

# CREATING THE *LEADING CHANGE FOR SUSTAINABILITY* *IN SCHOOLS (VIETNAM)* SIMULATION: A RESEARCH AND DEVELOPMENT PROJECT

Vien-Thong Nguyen  
Vietnam National University Hochiminh city,  
Mahidol University  
Thong.nguyen@hcmussh.edu.vn

Philip Hallinger  
Mahidol University,  
University of Johannesburg  
hallinger@gmail.com

## ABSTRACT

*This paper represents the initial steps of a research & development (R&D) project, aimed at producing an online computer simulation for the purpose of training educators for the challenge of integrating more sustainable practices into Vietnamese schools. The project used a formal set of R&D steps to create the Leading Change for Sustainability in Schools (Vietnam) Simulation based on an existing simulation previously designed for the global business sector (i.e., Leading Change for Sustainability – Business version). In this project, the authors adapted the existing English language business version of the simulation for use in preparing teachers and principals how to meet the challenge of leading the change towards sustainability in Vietnamese K-12 education system. Then, the authors present findings from the research and information collection phase which consisted of a literature review on education for sustainable development and a small-scale qualitative research study. Finally, the authors discuss how this information was employed to create an initial working version of the new education-oriented simulation for use in Vietnam. The significance of this paper lies in the detailed description of a research-based approach to simulation adaptation both in terms of organizational context (i.e., from corporate to school sector) and society (i.e., prepared explicitly for the Vietnamese cultural context).*

*Keywords: simulation, education for sustainable development, change management, whole school approach to sustainability, research and development project, Vietnam.*

## INTRODUCTION

The powerful change agents in educational institutions are leaders and teachers who cultivate the knowledge and attitudes of future citizens (Fullan, 2005; McKey, 2017; Pepper, 2014). Indeed, they play crucial roles in raising sustainability awareness and competences among learners, as well as preparing them with the decision-making values and tools needed to foster a sustainable society. With a priority on building educators' capacities, those stakeholders must gain the necessary values, knowledge, skills, attitudes required to support a sustainability transition in both the education system and society more broadly (Australian Education for Sustainability Alliance, 2014; Kennelly, 2012; UNESCO, 2020). There is an urgent need to improve sustainability training for educators to act as effective facilitators in the process of education for sustainable development (ESD).

Yet, current programs and methods used to prepare educators to meet sustainability challenges remain limited (Wals & Benavot, 2017). In concert with advancements in technology, computer simulations, online simulations and games focusing on sustainability have been proliferating in recent years (Hallinger et al., 2020). This is due in part to the perception that simulations and games are highly motivating and aligned to the developing kind of active problem-solving and higher-order thinking needed for citizens to understand and address sustainability problems (Crookall, 2013; Gatti, Ulrich, & Seele, 2019; Gosen & Washbush, 2004).

Simulations and serious games have been used extensively in Western countries as well as in some Asian countries in training for educators (Hallinger & McCary, 1990; Hallinger & Kantamara; 2001; Hallinger, Tang, & Lu, 2017). However, they have not yet been widely used in Vietnam. For example, current training programs for educators in Vietnam continue to rely heavily on traditional methods of lecture and discussion (Nguyen, 2019). Vietnamese educators tend to focus on 'communicating information' through the use of relatively passive approaches. This reduces the potential impact on developing learners' deeper understanding, actionable skills, and commitment (Farashahi & Tadjeddin, 2018). These competences are especially important in the domain of ESD where the ability to see, understand and act on problems systemically is paramount (Breiting, Mayer & Mogensen 2005; Pauw, Gericke, Olsson, & Berglund, 2015).

Vietnam has taken tentative early moves toward implementing sustainability. The Government of Vietnam affirmed its commitment to sustainable development through Vietnam Agenda 21 in 2004 (PM & Gov Viet, 2004). and again in 2017 with National Action Plan for the Implementation of the 2030 Sustainable Development Agenda. It has also committed explicitly to support for ESD in a policy statement, the ‘Vietnamese National Action Plan for ESD’. In 2017, Ministry of Education and Training (MOET) announced Decision 2161/QĐ-BGDĐT which outlined national goals of sustainable development in the field of education and training for the ensuing decade. Later, in 2018 MOET approved the phased implementation of the New General Education Program, which is aligned with ESD approaches such as building competence-based curriculum, increasing experiential learning and promoting local education.

Despite these positive steps, in reality, ESD is considered as a kind of add-on subject knowledge for incorporation into the curriculum in Vietnamese schools (Nguyen, 2019). A lack of awareness of ESD continues to be a major barrier to ESD implementation in Vietnam (Do & DeMaria-Kinney, 2013). The limited research on ESD implementation in Vietnam suggests that teachers lack the positive attitudes and knowledge competencies needed to integrate ESD into educational practices (Kieu, Singer, & Gannon, 2016; Nguyen, 2018). Thus, there is a demand for tools that can be used in training educators in Vietnam so that they can both manage their schools more sustainably and pass that knowledge on to future generations of students.

Reviews of the literature have identified two key problems in the domain of simulations and games for sustainability. First, despite assertions that simulations and serious games are well-suited to teaching the holistic, systemic perspectives needed to address sustainability challenges, empirical studies that validate this assertion remain relatively few in number and weak in quality (Hallinger et al., 2020). Second, most simulations focus on specific sustainability subject domains such as energy saving, climate change, and natural resource management (Barreteau, Le Page, & Perez, 2007; Crookall, 2013; Eisenack & Reckien, 2013; Hallinger et al., 2020; Nussbaum et al., 2015). No simulations have been identified that prepare educators with the knowledge and skills needed to prepare educators and trainers for the challenges of teaching, learning and managing for sustainability (Farashahi & Tajeddin, 2018).

This broad need also applies in Vietnam where simulations and games are not widely used and where ESD remains at a ‘primitive’ stage of implementation. This is the challenge addressed in the R&D project described in this paper. This project will result in an educational product which can be used in educational training and development on ESD with students, educators, trainers, teachers, and principals in K-12 schooling.

The following research objectives are addressed in this project:

1. To adapt and redesign the existing English language *Leading Change for Sustainability* (LCS) (Business) online computer simulation into a new simulation *Leading Change for Sustainability in Schools*.
2. To culturally adapt and translate the resulting English language version of the *Leading Change for Sustainability in Schools* online computer simulation for use in the Vietnamese K-12 school context, resulting in a new version of the simulation *Leading Change for Sustainability in Schools (Vietnam)*.
3. To evaluate the usability of the *Leading Change for Sustainability in Schools (Vietnam)* online computer simulation in a Vietnamese education setting.
4. To test the cultural relevance of the *Leading Change for Sustainability in Schools (Vietnam)* online computer simulation as perceived by users in a Vietnamese education setting.

In this paper, the authors will describe the initial steps in this R & D project: research and information collection; planning; and developing a preliminary working version of the institutionally and culturally adapted, Vietnamese language simulation. The significance of this paper lies in the detailed description of a research-based approach to simulation development and adaptation both in terms of institutional context (i.e., from corporate to school sector) and society (i.e., prepared explicitly for the Vietnamese cultural context). This recognizes the importance of situating knowledge in the context where it will be used (Brown, Collins, & Duguid, 1989).

## OVERVIEW OF THE LEADING CHANGE FOR SUSTAINABILITY SIMULATION

‘Leading Change to Sustainability’ is a web-based simulation that addresses these leadership competencies in the context of a private sector company that is trying to become more sustainable. Learners can access the simulation anytime from anywhere via an Internet connection. This allows learners to play the simulation in virtual teams when used in concert with an online platform (e.g., over Zoom or Blackboard).

