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Abstract

Organizational improvisation (OI) has been gaining an increasing attention to respond to rapidly changing environments, and it needs close and proper management. However, most of the findings on Improvisation I information system development studies are based on variance-based models. Thus, Du et al. (2019) propose a process model that features a continuous iteration between improvisational search and build in ISD. Their four-phase model describes continuous and iterative methods of organizational improvisation to respond to opportunities and threats, presenting an excellent step-by-step guideline for information system development managers to refer to from a practical standpoint. Despite the contributions, their exploratory research is not immune to limitations. Although the authors explained that learning is working in their model, there is only a fragmentary explanation of how the learning process works. In this work, we explore the boundary condition of Du et al.'s (2019) proposed model for the OI process in ISD then suggest a new model for ISD by combining the evaluation and learning process model proposed by Beynon-Davies et al. (2004), which is based on Argyris and Schon (1978). We believe that the new framework will help us apprehend that organizational improvisation in ISD generates short-term learning and long-term learning through the evaluation and learning from a process model perspective.

Keywords: *Organizational Improvisation, Organizational Learning, Information Systems Development*

Introduction

Improvisation in information systems development (ISD) has received much attention lately as a means to combat technological progress (Magni et al. 2010; Bansler and Havn 2004; Kautz 2009; Molnar et al. 2017; Du et al. 2019). In particular, studies have investigated how to use improvisation in ISD from an organizational perspective to assist traditional planning action (Du et al. 2019; Zheng et al. 2011). Existing studies show what factors are used to effectively conduct organizational improvisation (OI) in ISD, such as information technology, individual skills, and experience (Pan et al. 2012; Zheng et al. 2011; Orlikowski and Hofman 1997; Teoh et al. 2012), and the negative consequences of improper use (Brown et al. 1998; Levallet et al. 2013; Tjørnehøj et al. 2010). However, previous studies have barely focused on the mechanism that tells us how OI can be effectively conducted step by step in ISD (Du et al. 2019).

Du et al. (2019) present a process model that can manage the improvisation at the organizational level, using an approach to process theory and a case study method. Their four-phase model describes continuous and iterative methods of OI to respond to opportunities and threats, presenting an excellent step-by-step guideline for information system development managers from a practical standpoint. Despite the contributions, their exploratory research is not immune to limitations, such as their study assumes that OI is used for short-term learning or in real-time interpretation. In addition, it has not been studied that OI can be a source of long-term learning that produces reusable knowledge.[1] Although the authors explain that learning is working in their model, there is only a fragmentary explanation of how the learning process works. This ambiguity could ultimately be a barrier to applying their model and limit its potential. Therefore, it could be valuable to effectively conduct OI in ISD to address the challenge that emerges when applying them.

Organizational learning (OL), which is defined as the process of modifying strategies and assumptions from an organizational perspective to respond to errors (Argyris and Schon 1978), provides a good theoretical background for dealing with these limitations. In other words, OL presents solutions to manage the problems that emerge when implementing OI in ISD (Teoh et al. 2012; Molnar et al. 2017). We set out to address the following research question (RQ): *How can organizations gain reusable knowledge or experience through organizational improvisation (OI) and organizational learning (OL) in ISD?*

In this study, adopting the design science paradigm, we develop a design process model (i.e., design artifact) and evaluate it (Hevner et al. 2004; Gregor and Jones 2007). We discuss the potential limitations that can occur when operating OI in ISD presented by Du et al. (2019), and present a new model that combines the OL model proposed by Argyris and Schon (1978) to address those limitations. We believe that the new model will help us apprehend that OI in ISD generates short-term learning and long-term learning through the evaluation and learning from a process model perspective.

Literature Review

Organizational Improvisation Process Definition

Improvisation is inspired by the improvisation shown in jazz musical performances, often executed at the individual or team level (Moorman and Miner 1998). In terms of improvisation in organizational settings, OI is performed in which individual activities (i.e., individual improvisations) gather to create a system. OI is defined by Miner (1998) as the temporal convergence between planning and execution. This concept aids in the identification and measurement of OI by researchers. The first sign of OI is when preparation and execution occur at the same time. Second, the more improvisational the task is, the shorter the time between preparation and execution. One of 3M's most famous innovations, Post-it Notes, is a well-known example of improvisation. The product resulted from improvisation based on a failed experiment that was supposed to make a super-tack adhesive but ended up making a low-tack adhesive instead (Du et al., 2019).

