioned and changed to enable the possibilities of new technologies. Changing processes should be done case by case (Cooper and Zmud, 1990; Davenport and Short, 1990), and the case-specific factors must be taken into account. Rosemann and vom Brocke (2010) defined six core elements of business process management: Strategic alignment, Government, Methods, Information Technology, People, and Culture; it is important to see that they have organizational-level elements, but also elements relating to people and methods.

Change management is a higher-level term for whole organization change, and Kotter's (1995) eight-step transforming model gives management a clear overall path to follow. Kotter (1995) notes that new behaviours are rooted in social norms and shared values, which is in line with the ideas of Nonaka (1994), as well as Brown and Duguid (1991). In Kotter's eight-step model, the change process goes through the following steps:

1) establishing a sense of urgency, 2) forming a powerful guiding coalition, 3) creating a vision, 4) communicating the vision, 5) empowering others to act on the vision, 6) planning for and creating short-term wins, 7) consolidating improvements and producing more change, and 8) institutionalizing new approaches (Kotter, 1995).

When the ideas of Kotter (1995), Nonaka (1994), and Brown and Duguid (1991) are integrated, change managers create a framework for the change and encourage communities of practice to create new knowledge and ways to organize work, after which the new knowledge is consolidated with new approaches. However, there has also been criticism of these change models: critics claim

that the models simplify change too much and do not recognise its complexity or the human factor, and that the models are not prepared for resistance (Gilley, Gilley and McMillan, 2009).

Some organizational-level models combining the above-mentioned aspects already exist. One example is the expert-oriented digitalization (EXOD) model (Lagstedt, Lindstedt and Kauppinen, 2020), which emphasizes organizational change but recognizes the special nature of experts (such as lecturers) as well. In the EXOD model there are four developmental steps for process digitalization: 1) initiation, 2) process re-engineering emphasis, 3) information system development emphasis, and 4) stabilization. The idea is that each of these steps is done in close cooperation with all stakeholders (Lagstedt, Lindstedt and Kauppinen, 2020). Although the EXOD model was designed for situations where a new information system is developed at the same time education processes are changed, it can also be applied in situations where a ready-made EdTech solution is put into use (which causes processes to be changed). However, the EXOD model, though taking the expert point of view into consideration, does not give any specific guidance on how change occurs on an individual level, and other process change models seem to face that challenge as well.

When we are moving from organizational level to individual teacher level, we have to consider the different teacher groups that schools have. It is presumed that Rogers's diffusion of innovation curve (see Figure 5 below) can be applied to teachers as well, and it is not possible to get all teacher groups to develop new practices and knowledge from the beginning (Goh and Sigala, 2020). Innovators and early adopters are eager to change and test new practices and technologies, whereas laggards are skeptical of new ideas and resist change (Gilley, Gilley and McMillan, 2009; Goh and Sigala, 2020). Thus, when new knowledge is created, it is important to concentrate on innovators (and early adopters) and convince them to be change agents (Goh and Sigala, 2020).