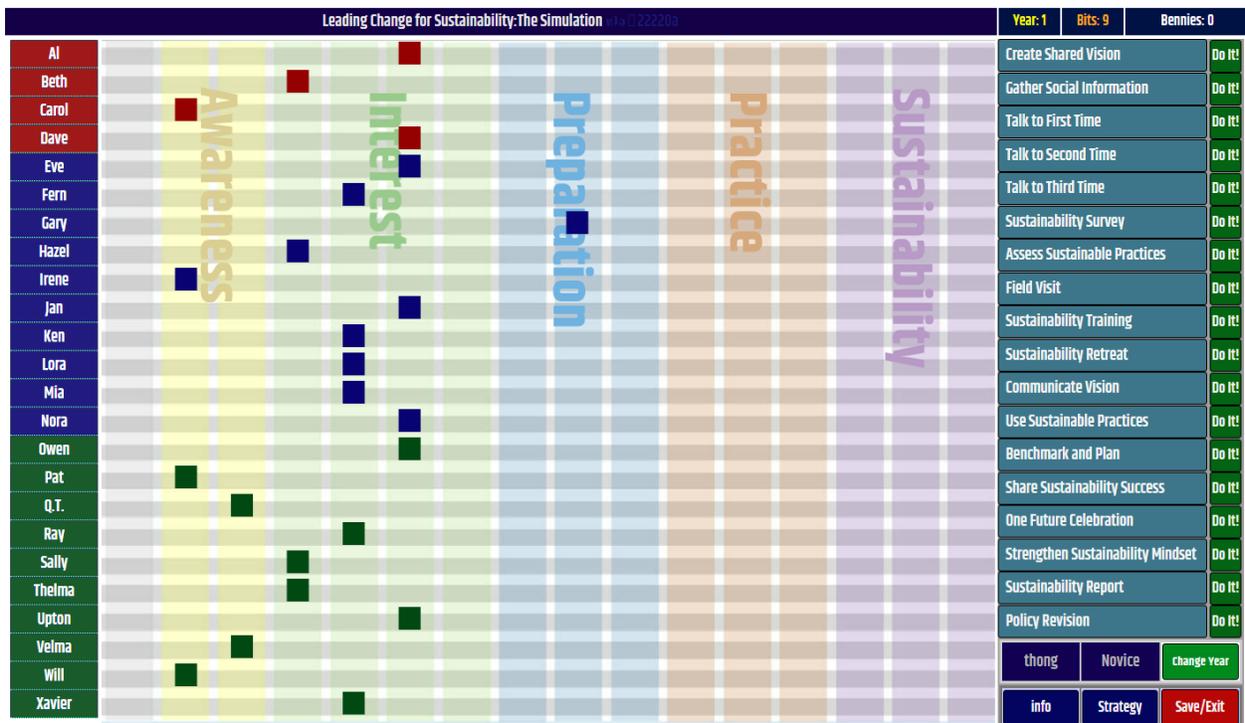
The learning objectives for use of the simulation include the following:

1. To gain a deeper awareness of the range of sustainability challenges faced by companies and society;
2. To analyze, plan, and execute a simulated strategy for helping an organization transform for sustainability;
3. To understand key concepts related to economic, environmental and social sustainability; and assess their implications for management practice (Hallinger, 2020).

In the simulation, as players, learners play a part as members of a Project Management Team charged with implementing a major sustainability project named ‘One Future’ in one company over a three-year period of time. During the simulation, players interact with 24 stakeholders located in several business units (i.e., head office and two branches). The first goal communicated to learners at the outset of the simulation is to reposition as many stakeholders as possible from off of the gameboard (i.e., left side) to

the ‘sustainability stage’ at the end of three years. In order to accomplish this ‘change’, the team will spend an annual budget on typical organizational activities that can be used to ‘move people’ through the five change stages towards sustainability (see Figure 1). Thus, when the team has played through the three years, it seeks to have as many stakeholders as possible in the sustainability stage where they have accepted and are using new sustainable practices in their work.

**FIGURE 1**  
**Leading Change for Sustainability (Business) simulation screen/gameboard**



A second goal communicated to learners in the simulation is to have a positive impact on the triple bottom-line of the company as it changes from a sole focus on maximizing shareholder value towards achieving a balanced set of economic, environmental and social outcomes. Therefore, as people start to adopt more sustainable practices, they may gain ‘Bennies’ (Sustainability Benefits) for the company. This conception of Bennies is aligned to the triple-bottom-line of social, environmental and economic benefits (Elkington, 1994, 2013). Consequently, learners may earn many Bennies if they are able to get the stakeholders in the simulation to actually use sustainable practices that yield improvements towards new social, environmental, and economic goals (Hallinger, 2018).

Players play this simulation within a three-year simulated timeframe. When starting each year, players receive a new budget to implement activities designed to move the project forward (see activities on the right side of Figure 1). These activities each have a cost as well as an underlying purpose. Some activities can be used to inform stakeholders and gather information about sustainability concepts and the purpose of the project (e.g., *Sustainability Survey*, *Assess Sustainability Practices*, *Talk with People*, and *Talk with People Again*). Other activities are used to motivate and inspire stakeholders to engage with the change (e.g., *Create Shared Vision*, *Communicate Vision*, and *Field Visit*). Some activities are used to prepare stakeholders for using new sustainable practices (e.g., *Sustainability Retreat*, *Sustainability Training*). Other practices focus on supporting the practical use of sustainable practice (e.g., *Use Sustainable Practices*, *Share Sustainability Success*, and *Strengthen Sustainability Mindset*). Finally, some activities are used to embed sustainability in the policy structure and corporate culture of the company (e.g., *Benchmark and Plan*, *Sustainability Report*, *Policy Revision*, *Theme Week Celebration*).

Players spend their budget on a sequence of activities and observe the results (stakeholders move, or not). Each time an activity is implemented, the costs is deducted from the team’s budget and feedback appears on the screen. The feedback tells ‘what happened’ (i.e., stakeholders moved, or not) as well as some information about ‘why happened’. Based on the results, the players may revise their ‘change strategy’ and continue to select additional activities until they run out of budget for the year.

There are more than 200 ‘hidden’ decision rules embedded in the simulation which determine the results of activities selected by the learners. Several theories of change were used to guide development of the simulation. The descriptions of the 24 stakeholders were informed by diffusion of innovation theory (Rogers, 2010) which proposes that people can be grouped into one of several categories in terms of their modal responses to change (i.e., Innovators, Leaders, Majority, Laggards). The stages in the change process which feature in the simulation were derived from research on change in organizations (Hall & Hord, 2006). This

research has found that successful change initiatives move through predictable stages (see Awareness, Interest, Preparation, Practice, Sustainability stages in Figure 1). However, movement through these stages depends upon whether the change management strategy used by the team meets the ‘concerns’ stakeholders have at different stages in the change process (Hall & Hord, 2006). Understanding the concerns people typically have at different stages and linking this to action strategies are fundamental to achieving success in real change efforts, and in the simulation. Kotter’s (Kotter, 1995; Kotter & Cohen, 2012) model of leading change also informed the decision rules and conceptualization of ‘change strategies’ that are built into the simulation.

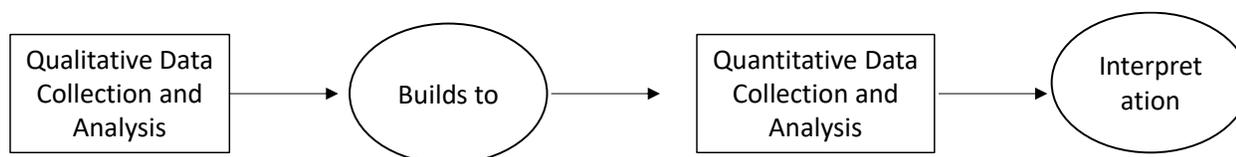
Both during and at the conclusion of the three-year period, players can observe the rate and patterns of changes in staff positions on the game board as well as the accumulation of Bennies. As players move across the game board, change is taking place. As Bennies increase, players can observe the impact of new practices on the triple bottom-line. Their results are reflected and evaluated into six levels from Apprentice to Change Master. The evaluation is measured on two main goals: 1) how many staff have achieved the Sustainability stage, and 2) how many Bennies a team/player has earned (i.e. impacted triple bottom-line). When a team reaches the higher levels (e.g., Expert and Master), it reflects the use of a ‘stronger change strategy’ based upon the theories of change embedded in the simulation.

## RESEARCH METHOD

### Research Design

Research and Development (R&D) is a research design aimed at developing products based upon learning from research and practice. In education, R&D has been used to design educational products such as curriculum modules, text books, and simulations and games (Borg, 1987; Hallinger & Kantamara, 2001). Gall, Borg, and Gall (2003) defined educational research development as, “an industry-based development model in which the research findings are used to design new products and procedures” (p. 569). The method requires that product design systematically proceed through a series of pre-determined project stages. These typically include sourcing information from research and practice, product design, field tests, product refinement, and further evaluation and refinement until the product meets effectiveness and quality criteria (Gall et al., 2003). R&D has been used in mathematics education (Gravemeijer, 1994), change management (Aistrup, 2010; Hallinger & Kantamara, 2001), flight attendant training (Lestari, 2017), and technology training (Martin, 2004).