[1] Based on existing studies (Miner et al. 2001; Du et al. 2019), we define short-term learning as learning knowledge or experience in real time (retention of learning is not assumed), and long-term learning as learning reusable.

For effective OI, two criteria were provided by Moorman and Miner (2003): (1) product effectiveness concerns the product's performance in the market, and (2) process effectiveness concerns internal efficiency, coordination, and effective learning during the improvisation process. Thus, there is an importance in satisfying both criteria for an OI to be effective in a development project. However, Du et al. (2019) argue that most of the findings on ISD improvisation studies are based on variance-based models. Therefore, they propose a process model that features a continuous iteration between improvisational search and build in ISD. In another study, Kautz (2009) develops a framework that emphasizes an improvisation process regarding the developers' past experiences, motives, and future expectations. In their case study, they found that the improvisation process was effective in driving ISD projects.

Ciuchta et al. (2021) conduct an extensive literature review on the papers that studied the OI phenomenon from multiple disciplines. They build a framework to help identify future gaps and research opportunities due to the complex approaches used to study OI. Similarly, a study proposed a framework that makes it possible to systematically review the existing literature on improvisation across different disciplines (Hadida and Tarvainen, 2015). In terms of research settings, Ciuchta et al. (2021) find that OI was used in emergency management, new product development (NPD), research and development (R&D), information technology (IT), government, and start-ups (Fultz and Hmieleski, 2021; Villar and Miralles, 2021). Recent studies have also looked at how OI can be used to tackle complex situations and challenges in higher education management, gaining competitive advantage, and digital transformation efforts (Scaglione et al., 2019; Yu et al., 2021; Zimmer, 2019).

Still, one crucial aspect of improvisation that is overlooked is the learning process. Publications on OL, such as management learning, have generally overlooked OI as a research subject (Vendelo 2010). Furthermore, there appears to be space for empirical research into the relationship between OI and OL (Antunes and Pinheiro, 2020; Hodgkinson et al., 2016; Leybourne and Kennedy, 2015; Vendelo, 2010). Hence, it highlights the importance of OL through the OI process to enhance organizational performance in ISD.

Organizational Improvisation and Learning

The purpose of OI is to solve problems quickly and create new values using novel ways in unforeseen circumstances (Miner 2001; Du et al. 2019; Akgun et al. 2007). However, it often produces by-products that become permanent forms, such as a culture or manners used in a particular project or a broader range of organizations. OI provides learning that can be effective for an extended period (da Cunha and e Cunha 2010; Miner et al. 2001). Separating these two situations, Miner et al. (2001) describe improvisation as a unique form of learning for the short-term and as a source for learning for a long-term of reusable by-products. In other words, the by-products serve as "trials" in the trial-error learning process and become an experience or knowledge aims to reduce errors when performing repetitive activities in the future (Miner et al. 2001; Barrett 1998).

Based on past studies that discussed improvisation as a way of creative creation, different types of learning and learning processes have been discussed in literature. Barrett (1998) explains that improvisation is based on multiple trial and error steps until reaching the desired outcome. Akgun et al. (2007) investigate the relationship between team improvisation, unlearning, new product's success, and environmental turbulence. In this study, the authors connect team unlearning and team improvisation and how they help organizations deal with turbulent environments and lead organizations to new products success via team knowledge or information implementation.

Improvisation and OL can give organizations a competitive advantage, which da Cunha and e Cunha (2010) discuss They synthesized that improvisation could be a source of change or a source of stability. As they state the factors in determining the status of improvisation might be challenging to specify; they concluded that boundaries determine the type of change or stability it brings upon organizations. Zheng et al. (2011) provide a way to plan and manage improvisation, where they described as routinized processes as part of the coordination process in ISD projects. They conclude that agile system development is part of the ongoing process of revision and learning, the same as improvisation.

On the other hand, we find that Leybourne et al. (2014) capture themes in literature where improvisations were discussed. They share similar views like Zheng et al. (2011), where different sets of requirements resulted in different types of improvisation and necessitated different levels of management. Furthermore, they believe that OI has evolved as a critical component in completing new and novel tasks and activities, dealing with unanticipated requirements, and developing and delivering new products and services (Leybourne et al. 2014). They conclude with four major OI themes that directly affect how OL and improvisation have been received and adopted in organizations.