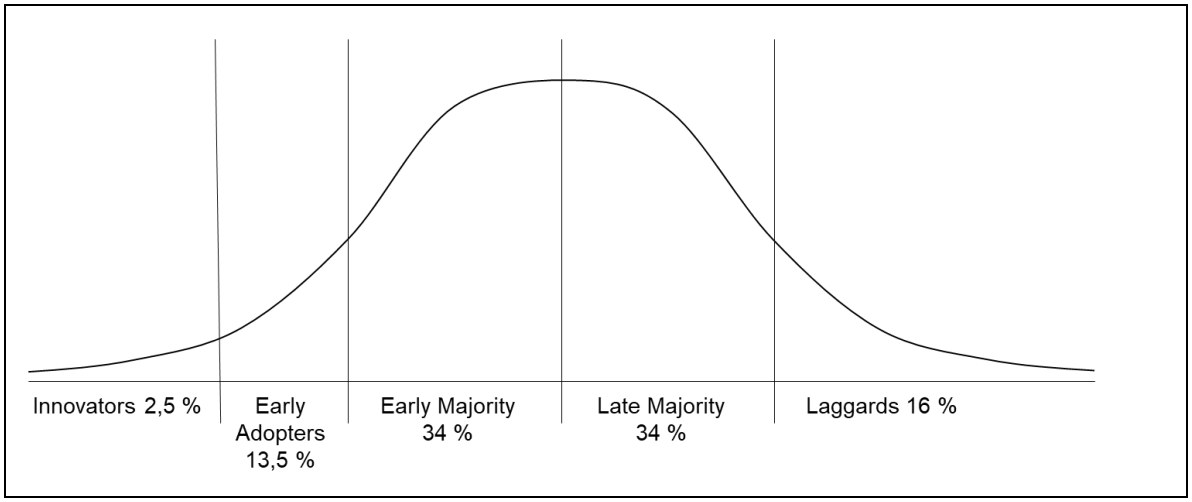

Figure 5*:* Rogers's diffusion of innovation curve (Goh and Sigala, 2020)

Change at the individual level is frequently studied, and many models describing the steps individuals go through in change have been constructed. Most of the individual-level models rely on the seminal work of Kübler-Ross (Elrod and Tippett, 2002). When studying how individuals cope with trauma or serious illness, she identified five phases through which individuals pass: 1) denial, 2) anger, 3) bargaining, 4) depression and 5) acceptance (Elrod and Tippett, 2002). Since then, more detailed models have been developed to consider human response to change in general. For example, Bubb (in Elrod and Tippett, 2002)) developed a graphical model for evaluating how

performance or morale changes during the different change stages (see Figure 6; Elrod and Tippett, 2002). Although different up-to-date models exist, we note that change at an individual level is not a linear improvement process, but there is a "death valley" of change as well (Elrod and Tippett, 2002). In practice it means that there must be enough time for the change, and the feelings and emotions related to the stages of the individual change process must be considered. Humans are not machines, and change is not a mechanical process.

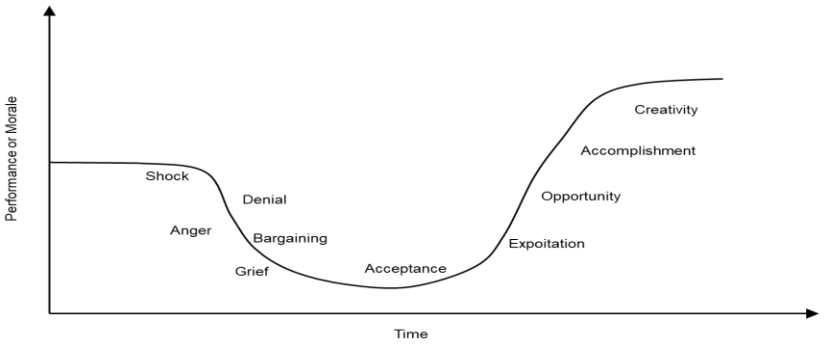

Figure 6: International Association of Machinists' change model, (Bubb (in Elrod and Tippett, 2002))

When change is examined at the individual level, it is important to ask why individuals are willing to change and learn new practices, and motivation becomes a remarkable factor. Lewin (in Cameron and Green, 2009) pointed out that to make change happen, driving forces must outweigh resisting forces (Cameron and Green, 2009), and that proposition can be applied in individual-level motivation as well. According to Keller (1987), there are four main conditions for learners' motivation: attention, relevance, confidence and satisfaction (ARCS). A motivational concern of the first condition, attention, is getting and especially sustaining the attention. According to Keller, attention is sustained by responding to sensation-seeking needs and knowledge-seeking curiosity and keeping balance between boredom and hyperactivity (Keller, 1987). About relevance, Keller (1987) pointed out that it does not necessarily relate to future expectations such as career opportunities, but it can also come from the way of learning: people may be high in "need for affiliation" or "need for achievement," and learning new practices can be an answer for their needs. Confidence is important when people are trying something new, and fear of failure can inhibit its development. To improve confidence, it is important that in the beginning the difficulty level be low enough and the goals realistic. It is also important that people feel good about the achievements they have attained through clear milestones and defined rewards (Keller, 1987; Gilley, Gilley and McMillan, 2009). However, facilitators must remember that people want to retain control of their lives, and over-controlling must be avoided (Keller, 1987).