**FIGURE 2**  
Exploratory sequential mixed methods research design (Creswell, 2015, p. 205)



In the current project, the broad R&D approach used for product development incorporated a mixed method, quasi-experimental research design (Creswell, 2015). More specifically, an exploratory sequential methods design was used to enhance the power of the information gathering and evaluation stages of the R&D process (see Figure 2). In the first phase, qualitative data were collected through interviews with educators in model ESD-active schools in Thailand. This information was used for the purpose of gaining insight into actual practices used by educators in schools that have adopted a whole school approach to education for sustainable development. Subsequently, during the evaluation phase quantitative data on learning process and outcomes will be collected in order to gain insight into the efficacy of the simulation as a learning tool (see Figure 3).

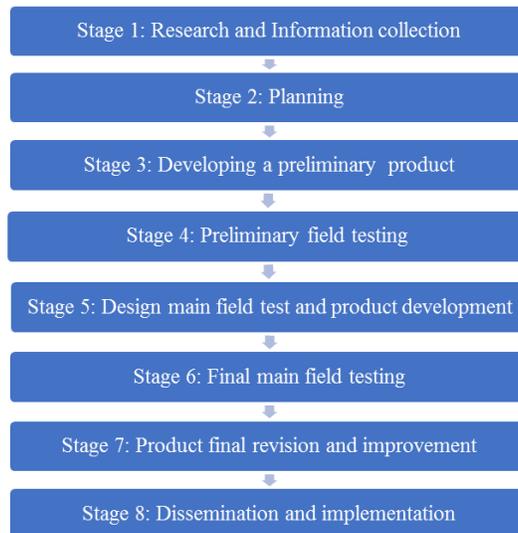
This qualitative phase will be followed by two phases of quantitative data collection and analysis. The first quantitative phase of the mixed methods research design will involve formative assessment of the LCS simulation’s use with Vietnamese school leaders and teachers. Then additional quantitative analysis using a quasi-experimental design will then be used to assess change in knowledge, attitudes and skills of learners (Campbell & Stanley, 1963, 2015). The initial key steps which guide the R&D process are shown below in Figure 3 and are described in this paper.

### Research and Development (R&D) Stages

Gall, Borg, and Gall (2003) proposed a systematic process for research and development projects whose goal is to develop research-informed products for use in schools. This process proceeds through a series of eight stages starting with Research and Information Collection and concluding with Dissemination and Implementation (see Figure 3). As suggested above the R&D process can be implemented in conjunction with a formal research design with the goal of enhancing the efficacy of the product. Thus, in the current project qualitative data were collected and analyzed during Stage One (Research and Information Collection) and quantitative research will be conducted in Stages Four and Six in Figure 3 below. In this section, the authors will briefly describe what was done in stages through three of the R&D process.

Stage One began with literature review and information collection, related to the planned simulation. To gain a comprehensive picture about ESD, the whole school approach to sustainability was also reviewed through examining some initiatives around the world. In addition, a small-scale research was conducted to gain real sustainable practices which schools have implemented sustainability in education. In Stage Two, a project plan was conducted. All of the details for redesign were planned and essential changes were investigated. Next, the authors developed a preliminary version of simulation in Stage Three. More specifically, in the following section, each of these steps was presented respectively.

**FIGURE 3.**  
**Research and development cycle, adapted from (Dick & Carey, 1985; Gall, Borg, & Gall, 2003).**



## REVISION OF THE LCS-BUSINESS SIMULATION

### Stage One: Research and Information Collection

#### Literature Review

Stage One began with literature review and information collection related to the planned revision of the existing English language business simulation for use in the Vietnamese educational sector. The literature review aimed to gain a broader and deeper knowledge about how schools integrate ESD and change to sustainability, and to generate more information available for adapting the simulation. This stage comprises two steps as following:

Firstly, to construct knowledge base how schools change to sustainability, a broad literature review was conducted on education for sustainable development (Hallinger & Nguyen, 2020). Based on this broad review of the literature a second review was conducted that examined the whole school approach to sustainability (Mogren, Gericke & Scherp, 2019; Nguyen & Hallinger, 2020). In this review, ESD initiatives from four countries (i.e., US, Sweden, Australia, and Thailand) were extracted that describe actual sustainability practices used in schools.

Typically, schools react to environment/ sustainability issues in one of four choices: denial the issues, bolt on due to external pressure, integrate into organization, and whole system redesign (Sterling & Thomas, 2006). As an ideal model, whole school approach represents an increasingly influential theme in the ESD movement. This approach is emphasized on rethinking and redesigning structure and organizations to address sustainability issues (Wals & Benavot, 2017). Emerging gradually over the last few decades, whole school approach to sustainability seeks to reorient basic school features around sustainability goals (UNESCO, 2002). The whole school approaches have spread across continents. They have interacted beyond school grounds improvement and environmental education, connecting governance, resource allocation, stakeholder involvement, curriculum, teaching and learning process, as well as community partnership (Tilbury & Wortman, 2005). In the whole school approach, “sustainability is lived as well as taught” (McKeown & Hopkins, 2007, p.22). Whole school approach to sustainability is also suggested for educational leaders to implement with multi-stakeholders inside and outside their institution in the global framework ‘ESD for 2030’ (UNESCO, 2020).

These reviews of the literature on sustainability in education yielded a set of principles and recommendation that were then used to guide the redesign of the LCS business simulation for schools. These included the following:

1. The simulation should emphasize the whole school approach to sustainability.
2. The simulation should maintain the existing focus on a triple bottom-line of educational learning outcomes related to

economic, social, and environmental justice. However, these would need to be ‘translated’ into the form and functions of an educational setting.

3. The redesigned simulation should incorporate a student-centered learning philosophy in conjunction with the efforts of schools to implement sustainability in curriculum and teaching.
4. Sustainability values should be embedded in the simulation.
5. The multi-stakeholder approach used in the business version of the LCS simulation should be maintained but adapted to education stakeholders.
6. The organizational structure embedded in the simulation would need to be adapted to the particular educational setting of Vietnam.
7. The simulation should incorporate a systemic change dimension so that educating for sustainability moves from a “project” to be implemented into a system change.

## Qualitative Research Findings

To supplement the literature review, a small-scale qualitative study was conducted in order to gain deeper insights into ESD practices as well as the change process experienced by educators in schools that have adopted a whole school approach to ESD. In this phase, the lead author interviewed experts involved in the Virtuous School Project (VSP) in Thailand (see question on Appendix A). Schools involved in this project have embedded the Sufficiency Economy Philosophy (SEP) of sustainability as the basis for whole school adoption of more sustainable practices (Dharmapiya & Saratun, 2015; United Nations Development Programme, 2007). In addition, the authors analyzed practices used by educators in four model VSP schools for the same purpose of identifying VSP practices aimed at enhancing stakeholder’s knowledge and attitudes towards economic, social and environmental sustainability.

With respect to goal of small-scale research, data obtained from the interviewees and videos reinforced several themes that had been highlighted in literature review. These included some key factors which makes some schools achieve more sustainable, e.g., inspire other stakeholders; engage teachers, parents and principals; give training about sustainability; change students and teachers’ mindset; redesign sustainability curriculum and activities; get support from community in terms of labor, traditional knowledge, money, etc.

Furthermore, the interviewees made specific comments on factors associated with schools that implemented sustainability slowly. The small-scale research also provided abundant of evidences of whole school approach effect in SEP-based schools. It included sustainability strategies, principles, and practices which school stakeholders experienced. Those reflected honestly what happened in schools while implicating sustainability in education. From their own experiences, they gave several useful practices which schools have executed in term of three sustainability pillars and cultural aspect. The scope and size of sustainability practices varied depending on the school type or location. Those give the authors actual practices which applied for redesigning simulation. Learners will learn directly from effective initiatives, and use them as references.

The data then were then synthesized to generate knowledge about the change process to sustainability in schools. These results were used to inform the basic decision rules that govern the movement of stakeholders on the gameboard and the generation of sustainability benefits for the schools. In addition, practical examples drawn from the interviews and analyzed videos of case school were incorporated into the new version of the simulation. These included both change related obstacles encountered by schools as well as examples of actual sustainability practices that could be woven into the text of the new school simulation response cards. These data were collected systematically and stored in a form that could be used to inform the new simulation activities and response cards (see appendix B).