Finally, Xue and Sun (2019) propose a model that deconstructs organizational creativity into four dimensions: opportunity recognition ability, integration ability, knowledge storage and transformation ability, and breaking path dependence ability. Based on their context, OL is the primary source of organizational knowledge. Even though their model promoted a positive learning experience, it does not explain which level of learning is required and the level of changes or the type of learning resulting from the improvisation process.

This paper investigates how the learning process can be achieved when combined with OI to achieve both short-term and long-term learning. We look at the level of learning required in a specific organizational objective, the required changes, and the type of learning applicable to achieve these objectives.

ISD Evaluation and Learning Model

Beynon-Davies et al. (2004) introduce the importance of evaluation in ISD processes and how it can affect the success of ISDs. They associate the evaluation step in ISD with the learning process which emerges during ISD's successful and failed projects. Beynon-Davies et al. (2004) derive the learning loops from Argyris and Schon (1978), who introduce the single loop and double loop learning cycles in organizational settings (Figure 1). Since evaluation directly relates to ISD projects' success or failure, as Beynon-Davies et al. (2004) propose learning is essential for organizations through the evaluation stage, where it is considered part of the project development process (Beynon-Davies et al. 2004). The loop learning approach has been studied in different applications, such as software development, emergency response systems, supply chain management, higher education, and machine learning models (Azadegan et al., 2019; Bohanec et al., 2017; Lauer & Wilkesmann, 2017; McAvoy & Butler, 2007; Metallinou, 2018).

In single loop learning, individuals can learn by following organizational norms and taking actions within organizational boundaries and strategic goals (Argyris and Schon 1978). The loop starts by detecting an error that needs adjustments. When adjustments are performed, a particular action value is retrieved, and a learning variable has been created, directly affecting OL. Then in double loop learning, resolving errors when they appear can be an outcome for studying the inconsistencies this error brings between the actions needed and the organizational norms (Argyris and Schon 1978). Evaluation helps understand where this consistency lies, how the organization can develop new norms and the proper actions to treat them (Beynon-Davies et al. 2004). Beynon-Davies et al. (2004) indicate that a form of evaluation procedure in ISD could be applied in various cycles of ISD projects to avoid project failure. Consequently, the evaluation and learning process could increase the probability of success of ISD projects.

Therefore, the single and double learning models can be improved to account for the OI process within its current design in ISD. The model can be extended by capturing improvisational processes done by employees in organizational settings. Thus, we believe our design combines the best of the two models through learning and evaluation in each OI process to accomplish new and novel tasks in organizational settings in ISD.

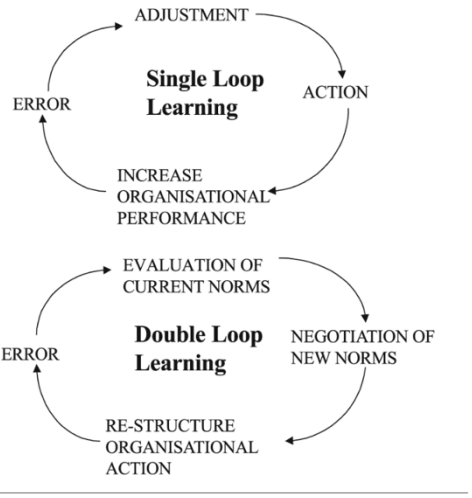

Figure 1. Single and Double Loop Learning from OL model adapted from Argyris and Schon (1978) & Beynon-Davies et al. (2004)

Proposed Model

Our proposed model is a merge between two original models: The process OI model (Du et al. 2019) and OL (Argyris and Schon 1978). These two models focus on each process in a different and independent context. Our model takes on the evaluation process within the ISD process and implements the two learning loops within the OI model (Comparison between the models in Table 1).

We believe that our new design adds that value by creating a process of evaluation and learning as part of the OI process. Also, it can help build a knowledge base that can be part of a more extensive knowledge management system within the organization, which can help increase organizational effectiveness and productivity in ISD projects.