FINDINGS

When the CIT model was presented to the other trainers providing training sessions to the Namibian schools, feedback was collected to evaluate how much it resonated with their extended experience and observations of how the teachers were integrating the new EdTech solution into their work practices.

It was found that the developed CIT model gives practical tools for trainers who are supporting schoolteachers in integrating EdTech into their work practices, as one trainer stated:

> *I love it! The shock is really there, we try to tell the users that they shouldn't be afraid of technology and if anything they won't break the system if they try to do anything with it […] The change of the mindset and getting users comfortable with the tool is really important because whether [/in case] the tool is really bad we won't get the feedback to improve the tool.*

The same trainer also emphasized the need for synchronizing EdTech integration to the school policy, so that laggard teachers who postpone using it will also start learning and implementing it.

> *We are always trying to get teachers to attend the sessions […] but because some of them see the program as an extra activity they sort of withdraw themselves from the program. And because there is no school policy on these programs, the teachers see it as just an extra activity, especially those from government schools. For example, what the school principal of [XXX] is considering doing is that he wants to have it as part of the contracts signed by the teacher.*

Finally, according to the trainers, EdTech solutions "shouldn't only be integrated into the school curriculum, but also be part of the curriculum at the university," emphasizing the need to prepare teachers for the rapid changes in the education sector right from their initial education as teachers.

The CIT model is also in line with existing literature and adds organizational and individual levels to previous models that have approached technology acceptance and use, and processes of learning and change. Table 2 summarizes how the CIT model corresponds and/or complements aspects of existing models. From the point of view of setting goals for using EdTech solutions, the CIT model overlaps in many aspects with UTAUT. Performance and Effort expectancy (UTAUT model) are cognitive determinants that correspond to the evaluation process that individuals go through in the negotiation state (CIT model). Complementarily, social influence and facilitating conditions (UTAUT model) reflect the key role of leaders (such as the trainers) on creating the atmosphere needed for collaborative and peer learning, social support, communication channels for feedback and evaluation of processes, that are relevant in the shock and negotiation states (CIT model).

A powerful tool for trainers to investigate in which direction (positive or negative) teachers are evaluating the EdTech solution in the negotiation state (CIT model) is the TPACK model-based evaluation scale (Valtonen, Sointu and Mäkitalo-siegl, 2015). This short questionnaire (7 items, 6-point Likert scale) screens how much additional knowledge the teachers need or how much strong knowledge they already have about using the EdTech solution for sharing ideas with students and promoting reflective thinking, problem solving, creative and critical thinking, and group work.

While the TPACK model focuses mainly on the cognitive aspects of EdTech integration into teaching, the UTAUT model focuses on both cognitive and social aspects of the same process. However, both models lack the integration of emotional processes that impact the adoption of technology as well. In the CIT model, the emotional aspect of change is considered in all states, of which the shock state represents the moment in which emotional reactions to the technology have the strongest impact on the acceptance and use of it.

Table 2: *Comparison between previous models and the CIT model*

	Previous models	**CIT model**
Setting the goals	UTAUT	Adds emotional aspects of change, as well as provides clearer guidance on collective process of EdTech integration
	TPACK	
Managing the change	Change agents and Kotter's eight-step model	Managing the change has more bottom-up approach, and the change process is not so linear. Teachers become change agents and help leading the change
	Rogers's diffusion of innovation curve	Teachers who are early adopters of the EdTech become change agents. They have strong potential to enter the explorer state and become innovators.
	Communities of practice	Trainers and teachers—change agents develop organizational learning culture and transform new informal practices into espoused ones
	EXOD	Adds more comprehension on how the change is experienced at individual level
	Bubb (and other change-curve models)	Adds clearer guidance on collective process of EdTech integration. States can be experienced simultaneously, and decreasing performance does not necessarily occur on the individual level.
	ARCS	School leaders, trainers and teachers/change agents develop organizational learning culture that sustains teachers' motivations on integrating the EdTech into their work practices

From the point of view of managing the change processes of integrating EdTech into teachers' work, the CIT model resonates with the concept of "change agents" and middle management roles by considering how the trainers should identify which teachers are becoming confident in, and satisfied with using the new technology, so they can be invited to support other teachers who are lagging behind. These change agent teachers would be responsible for encouraging the learning culture within the school, culminating in the sharing of new informal practices until they become official practices. Existing models support the understanding of middle management's role in leading change and integrating EdTech solutions, such as Kotter's eight-step model or the EXOD model. However, as pointed out previously, they do not give guidance on how the change occurs at the individual level.