Based on interviews, the authors also identified eight typical obstacles which schools might face while pursuing sustainability. Listed from external to internal factors mentioned by the interviewees, they were:

- (1) discontinue, and inconsistent policy (e.g., too many educational approaches and initiatives)
- (2) limited budget and resources
- (3) non-cooperation from parents, especially those from urban areas
- (4) maintaining sustainability education in community
- (5) issues related to school leader: principal succession, role model, personal interest, career path, top down pressure, mindset and behaviors, rational leadership
- (6) lack of teacher knowledge about sustainability
- (7) lack of teacher interest due to overwhelming workload
- (8) inappropriate teaching style for sustainability education, which requires more system thinking and critical thinking

## Stage Two: Planning

The authors recognized that the K-12 education sector has distinctive differences compared to the business sector. Thus, this stage began by conceptualizing the various features of the business simulation that would need adaptation for the education simulation. These included the institutional context, roles of the stakeholders, types of activities to be conducted, and the means through which sustainability can be integrated into schools. Redesign of the LCS business simulation involved a wide range of adaptations to the context of a school system. These included organizational goals, institutional structure of education, position titles

and description of the 24 stakeholders, problem description, and activities typically undertaken to implement and integrate sustainability concepts and practices in schools.

Planning included identifying knowledge and skills to be learned, defining and sequencing simulation scenarios, distinguishing activities, and examining small-scale study feasibility. After the literature review and collection of other appropriate relevant information in Stage One were completed, this stage analyzed and synthesized data. They offered in a ‘bank’ of information about the organizational and cultural context of schools, as well as propositions about the change process, key obstacles, and leadership strategies employed when leading changes to sustainability in education. Those data were synthesized into content that could be applied in next stages such as repositioning simulation, adapting cultural and institutional settings, as well as changing rules or activities, etc. For instance, following is sustainability practices, extracted from one SEP-based school data. Those data were woven in simulation activities or feedback cards.

**TABLE 1.**  
**Example of sustainability-oriented practices from school number 1’s video.**

Concepts/Practices	Scope					Themes
	Class	School	Community	Parents	Student	
School focuses on applying the SEP-based knowledge, and encourages pupils to maintain their moral principles; put health, working skills and love for their work.		x				SEP model process
The school should establish mutual awareness and correct understanding about SEP with all parties involved.		x				multi-stakeholders
The school should prepare the pupils for learning in terms of physical and mental health and fundamental learning skills.		x			x	whole person education
The teachers should assess the learning use of media and learning centers and use the assessment results in the teaching development in order to imbue learners with sufficiency, mindset and habits.	x					teaching and learning
There should be learning activities regarding the love for nation to learners.					x	virtue -mindset
Parents should not over-indulge their children. They should give advice, consultation and suggestions as to what should and should not do.				x		parents’ involvement
The school has activities that encourage learning of local culture and tradition, continually promote the love of Thainess, and emphasize on teaching of Thai music and dance.		x				culture
Pupils use SEP as a main concept and practice in life, such as moral principles.					x	virtue
The school organizes learning activities outside the school.		x				extra curriculum activity
There should be an effective system in organizing field trips.		x	x			extra curriculum activity
The community takes part in developing the school in all aspects of development in the school.			x			community
If the three parties (teachers/school personnel, parent/community, students) achieve consolidated aims, and the school can advance, the strength of sufficiency school will now take place.		x	x	x	x	multi-stakeholders

As a result, numerous proposed functionalities were prepared. To accommodate the Vietnamese setting, new text,

responses, and decision rules were considered. The text was translated and rewritten to reflect the various assumptions, emphasizing the importance of a sustainable change in education sector. The authors summarized instructions for players (see Appendix D).

Fortunately, the authors had access to the original MS Excel worksheets that had been used to develop the LCS-Business simulation. The Excel file included worksheets that contained all information related to the problem, people, activities, response cards, and decision rules. Within each worksheet, the authors created new text columns next to the columns containing the relevant business-oriented information (e.g., people roles and description). Then, the authors worked systematically through the information using information collected during Stage One to make revisions that reflected an education orientation. Thus, for example, the Eastern Branch Manager was replaced by a Primary School Principal, and a Marketing Staff was replaced with a second-grade teacher.

This process was followed by the revision of all the main components of the simulation noted above (i.e., problem, people, activities, response cards, decision rules, gameboard vocabulary). This resulted in significant changes to the organizational structure and implications for the relationships among stakeholders, as well as to some of the actual change activities. These were described in the following section.

### Stage Three: Developing a Preliminary Version of the Leading Change for Sustainability in Schools (Vietnam)

Redesign of the simulation required consideration of changes at two levels. These were principles underlying educating for sustainability and principles that guide success change management in schools. In addition, redesign would require adaptation to several dimensions of the simulation. These included the cultural and institutional context in which schools are organized and operate, roles and characteristics of the stakeholder, activities used to implement change in an education system. Therefore, revisions to the simulation features were divided into following categories: (1) Reposition simulation context; (2) Adapt cultural and institutional setting; (3) Change roles and characteristics of the stakeholders; (4) Change and revise activities; (5) Change and adjust decision rules; (6) Change the activity feedback to learners; and (7) Programming the Leading Change for Sustainability in Schools

**TABLE 2.**  
Example of sustainability-related themes, integrated in simulation.

Sustainability-related Themes	Example of applying in simulation
Education for sustainable development	<i>Feedback cards 3M:</i> Minh (parent representative) says, "I'm impressed with what you're trying to do. I'd like to see One Future prepare our students so they can work in the 'Green Economy' of the future. Personally, I'd like to see what innovative education for sustainability looks like." Minh moves 2 spaces.
Whole school approach to sustainability	<i>Feedback card ST7:</i> People learn about a 'Whole School Approach' to educating for sustainability. This involves rethinking curriculum, school operations, stakeholder participation, and school management. Gain 150 Bennies. Each participant moves 1 space, except Ich, Phat and Will (name of people).
Sustainable Development Goals	<i>Feedback card ST9:</i> People learn about 'Sustainable Development Goals', proposed by UNESCO. The workshop also encourages people to think about how the education system could develop students with skills needed in the 21st century economy and greater environmental and social awareness. Gain 200 Bennies. Each participant moves 2 spaces.
Sustainable Consumption	<i>Feedback card ST1:</i> Sustainable consumption is introduced at the workshop where participants learn to create personal budgets and savings plans. Teachers discuss how this mindset and skills could be taught to students. Gain 150 Bennies. Each participant moves 1 space, except Ich, Phat and Will (name of people).
Biodiversity	<i>Feedback card SP3:</i> These stakeholders use the garden to teach students about sustainable growing techniques, the dangers of toxic chemicals and pesticides, and the importance of maintaining biodiversity in agriculture. Participants each move 2 spaces. Gain 150 Bennies.
Climate change	<i>Feedback card SS1:</i> A team of teachers from the school share the results of using project-based learning on the effects of climate change on flooding in Vietnam. School stakeholders in Preparation Stage or beyond move 1 space. Gain 50 Bennies for each person in Practice and 100 Bennies for each person in Sustainability.
Inequality	<i>Feedback card PR6:</i> The Ministry of Education accepts the Committee's proposal to integrate active citizenship, social participation, and gender equality competencies into the National Curriculum. Everyone moves 1 space. Gain 2,000 Bennies.
Culture values and heritage	<i>Feedback card SS6:</i> The stakeholder team shows how they have integrated learning about Vietnamese cultural values and heritage into music, dance, social studies. Student products and performances highlight the relevance of cultural heritage even in the era of globalization and social media. Stakeholders in Preparation Stage or beyond move 1 space. Gain 50 Bennies for each person in Practice and 100 Bennies for each person in Sustainability.

simulation.

**Reposition Simulation Context.**

In addition to integrate ESD themes across the curriculum, whole school approach to sustainability recommends an educational institution transform to a place where “pupils and students, teachers, managers and other staff, as well as parents, should follow principles of sustainable development” (UNECE, 2005, p.6). Keeping that principle, the authors aimed to lead simulation’s players pursuing sustainability through concepts of ESD and whole school approach to sustainability with the foundation of change management theory. Therefore, the context of simulation was redesigned completely. Below were some of the sustainability-related themes embedded in simulation. Noted that, players gain knowledges, attitudes, and skill through interaction with simulation, combining guided self-study and mini-lectures.