	Du et al. (2019) Organizational Improvisation Model	**Argyris and Schon (1978) Organizational Learning Model**	**Proposed OI and OL Model**
Steps and Phases	It consists of four steps: Grounded observation, Grounded Design, situated execution and situated Reflection	It consists of two loops and four Steps.: Error Detection, Adjustments, Actions taking and Organizational Actions (Single Loop) and Organizational Action Restructuring (Double Loop)	The new model merges the four phases in each model: It starts with input which is error detection, and continues to evaluate until either action is created, or organizational action is restructured.
Step 1	Grounded Observation	Error Detection	Threat, Error or Opportunity detected or observed
Step 2	Grounded Design	Determining Adjustment type (Single Loop) or evaluating current norms (Double Loop)	Determining the type of action need to be undertaken

Step 3	Situational Execution	Targets how the error is approached, action within organizational norms (previously known errors) or new actions based on new norms	Execution based on evaluation: either new restructured adjustments or better ISD
Step 4	Situational Reflection	Higher performance or new norms adjustments	performance based on prior organizational knowledge or new knowledge results from learning
Types of Learning	Short-term learning in ISD	Short-term and long-term learning in organization	Short-term and long-term learning in organization in ISD

Table 1. Comparison between the discussed models

Organizational Improvisation

The OI operation in our model is following the OI model proposed by Du et al. (2019) consisting of four phases: Grounded Observation, Grounded Design, Situated Execution, and Situated Reflection (Figure 2). We first discuss the four phases then we will be covering both the improvisational search and improvisational build concepts.

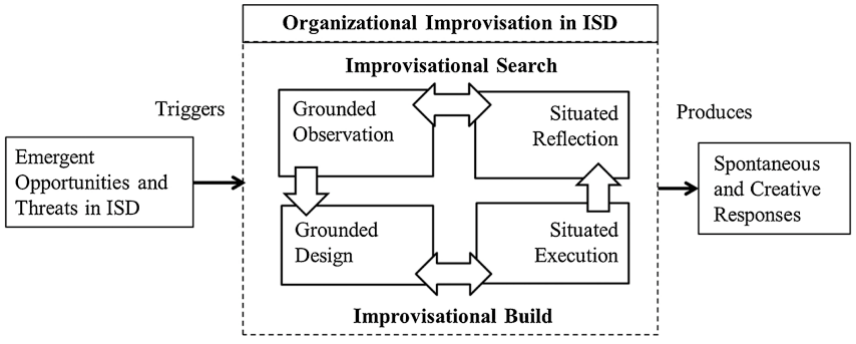

Figure 2. The process OI model adapted from Du et al. (2019)

Grounded Observation

Du et al. (2019) label this phase as the grounded observation due to the inspiration behind it from grounded theory used in qualitative research methods. Similar to grounded theory, grounded observation identifies findings based on the emergence from the observed reality rather than prior hypotheses. Grounded observation does not make any prior assumptions about what will occur or happen in the market. Thus, it is extremely important to monitor the surrounding environment, be aware of it, and respond flexibly.

The grounded observation phase is executed by a self-organized development team with no interference from top management on how they perform their operations and the ideas generated from the developers. This gives developers extreme flexibility in focusing their attention on the market to identify opportunities and threats. Moreover, the monitoring is done by the developers via real-time information; this reduces the risk of making the wrong decisions. Thus, increasing the improvisation effectiveness by developers.

Grounded Design

The next phase is grounded design which is defined by Du et al. (2019) as "a design that makes no prior assumptions and captures emergent user needs." Development teams engage in grounded design after identifying the new ideas that emerge from the prior phase, grounded observation. This action requires that development teams keep a close relationship with the users and necessitates the early involvement of users by development teams. Grounded design aids development teams in avoiding a popular ISD pitfall: creating advanced functions that users do not need.

Incremental development helps to promote grounded design. Du et al. (2019) proclaim that development teams break down development tasks into small chunks and progressively update the system in order to gather real-time feedback to adjust development. The development teams can probe customers, commit resources steadily, and remain agile in the face of unforeseen needs thanks to incremental development. It also enables development teams to uncover users' inherent and genuine needs by analyzing user input on incremental improvements on a regular basis.

Situated Execution

This phase is labeled as situated execution by Du et al. (2019) due to its similarity in the improvisation done in jazz: smoothly adjusting the tone to fit the change in the atmosphere. Thus, situated execution responds to emerging user needs and facilitates the introduction of new demands when both the grounded design and grounded execution phases are carried out in tandem with one another.