When we identify the group of teachers who correspond to the early adopters of new technology, according to Rogers's diffusion of innovation curve, and the right conditions are set by school leaders and trainers (such as, establishing a forum for sharing ideas and exchanging experiences), this group of teachers can become innovators by entering the explorer state (CIT model). Therefore, they start developing new work practices through the constant (innovative) use of the new technology. At this point, the organization would have established fruitful communities of practice.

Bringing the discussion to the individual level, the similarities of the CIT model with the Bubb model (and other change-curve models) for dealing with radical changes are quite clear. The shock state (CIT model) corresponds to the shock, denial, and anger phases (Bubb model), while the

negotiation state (CIT model) overlaps with the bargaining, grief, and acceptance phases. Additionally, the empowerment and explorer states of the CIT model correspond more or less with the exploration, opportunity, accomplishment and creativity phases (Bubb model). However, Bubb's model is based on the idea of linear change, while the CIT model reflects the observation that teachers can experience different states simultaneously. Additionally, the "death valley" phenomenon might be true on the organizational level, but not necessarily on the individual level in EdTech integration.

Complementarily, the CIT model also approaches some of the motivation conditions (attention-relevance-confidence-satisfaction) highlighted by Keller (1987), but not as explicitly. According to the CIT model, trainers must establish an effective communication channel with the teachers so they can provide immediate feedback and answer queries from the teachers who are learning about the new EdTech (sustaining attention). Trainers need to identify the teachers who tend to negotiate negatively towards the changes and emphasize the positive aspects that the new EdTech potentially brings (relevance). When teachers feel empowered by the technology in the CIT model, there is a clear aspect of confidence from overcoming the challenges and applying strategies to learn more about the EdTech solution. The satisfaction aspect is also brought out in the CIT model when trainers and school leaders engage in creating a collaborative and serving leadership culture, so teachers/change agents support other teachers in learning about EdTech at the same time they are rewarded for that.

DISCUSSION AND CONCLUSIONS

The CIT model was developed to help schools digitalize their teaching, primarily to make remote education possible due to the COVID-19 pandemic. The CIT model considers the collective process of knowledge building of a group (teachers, Heads of Office, principals) and how the learning culture of the organization can support (or hinder) EdTech integration into school practices. Most importantly, the CIT model fills the gap of the interactional factor in the technology integration process by approaching the behavioral, cognitive, emotional, and social processes of implementing and managing change. Therefore, the CIT model can be used as a "change meter" for teachers and managers to evaluate themselves and their own state in relation to the EdTech integration process – as well as how they can best act accordingly to generate productive work changes.

As leadership has an essential role in change management (Gilley, Gilley and McMillan, 2009), we find it important that the school leaders, as part of their communication and motivation tasks, clarify the role of teachers in engaging with the EdTech integration as a new part of school policy, organizational culture, and education vision. Therefore, we see it as vital that digital transformation in education comes with curriculum reform to make the change sustainable.

Lastly, professional training of teachers has been seen as a key to successful change (Hennessy, Harrison and Wamakote, 2010; Kim *et al.*, 2013; Muianga *et al.*, 2019), but the change should not be seen as a responsibility only of individuals. Organizations (schools) can have barriers inhibiting change (Muianga *et al.*, 2019; Singhavi and Basargekar, 2019), and the schools as organizations have to be involved in the change (Hennessy, Harrison and Wamakote, 2010; Singhavi and Basargekar, 2019; Kayanda, Busagala and Tedre, 2020). To have a sustainable change, there must be change at all organizational levels.

This study consists of the first attempt to better understand EdTech integration in schools. Therefore, the CIT model is still at the suggested stage (shown in Figure 1), and further research with data collection and empirical analysis will be done to confirm (or reject) the findings. In the following research phases, it is important to have more empirical validation, and for that we are

going to apply Solli-Sæther and Gottschalk (2010) stage-of growth process steps from two to five (see Figure 1). In those phases, we will also emphasize the practicality and use of the CIT model.

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