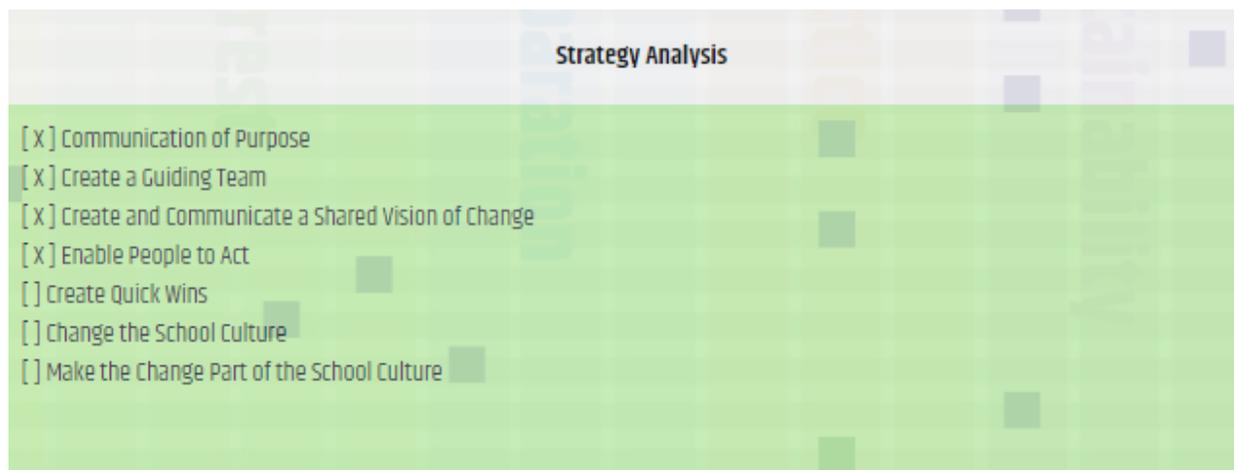
Identifying the similarities in the process of change management in business and education is important. It suggested that the fundamental features of the simulation remain the same at a particular level. The authors adjusted Kotter’s 8-Step Change Model (Kotter, 1995; Kotter & Cohen, 2012) to fit with education version. For example, to achieve strategy ‘Create and communicate a shared vision of change’, players have to successfully conduct ‘Create and Shared Vision’ on year 1 and year 2 or year 3 and organize ‘Sustainability Retreat’. Those condition rules are hidden for players.

**TABLE 3.**  
**Hidden condition for strategy ‘Create and communicate a shared vision of change’**

Strategy	Meaning	Source	Condition must achieve	
3. Create and communicate a shared vision of change	An organizational change in schools must be guided by a shared vision of the educational organization that all stakeholders aim to create in the future.	Crandall et al. (1986); Doppelt (2017); Fullan (2005,2007); Hall (2006); Kotter (1995); Kotter & Cohen (2012)		Create shared vision in Year1
			and	Communicate Vision in Year1
			and	Sustainability retreat
			and	Communicate Vision in Year2 OR Year3

If learners play successfully, there is marked on the results screen for players (see Figure 4).

**FIGURE 4.**  
**Screen play for Strategy Analysis (adjust from Kotter's 8-Step Change Model)**



**Adapt Cultural and Institutional Setting**

As the structure of business organization are somewhat different from educational systems. In business simulation, there are three units: headquarters, Eastern branch and Western branch. Paralleled with that structure, in education version, the authors redesigned three units: Department of Education, primary school and secondary school.

To achieve SDGs target, the goals should be localized to national and local levels as there is no “one size fits all” approach. ESD promotes local level actions because ‘localization’ of problem scenarios and actions is considered as a critical criterion while implementing sustainability in education at the community level (UNESCO, 2020). Thus, the authors accelerated cultural and

institutional adaptation so the simulation addresses global issues and local challenges in a coherent way.

Through the small-scale research, it revealed that urban schools may gain greater access to educational advancement. However, parents from those schools put an emphasis on ranking, test score, and university admission. They might think that non-academic activities are a waste of time. Particularly, interviewee 1 expressed:

“It is easier to implement sufficiency schools in rural areas than in big cities. Because parents in rural area, they respect school leaders and teachers more. So, I believe that it's easier for the school personnel and administrators to explain to them (parents) and try to convince them to go along with the idea that the school proposed. But in Bangkok or in other big provinces in Thailand, with the environment, the context, and with the mindset of their parents who believe in very competitive education, I cannot see the change can be easily that parents will allow their children to participate in extracurricular activities. That's not in the classroom”.

This is similar to Vietnamese parents' expectation. Therefore, the authors redesigned this feature in the simulation that the secondary school is in urban area. Consequently, it faces more resistance to change, and shifts toward sustainability more slowly than primary school which is designed in sub-urban area.

### Redesign Roles and Characteristics of the Stakeholders

As whole school approach to sustainability, there are wide range of stakeholders taking part in education and learning process. In the simulation, the authors redesigned various representatives, including educational administrators, representatives for Vietnamese People Committee, school leaders, trade union, parent representatives, students' affair officers, and teachers.

All stakeholders were remodeled the job position to be adapted to educational system in Vietnam. The authors changed to the authentic name for Vietnamese identification (e.g., Carol to Cúc, Dave to Duong, etc). However, some key features were remained, in particular their adaptation types such as leader, innovator, late majority, early majority and resistor. Especially, some key roles were modified based on the case of Vietnam. Here are some features which occurred in the Vietnamese context.

**TABLE 4.**  
**Some key changes to the role of personnel**

Old role	New role	Explanation	Type
Carol: Board Director	Cúc: Member of Local Political Committee - in charge of Finance	In Vietnam, as the local organ of State power, the People's Council is in charge of national defense and security, and decides on socioeconomic development plans, as well as budgets. People's Committee is the executive organization of the People's Council.	Political Structure
Dave: Board Director	Duong: Member of Local Political Committee - in charge of Education	This role is presented for outside stakeholders, but involve in education. This person is interested in education, and have voice for society about education, and make a critique if necessary.	Political Structure
Eve: Manager, Eastern Branch	En: Primary School Principal, Head of Party Cell	School principal/ vice principal also take a role for school's political committee in Vietnam.	Political and Institutional Structure
Irene: Finance	Ich: Head of 1st -3rd Grade Teachers, Head of Trade Union	Common role in Vietnamese schools. Trade union take care of labor issues in schools.	Political System
Nora: Public Relations	Nuong: Head of Ho Chi Minh Pioneers' Organization	Ho Chi Minh Pioneers' Organization is part of political system in education, especially for primary schools.	Politics in Educational System
Owen: Manager, Western Branch	Oánh: Secondary Principal, and head of Party Cell	School principal/ vice principal also take a role for school political committee in Vietnam.	Politics in Educational System
Xavier: Community Representative	Xuân: Head of HCM Communist Youth Union	Ho Chi Minh Communist Youth Union is part of political system in education, especially for secondary and high school level.	Politics in Educational System
Mia: Customer Representative	Minh: Parent Representative	Parent-teacher-school partnership is one of the key factors in education for sustainable development.	Educational System

## Change and Revise Activities

Whole school approach to sustainability means a school integrates sustainability not only through curriculum, but also through school operations such as managing, planning, monitoring, and evaluating, as well as involving stakeholders and community. As interviewee 1 mentioned:

“That is not be do done holistically. It only focused on teaching and learning. Like designing learning activities that there's been covered economics, environmental and culture. You know, right? But in fact, changing in teaching styles is not enough. It has to be in school management, curriculum, relationship with all stakeholders, with parents. you know. It cannot happen with one part in the school”.