Situated execution is done when development teams adapt to customer requests on a continuous basis. The continuous response keeps users engaged in the development process and ensures continuous feedback. Resource constraint can be a hindrance in the situated execution phase. In the case study example in the Du et al. (2019) paper, the organization overcame the personnel resource constraint by establishing ad hoc teams that collect the required personnel across all the various development teams and redeploy them to areas that need urgent attention.

Situated Reflection

This phase is labeled as Situated reflection by Du et al. (2019) since it reflects on the situations in which the outputs are applied. Reflection yields insights that aid observation and reaction to unforeseen opportunities and threats. The aim of situated reflection is to guide further actions. This phase works in tandem with the first phase, grounded observation. The effectiveness of situated reflection comes from its ability to generate new ideas from the development team. Thus, in the case study presented by Du et al. (2019) for the improvisation process to be effective, the organization rotated their development teams in order to generate ideas from different backgrounds, and facilitate learning and enable the sharing of knowledge.

Improvisational Search and Build

Du et al. (2019) label the first improvisational practice as "improvisational search" since the two improvisational practices are represented by the four stages. The temporal fusion of grounded observation and situated reflection eliminates the need for a pre-planned search. It transforms the search for new functions into an intuitive operation that develops in response to consumer feedback. As for the labeling of the second improvisational practice as "improvisational build", since the temporal convergence of grounded design and situated execution eliminates the need for a prior design, making the development of new functions a spontaneous activity that develops in response to immediate user feedback. This ISD process in the OI model extends the one-way relationship by demonstrating that improvisation can be a continuous iteration of improvisational search and build. This iterative process identifies a problem, thoroughly solves the problem, and from that process, we further identify new problems that need to be solved.

Information System Evaluation

Observing the original OI model, we propose that the learning loops could be implemented within the organizational improvisational process especially within the situational reflection and grounded observation steps. Learning can be processed as a knowledge base by using already established processes through improvisation and learning loops which can be related to developers' job effectiveness directly.

Single loop learning is conducted when the need for change emerges to address errors of assumption and strategies within organizational norms (Argyris and Schon 1978; Beynon-Davies et al. 2004). Developers can respond to errors or threats or any obstacles in the development process with indirect organizational support, as long as it follows organizational guidelines (Figure 3). In these conditions, developers are encouraged to improvise when needed. That would be empowering to developers in terms of applicability and authority.

Double loop learning is conducted to resolve the inconsistency where the new norms for responding to errors detected in single loop learning do not match the existing organizational norms (Argyris and Schon 1978; Beynon-Davies et al. 2004). It manages the changes for unprecedented situations where intervention is necessary and new norms are needed to be defined to take place to face opportunities and threats. In this context, the learning process within the organizational improvisational context gives an outline for developers to assess the situation and consult management in the future (Figure 4). Based on Alter (2013), Workaround can be problematic to organizations where some of the workaround decisions can be around organizational formal policies. With this addition to the OI model, double loop learning is a way to ensure that the practice of improvisation adheres to organizational culture and encourages developers to seek advice when needed.

These two models work simultaneously in our design. While the sources of error, threat or opportunity can emerge from internal or external resources, in both models, improvisations start by the grounded observation where the need for improvisation arises, and therefore the type of learning can also be determined if it is within organizational norms or not; Is this error detected new? How can it be treated? What adjustments need to be made? Situated reflection will be synchronous feedback on how the improvisation and learning are performed, and the level of the success of the process. Similarly, improvisational build and organizational performance or organizational restructure works simultaneously, when improvisation is processed it leads to determining what action must be taken, and whether it increases the need to escalate the issue to discuss new organizational norms or it can be performed within available resources. By the end of each process, the resulting action will either lead to higher organizational performance or establish a new set of organizational structures as a response to the threat or opportunity that emerged.