The basic 16 activities in simulation (see Appendix C) represented the engine that leads change to sustainability. However, different sorts of activities used to drive changes may vary from one society to another (Hallinger & Kantamara, 2001). As a result, the authors checked whether the existing activities were congruent with the ‘school culture’ in Vietnam and whether any key sustainable activities might be missing. The cost of each activity also was revised coherently. Based on finding of stage One, one activity (*Benchmark and Plan*) was eliminated, the names, context and descriptions were revised for four activities to reflect education setting. And one new activity was added (*Open class demonstration*) as this activity is a form of teacher-led modelling activity of new professional instructions often used in Vietnamese schools. One activity was expanded its effectiveness, compared to one in business version. Especially, the activity ‘*Use Sustainable Practices*’ was tailored meticulously by integrating finding from literature review and small-scale research. These revisions are summarized in table below:

**TABLE 5.**  
**Summary of the revised activities in education version**

Action	Activity	Reason
Create new activity	Open class demonstration	This is a typical activity in the educational sector.
Eliminate activity	Benchmark and Plan	This activity is tailored to the business sector and it is inappropriate for education.
Change context	Create Shared Vision Gather Social Information Talk to First Time Talk to Second Time Talk to Third Time Sustainability Survey Assess Sustainable Practices Sustainability Retreat Communicate Vision ‘One Future’ Festival Share Sustainability Success	Those activities were designed to adapt to educational context under the concept of education for sustainable development and whole school approach to sustainability. The activities were based on theory of change management and diffusion of change stages. They form the basic structure of the simulation.
Change name and context	School Visit Sustainability Workshop School Support Group Revise School Report	Those useful activities are ones where players (educators) able to take what they have learnt from engaging with the sustainable activity in educational institution. They help educators in developing and learning new knowledge, working tasks, teaching and learning strategies, classroom management, technological advancement, novel innovation, etc.
Deeply integrate context	Use Sustainable Practices	These applicable practices are aimed at ESD and concept of whole school approach to sustainability, drawing on real-life practices from small-scale research and literature review. They make players not only learn theoretical framework but also learn how to apply in daily work.
Extend the effectiveness	Policy Revision	The former activity in business version affects at organization only. New activity in education version expands the effectiveness in both national and regional level.

## Change and Adjust Decision Rules

As discussed above, the decision rules are based on change management theories. They represent the energy into motion (i.e. movement of people in simulation). So, successful strategies reflect the underlying principles for change and are implemented through the decision rules. The literature review and small-scale research had largely supported the notion that many of the change principles already incorporated in the business simulation still applied in the educational context. These included the following:

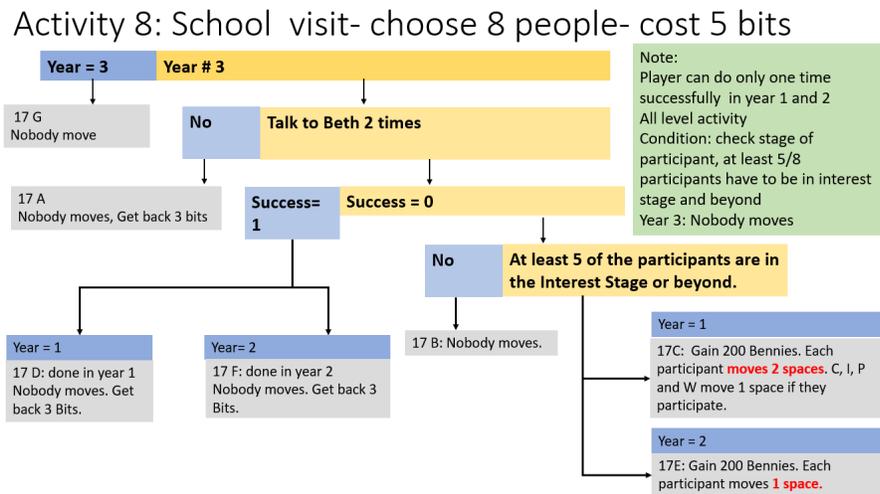
1. Obtain administrative approval before hosting activities in an organizational;
2. Use different required strategies to change a diverse group of people;

3. Inform and create interest for people to prepare them and build commitment before sending them to advanced activity such as workshops; or share success.
4. Implement change with requirement from both top-down pressure and peer support.

However, with the distinction of educational sector, several changes to decision rules were adjusted to reflect this setting. New embedded decision rules coherent with sequences of change strategies for sustainability. Some decision rules let players undertake activity one time on simulation. Players have to choose 'right time' to do that activity; otherwise they will get unsuccessful response. For example, the activity 'School visit' is able to conduct in year 1 and 2 as people need to gain information and interest about sustainability education. However, if players conduct this activity in year 3, no successful feedback card appear as people have already get preparation to practices sustainability in teaching and learning (see Figure 5).

**Figure 5.**

Algorithm for activity 'School visit' in simulation



### Change the Activity Feedback to Learners

It is obvious that all the feedback cards provided in response to activities were rewritten to reflect the education sector, as well as Vietnamese culture. More than that, the authors utilized contents, practices from the whole school approach to sustainability literature, and findings from a small-scale research about SEP-based school model (see Appendix B - synthesized table). This does not only give players real experiences how school integrate sustainability in education, but they also have some preference practices to apply in the future at their institution in Vietnam. When the authors rewrote the feedback cards, or content; the authors tried to select suitable and applicable practices, resembling Vietnamese situation and condition. Plus, the authors wrote some feedback cards which is distinctive for Vietnamese educational context. The authors expect players to be able to apply those knowledges and practices directly to daily life, rather than theoretical framework.

### Programming the Leading Change for Sustainability in Schools simulation

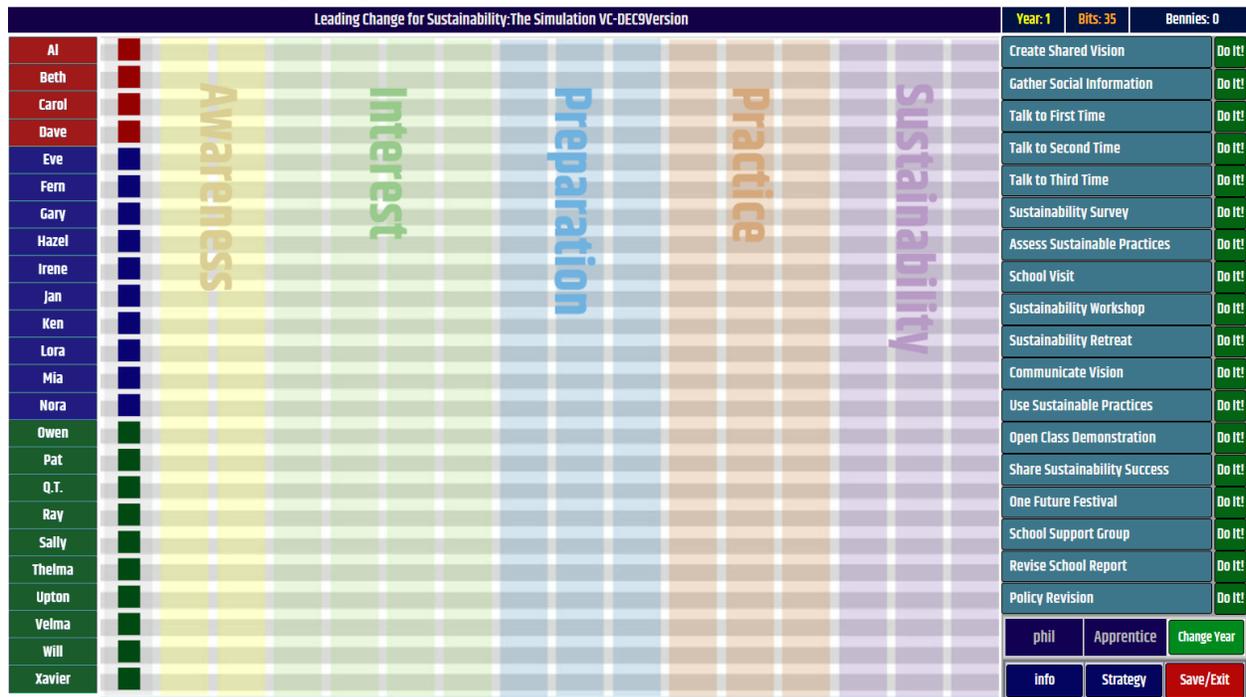
All of the types of changes detailed in the above examples were then incorporated into the master Excel file., The result was an Excel file that contained worksheets consisting of columns containing the business-related information used to create the original Leading Change for Sustainability (LCS) -Business simulation followed by columns containing the revised information developed for the education version. This Excel file was, in essence, a database of English language text that could be used in the development of the new Leading Change for Sustainability in Schools (LCSS) simulation for Vietnamese context.

Once this step had been completed, additional columns were added to each worksheet and the English text for the LCSS simulation was translated into Vietnamese by a native speaker. The result was an Excel file containing five worksheets: The Problem Scenario, People, Activities, Feedback Cards, Other Vocabulary. Each worksheet contained three sets of related information describing the content of three different simulation 1) LCS -Business simulation (English), 2) LCSS (English), and 3) LCSS (Vietnamese). The information in these worksheets was then used as the basis for developing preliminary versions of the LCSS (English) and LCSS (Vietnamese) simulations. Next, the project proceeded to the programming phase. This involved a four-step process.

In step one, a new LCSS gameboard was created in English to reflect the new education context and activities (see Figure 6). Then all information about the Problem Scenario, People (i.e., 24 stakeholders), and Activities was copied and pasted into the

program file to replace the business-related information contained in the original LCS-Business simulation program. Next, the computer code had to be reprogrammed to reflect changes to the activities that had been replaced as well as to changes in the decision rules and feedback cards.

**FIGURE 6.**  
**Leading Change for Sustainability in Schools (LCSS) simulation gameboard**



Once these changes to the computer code had been completed, a Beta version of the new LCS-Schools (English) simulation was produced for testing. While the gameboards of the LCS-Business and LCS-Schools simulation appear quite similar, the scope of changes from the original to the school version were significant. Virtually, every piece of content-related information in the simulation was changed in the computer code.

The new LCS-Schools (English) version was tested for stability, bugs, and internal coherence. Only after the simulation was played numerous times could the authors not only identify bugs, but also whether the patterns of movement and feedback had face validity, or ‘made sense’ in terms of both the change process and sustainability content. In order to test the simulation, a team of five educators familiar with the LCS-Business were recruited to test the simulation. Each was asked to play the simulation all the way through to its conclusion multiple times and keep a record of bugs and other issues. This feedback was used to make revisions to the computer code. After a stable version of the LCS-Schools (English) simulation was produced, a Vietnamese language version was created using comparable data from the Excel file. Since the only different between the LCS-Schools (English) and LCS-Schools (Vietnamese) version was the language, the authors were able to use the debugged code from the LCS-Schools (English) version as the basis for the Vietnamese language simulation.

## CONCLUSION

In this paper, the authors described three key stages from Research and Development project for redesigning Leading Change to Sustainability simulation for education version. At the end of this first three stages, a working beta version was redesigned, culturally adapted, and translated to Vietnamese language. The simulation will be assured to ‘work as intended’ when users play it, and will be evaluated for its face validity in the eyes of Vietnamese educators, and determine their response to learning ‘Leading Change to Sustainability in Schools’ via a problem-based computer simulation.

It could raise a question why the authors conducted small scale study in Thailand while redesigning a simulation for Vietnamese context. As noted above, the project was not oriented to put a mold of Thailand SEP-based school model into Vietnamese settings. Those results are explicitly limited for generalization due to the small sample size. Plus, the differences in political system and educational hierarchy are noticeable for both countries. However, as noted in the purpose of small-scale research, it gives the authors the real sustainability practices and the process how schools implemented sustainability in education. And, thanks to the similarity of cultural characteristic in Vietnam and Thailand, the study can be applied in some extent. The reliability and validity of simulation will be checked in the next stages of preliminary and main field test in Vietnam.

As future work, the authors intend to conduct a pilot test and do one more stage for simulation revision. Afterwards, the authors will conduct a main field test with the participants who are educators, teachers and principals in Vietnam. Plus, interview questions also are developed to gain feedback from the players for those stages. The product after dissimulated will be used widely in educational system with an aim to cultivate mindset and competences to lead change for sustainability in education.

## REFERENCES

- Aistrup, S. A. (2010). *Implementation strategies for effective change: A handbook for instructional leaders*. (Doctoral dissertation). Kansas State University, Kansas.
- Australian Education for Sustainability Alliance. (2014). *Education for Sustainability and the Australian Curriculum Project: Final Report for Research Phases 1 to 3*. Melbourne: AESA
- Barreteau, O., Le Page, C., & Perez, P. (2007). Contribution of simulation and gaming to natural resource management issues: An introduction. *Simulation & Gaming*, 38(2), 185-194.
- Borg, W. R. (1987). The educational R & D process: Some insights. *The Journal of Experimental Education*, 55(4), 181-188.
- Breiting, S., Mayer, M., & Mogensen, F. (2005). *Quality criteria for ESD-schools: Guidelines to enhance the quality of education for sustainable development*. Austria: Stollfuß Medien.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Campbell, D. T., & Stanley, J. C. (1963). *Experimental and Quasi-Experimental Designs for Research*. USA: Houghton Mifflin Company.
- Campbell, D. T., & Stanley, J. C. (2015). *Experimental and quasi-experimental designs for research*. New York: Ravenio Books.
- Creswell, J. W. (2015). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (5th ed.). Upper Saddle River, NJ: Pearson.
- Crookall, D. (2013). Climate change and simulation/gaming: Learning for survival. *Simulation & Gaming*, 44(2-3), 195-228.
- Dharmapiya, P., & Saratun, M. (2015). *Cultivating a "sufficiency" mindset: Thailand's educational strategy for a sustainable society*. Bangkok: Thailand Sustainable Development Foundation.
- Dick, W., & Carey, L. (1985). *The systematic design of instruction* (2nd ed.). Glenview, IL: Scott, Foresman Company.
- Do, V. N., & DeMaria-Kinney, J. (2013). Reviewing National ESD Experiences from Vietnam. In *National Journeys towards Education for Sustainable Development 2013: Reviewing National ESD Experiences from Costa Rica, Morocco, South Africa, Sweden, Vietnam* (pp. 109–134). Paris, France: UNESCO.
- Doppelt, B., & McDonough, W. (2017). *Leading change toward sustainability: A change-management guide for business, government and civil society*. London: Routledge.
- Eisenack, K., & Reckien, D. (2013). Climate change and simulation/gaming. *Simulation & Gaming*, 44(2-3), 245-252.
- Elkington, J. (1994). Towards the sustainable corporation: Win-win-win business strategies for sustainable development. *California management review*, 36(2), 90-100.
- Elkington, J. (2013). Enter the triple bottom line. In *The triple bottom line* (pp. 23-38). London: Routledge.
- Farashahi, M., & Tajeddin, M. (2018). Effectiveness of teaching methods in business education: A comparison study on the learning outcomes of lectures, case studies and simulations. *The International Journal of Management Education*, 16(1), 131-142.
- Fullan, M. (2005). *Leadership & sustainability: System thinkers in action*. California: Corwin Press.
- Fullan, M. (2007). *Leading in a culture of change*. New York: John Wiley & Sons.
- Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction* (6th ed.). White Plains, NY, England: Longman Publishing.
- Gall, M. D., Borg, W. R., & Gall, J. P. (2003). *Educational research: An introduction* (7th ed.). Boston, MA: A & B Publications.
- Gatti, L., Ulrich, M., & Seele, P. (2019). education for sustainable development through business simulation games: An exploratory study of sustainability gamification and its effects on students' learning outcomes. *Journal of Cleaner Production* 207, 667-678.
- Gosen, J., & Washbush, J. (2004). A review of scholarship on assessing experiential learning effectiveness. *Simulation & Gaming*, 35(2), 270-293.
- Gravemeijer, K. (1994). Educational development and developmental research in mathematics education. *Journal for Research in Mathematics Education*, 25(5), 443-471.
- Hall, G. E., & Hord, S. M. (2006). *Implementing change: Patterns, principles, and potholes*: Pearson Education.
- Hallinger, P. (2018). *Leading change for sustainability: Development of an online computer simulation*. Bangkok: College of Management, Mahidol University.
- Hallinger, P. (2020). *Course syllabus for Consulting Tools: Leading change for sustainability*. College of Management, Mahidol University, Bangkok, Thailand.
- Hallinger, P., & Chatpinyakoo, C. (2019). A bibliometric review of research on higher education for sustainable development, 1998–2018. *Sustainability*, 11(8), 2401.
- Hallinger, P., & Kantamara, P. (2001). Learning to lead global changes in local cultures-Designing a computer-based simulation for Thai school leaders. *Journal of Educational Administration*.
- Hallinger, P., & McCary, C. (1990). Developing the strategic thinking of instructional leaders. *The Elementary School Journal*, 91(2), 89-108.
- Hallinger, P., & Nguyen, V.-T. (2020). Mapping the landscape and structure of research on education for sustainable development: A bibliometric review. *Sustainability*, 12(5), 1947.