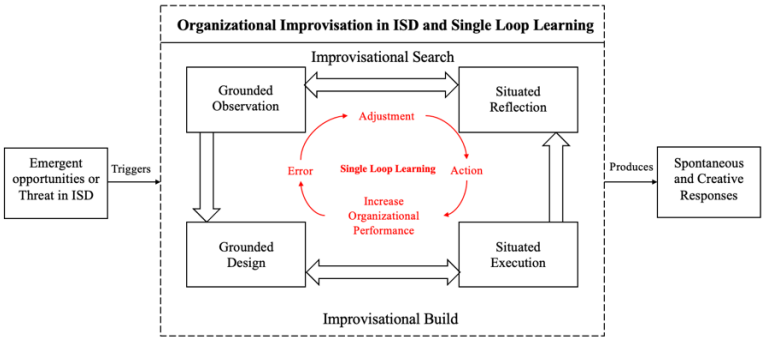

Figure 3. Our Proposed Combined Model (OI and Single Loop learning Model)

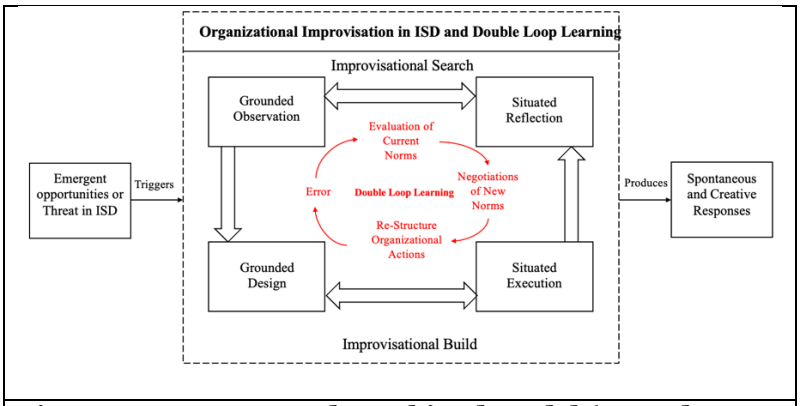

Figure 4. Our Proposed Combined Model (OI and Double Loop learning Model)

Scenario-Based Evaluation

In this evaluation section, we evaluate the suitability of the proposed model (i.e., artifact) by using an illustrative scenario evaluation method, which is a design science research methodology. We believe this methodology that is defined as an application of an artifact to a synthetic or real-world situation aimed at illustrating suitability or utility of the artifact (Peffers et al. 2012) is a good way to show how the proposed model works.

We utilize the example of Tencent used in Du et al. (2019) research. Tencent has developed a mobile phone-based messaging system, Tencent messaging system (TMS), with features that meet the needs of its users. In competitive market conditions, the development team identified risks and opportunities with an aggressive and flexible mindset to make a difference from competitors' products. Many of these services resulted from unexpected discoveries and impulsive responses to emergent opportunities and user demands rather than planned efforts. TMS had grown to become China's most popular online messaging system by 2008, with 400 million individual and corporate users. In 2018, the firm exceeded a market value of $500 billion, becoming the first Asian technology corporation to do so (He, 2017). Thus, this highlights the effectiveness of improvisation activities done by Tencent in the success of their services and products.

Learning Loops Cycles

During the OI process, errors are detected either by the design phase or the execution phase. Let's say a user requested a new feature that requires the developer's attention to build. It is a new feature that will be added to the TMS. These new features include one of two situations: First, New features are requested on the project, and they can be designed within organizational general policies. Of course, requirements need a bit of tweaking, but the developers' team is aware of the requirements; either by experience or by formality. In other words, such requirements are familiar to the group of developers, and they have the required resources to develop them in such cases, a single loop learning is recognized, and adjustments can be added within the current organizational regulations (Figure 3). Such quick response and adaptivity to this change will yield higher organizational performance. Similarly, if these changes were errors detected within the development cycle, they can be treated similarly, which will also yield higher organizational performance. A single loop also appears as part of the use of the current resources resulting from previous double learning loops. For example, current IO elements used in the ISD process are considered a result of previous learning opportunities, which are used now as part of the new norms of the organization.

Second, when new features or developments requirements or errors are detected, they are first-time requirements that need to be addressed. Nor experience or formality provide an insight on how to develop such requirements. A double learning loop learning is identified, and the need for top management support is apparent. In this case, new general policies, permissions, or outsourcing are required to resolve the error, or to get permission to outsource, or to set a new policy for certain situations. i.e., new organizational norms.

The new norms can come in a variety of forms, for example, when developing a similar kind of information system, it would be possible to proceed with development along a path that has passed in the past. In the case of Tencent, when adding new performance or features to TMS, it may be able to reuse the characteristics of workforce configurations (e.g., the background of team members) or collaboration methods that it has experienced in the past. If the know-how gained through single loop learning becomes a new norm through evaluation of double loop learning, managers may be able to save time for team formation and reduce role conflicts due to role changes. Also, if the organization learns new methods or approaches, such as "be open to all changes and make no assumptions," it may improve the development process or reduce error.

Through this, the ISD team quickly reflects user feedback and adds new user needs to the product. In other words, they gain knowledge through real-time learning in terms of short-term and long-term learning (Du et al. 2019, Miner et al. 2001). For example, short-term learning could be achieved by adjusting errors in real-time in single loop learning. Subsequently, the error could be assessed to have been caused by existing norms, and if the new and existing norms are inconsistent, the double loop learning would be adjusted. In short, previous double loop learning becomes known and used elements used in the current single loop process when OI is applied, new changes or challenges go through the double loop learning and becomes the new set of rules and procedures, and so on. In the subsequent sections, we will illustrate how the new model could be applied to this example using the four steps of OI.

Grounded Observation

The ISD team always captures opportunities or threats in the external environment. In this phase, an open mind with no assumptions or restrictions and the support of top management for the ISD team are key elements (Du et al. 2019). Observing the market opportunities and threats is a continuous process, to be able to respond adequately. The team of developers is directly supported by management, but their work is not overlooked or interfered with, instead, management is available to make decisions about unprecedented changes, or different resource allocations. To support these activities, top management gives the developing team autonomy that was not interfered with by general policies. General policies are in place for teams to follow, other than that, teams are encouraged to work independently. Like we mentioned earlier, observing the market threats and opportunities comes as an ongoing process. For example, the development team for TMS was allowed to be independent of the company's mobile policy, which needs to make new systems mobile environment friendly. Therefore, this granting of independent autonomy might be a new norm for future development teams to respond to market conditions.

Grounded Design

At this stage, it is emphasized to obtain user feedback to identify users' needs. In our example, user blogs or interviews with users can be used to provide real-time feedback on the designed blog. Features and design elements are determined, a continuous review to the user feedback always occurring to modify the requirements when needed. An important element at this stage is that no assumptions are made related to users' needs. Users are involved in the development process closely with the team and development is considered incremental with continuous users' feedback. For instance, the development team for TMS has significantly reduced the capacity of the installation package by developing a new program that eliminates some features to deal with complaints from users arising from limited bandwidth problems in China. To support this activity, Tencent introduced a new policy, 10/100/1000 policy, to its product managers to continuously gather user feedback. The policy requires managers to interview at least 10 users every month, follow 100 users' blogs, and respond to 1000 user posts. By introducing this policy, the company might have a new norm that can quickly collect new feedback from users that may arise in the future.

Situated Execution

Design and execution phases are carried out simultaneously. Through simultaneous execution, the development team can respond quickly to user needs when a new user need emerges. However, conducting design and execution at the same time puts a heavy burden on the development team. For example, during

the initial launch of the emergent functions, the user's request for change often exceeded the team's capacity. In the case of Tencent, ad-hoc teams consisting of members of the focal team and temporary employees from other teams were included in the process of development. For instance, to add a new blog feature, the blog team can get help from the messaging team. Meanwhile, in order to work within a tight deadline, it is important to get help from both teams. The same goes when developing a code for a new feature, developers may be able to request a similar code already developed by the other developing team and vice versa. Tencent facilitated the act by creating a culture of knowledge sharing that encourages this cooperation. Therefore, at this stage, it will be able to obtain reusable norms, ad-hoc teams, and knowledge-sharing culture, when Tencent makes new developments in the future.

Situated Reflection

Du et al. (2019) define reflecting the success and failure of the new functions as reflection, as the last of the four phases. Reflection and observation phases work simultaneously in iteration. To reflect user feedback immediately at the execution phase, the need for the operation of the ad-hoc team to effectively use corporate internal resources is argued. The design and execution phases continue until new functions become mature and users are satisfied**.** In the case of Tencent, sometimes new functions are canceled halfway, but it is emphasized that top management's role is to support these failures or errors as learning opportunities, not punishment. Thus, the norm of tolerance for failure could have a positive effect on future developers trying novel ideas.

Reflection is best timed when there are new ideas emerging, as in our study case, members of research centers rotate with the developing teams to provide insights and/or to give feedback on certain projects. On another level, cultural differences between team members can be problematic, assuming that the example company is an international company. The learning loop may present a solution to adequately deal with problems (in terms of "error") that may arise in terms of these management decisions. To achieve top management's goal in rapid development using improvisation, the learning loop allows us to identify possible problems among developers and create solutions. For example, double loop learning can change the norms of an organization that rotates team members or reorganize teams for technical diversity alone without considering developers' cultural characteristics and levels of involvement. In addition, not only the technical diversity of backgrounds needed for the product but also the personal factors of developers (e.g., the pursuit of the balance between work, life, and fatigue) could be considered. These modified norms of organization can be learned and applied by members through single loop learning.

In summary, throughout the four phases of the OI process, we illustrated how the learning loops could be embedded within the OI process in ISD projects. Short-term learning using the single loop is essential and provides a more facilitative process that leads to higher organizational performance. On the other hand, long-term learning using the double loop will enhance the adoption of new norms and provide a flexible adoptions process to these new norms, formalities, and knowledge bases to be used as future references in the OL context.

Discussion and Conclusion

OI has been gaining increasing attention to respond to rapidly changing environments, and it needs close and proper management. In this work, we explore the boundary conditions of Du et al.'s (2019) proposed model for the OI process in ISD then suggest a new model by combining the organizational learning process model by Argyris and Schon (1978). We believe our new design will motivate organizational adoption that has multiple benefits and multiple contributions. First, it is valuable to consider reusable know-how when applying OI in ISD from a long-term learning perspective. By considering not only the short-term learning of the model proposed by Du et al. (2019) but also the long-term learning from the learning loops proposed by Argyris and Schon (1978), we believe that our proposed model increases the applicability of OI in ISD projects.

Second, our proposed model may contribute to organizational effectiveness and increase developers' job effectiveness by providing an established framework where a developer can participate in the process, be

empowered when facing development challenges, and seek organizational support through the established learning loops. In other words, changing organizational norms through existing experience, organizational assistance (culture, team organization, etc.) in similar situations in the future will help developers perform their tasks more effectively.

Another significant contribution of this model is the add-on value of the knowledge it could create, which could be enriched by the outcome and the result of different learning loops through many ISD projects. Like we mentioned earlier, we believe that our new design adds that value by creating a process of evaluation and learning as part of the improvisation process. In addition, it can help build a knowledge base that can be part of a more effective knowledge management system within the organization, which can help increase organizational effectiveness and productivity through its developers and ISD projects.

Here we provide a few limitations of the proposed study. Despite the achievements of the exploratory research, the present study has important limitations. First, a more rigorous evaluation of our proposed model should be considered. For example, conducting a survey with IS experts could highlight the potential of the proposed model design. Second, our proposed model presents the possibility of long-term learning but does not investigate what differences make it short-term and long-term learning. Learning through OI rarely becomes general knowledge applicable, in terms of long-term learning, throughout the organization. Miner et al. (2001) point out that while OI produces good learning outcomes in the short term, its effects are limited in the long term. In other words, even if sources for trial-and-error learning are obtained through OI, learning from them is still utilized for local and repetitive activities, making it difficult to respond to variations. Future studies will be able to study what differences in OI create short-term or long-term learning effects. Third, we focus on forming reusable knowledge rather than innovation in OI. Perhaps, the extended model will be able to examine the relationship between innovation and learning in OI. Fourth, in this study, we are not discussing creativity which is one of the positive outcomes achieved through improvisation. The relationship between OI in ISD and creativity could be an interesting topic in the future. Fifth, we do not discuss the chaos that the proposed model may cause. Knowledge gained through our proposed model can be reused, but it may not be applicable in all situations. If that knowledge is misused in a poorly structured process, it can have negative consequences. Therefore, future studies may explore ways to control these confounding results. Finally, research has reported that stored knowledge and skills affect the performance of improvisation (Moorman and Miner 1998; Miner et al. 2001). Researchers could consider it for future extensions of this proposed model and study the effectiveness of the addition of the knowledge and skill base.

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