- Hallinger, P., & Wang, R. (2019). The evolution of simulation-based learning across the disciplines, 1965–2018: A science map of the literature. *Simulation & Gaming, 51* (1), 9-32.
- Hallinger, P., Tang, S., & Lu, J. (2017). Learning to make change happen in Chinese schools: Adapting a problem-based computer simulation for developing school leaders. *School Leadership & Management, 37* (1-2), 162-187.
- Hallinger, P., Wang, R., Chatpinyakoo, C., Nguyen, V.-T., & Nguyen, U.-P. (2020). A bibliometric review of research on simulations and serious games used in educating for sustainability, 1997–2019. *Journal of cleaner production, 256*, 120358. doi:https://doi.org/10.1016/j.jclepro.2020.120358
- Kennelly, J. (2012). Education for Sustainability and Pre-Service Teacher Education. *Australian Journal of Environmental Education, 28*(1), 57-58.
- Kieu, T. K., Singer, J., & Gannon, T. J. (2016). education for sustainable development in Vietnam: Lessons learned from teacher education. *International Journal of Sustainability in Higher Education, 17*(6), 853-874.
- Kotter, J. P. (1995). Leading change: why transformation efforts fail. *Harvard Business Review, 73*(2), 59-67.
- Kotter, J. P., & Cohen, D. S. (2012). *The heart of change: Real-life stories of how people change their organizations*. Boston, MA: Harvard Business Press.
- Lestari, S. E. (2017). *Designing an English course book for flight attendant schools*. (Magister Humaniora). Sanata Dharma University, Yogyakarta.
- Martin, P. C. (2004). *The research, development and validation of a handbook of study modules for use by district technology coordinators in the attainment of technical and educational skills*. Kansas State University,
- McKeown, R., & Hopkins, C. (2007). Moving beyond the EE and ESD disciplinary debate in formal education. *Journal of Education for Sustainable Development, 1* (1), 17-26.
- McKey, T. (2017). US Department of Education Green Ribbon Schools Award from 2012, 2013, and 2014: Teacher Perceptions of Ecological and Democratic Principles. *Journal of Sustainability Education, 13*.
- Ministry of Education Thailand (2011). *Handbook for school assessment as knowledge management and management based on Sufficiency Economy Philosophy 2011 –2013*. Bangkok: Ministry of Education.
- Mogensen, F., & Schnack, K. (2010). The action competence approach and the ‘new’discourses of education for sustainable development, competence and quality criteria. *Environmental Education Research, 16*(1), 59-74.
- Mogren, A., Gericke, N., & Scherp, H.-Å. (2019). Whole school approaches to education for sustainable development: A model that links to school improvement. *Environmental Education Research, 25* (4), 508-531.
- Nguyen, T. P. (2018). Education for sustainable development in Vietnam: Exploring the geography teachers' perspectives. *International Research in Geographical and Environmental Education, 27*(4), 341-356.
- Nguyen, T. P. (2019). Searching for education for sustainable development in Vietnam. *Environmental Education Research, 25*(7), 991-1003.
- Nguyen, V.-T., & Hallinger, P. (2020). Education for sustainable development literature and Whole school approach to sustainability. Paper presented at the 26th International Sustainable Development Research Society Conference "Sustainability in Transforming Societies", Budapest, Hungary.
- Nussbaum, E. M., Owens, M. C., Sinatra, G. M., Rehmat, A. P., Cordova, J. R., Ahmad, S., . . . Dascalu, S. M. (2015). Losing the Lake: Simulations to promote gains in student knowledge and interest about climate change. *International Journal of Environmental and Science Education, 10*(6), 789-811.
- Pauw, J. B.-d., Gericke, N., Olsson, D., & Berglund, T. (2015). The effectiveness of education for sustainable development. *Sustainability, 7*(11), 15693-15717.
- Pepper, C. (2014). Leading for sustainability in Western Australian regional schools. *Educational Management Administration & Leadership, 42*(4), 506-519.
- Prime Minister and Government of Vietnam (PM & Gov Viet). (2004). *The Strategic orientation for Sustainable Development in Vietnam (Vietnam Agenda 21)*. Hanoi: National Political Publishing House, Socialist Republic of Viet Nam.
- Rogers, E. M. (2010). *Diffusion of innovations* (Fourth ed.). New York: Simon and Schuster.
- Sterling, S., & Thomas, I. (2006). Education for sustainability: The role of capabilities in guiding university curricula. *International Journal of Innovation and Sustainable Development, 1*(4), 349-370.
- Tilbury, D., & Wortman, D. (2005). Whole school approaches to sustainability. *Geographical education, 18*, 22.
- Ulrich, M. (1997). *Games/simulations about environmental issues: Existing tools and underlying concepts*. Paper presented at the Gaming/Simulation for Policy Development and Organizational Change: Proceedings of the 28th Simulation and Gaming Association, Netherlands.
- UNECE. (2005). *UNECE strategy for education for sustainable development*. Vilnius: UNECE
- UNESCO. (1997). *Educating for a sustainable future: A transdisciplinary vision for concerted action*. UNESCO
- UNESCO. (2002). *Education for sustainability from Rio to Johannesburg: Lessons learnt from a decade of commitment*. Paris: UNESCO
- UNESCO. (2006). *Framework for the UNDESd international implementation scheme*. Paris: UNESCO
- UNESCO. (2015). *Education 2030 Incheon Declaration and Framework for Action*. Paris: UNESCO
- UNESCO. (2018). *UNESCO Associated Schools Network: Guide for National Coordinators*. France: UNESCO
- UNESCO. (2020). *Education for Sustainable Development: A Roadmap*. Paris, France: UNESCO
- United Nations Development Programme. (2007). *Thailand Human Development Report 2007: Sufficiency Economy and Human Development*. Bangkok: UNPD
- Wals, A. E., & Benavot, A. (2017). Can we meet the sustainability challenges? The role of education and lifelong learning. *European Journal of Education, 52* (4), 404-413.

## APPENDIX

### A. Expert/Consultant Interview Protocol

1. Could you briefly describe your role and experiences with the Virtuous Schools Project in Thailand?
2. Typically, what knowledge did the schools have about sustainability at the start of the project?
3. What were 5 key obstacles that all or most schools faced in making the project successful?
4. If you look back now, what elements or factors enabled schools to succeed in this initiative? Can you give some examples?
5. What factors were associated with schools that implemented slowly or hardly at all?
6. If you consider the 3 sustainability pillars, can you give a couple of examples of successful practices schools have implemented for each one?
  - a. Environmental
  - b. Economic
  - c. Social
7. In terms of changing staff attitudes and values, what kinds of activities have proved most beneficial?
8. If I were to visit several of the model SEP schools, what are some of the things I might see that would be different from Thai schools in general? (e.g., curriculum, management, school activities, etc.)

### B. Synthesis table

Synthesized practices from interviews and video	Content for new activity's feedback
Do it only in one dimension, Not holistic approach. Just learning and teaching change is not enough => should be school management, curriculum, relationship with all stakeholders, with parents	A new vision of "Caring for People and the Planet" is adopted to signal the education department's new long-term commitment to educating for sustainability, both in classroom teaching and school management. All participants move 1 space except Carol, Irene, Pat, and Will. Gain 200 Bennies.
Keeping accounts as an ongoing strengthening project: <ul style="list-style-type: none"> <li>⇒ Campaign to build habit</li> <li>⇒ Account training</li> <li>⇒ Keeping accounts</li> <li>⇒ Applying for an account with the school Bank</li> <li>⇒ Assigning saving dates for each year group</li> </ul>	School Support Group shares ideas to show 'Caring for the People' such as applying for an account with the school Bank, helping individual keep account and getting out of debt. Participants each move 1 space and gain 250 Bennies.
Piggy bank project to encourage saving habit.	Sustainable consumption is introduced at the workshop where participants learn to create personal budgets and savings plans. Teachers discuss how this mindset and skills could be taught to students. Gain 150 Bennies. Each participant moves 1 space, except Irene, Pat and Will.
Workshop on planning and managing personal finance for teachers and school staff	Sustainable consumption is introduced at the Workshop where teachers and school leaders learn how to balance finance and plan ahead in spending money school operations. Gain 100 Bennies. Each participant moves 1 space, except Irene, Pat and Will.
Media-savvy parents, media savvy team building projects: <ul style="list-style-type: none"> <li>⇒ Pamphlets</li> <li>⇒ Websites</li> <li>⇒ Radio broadcasts</li> <li>⇒ Line application for the group</li> <li>⇒ Parents meeting</li> </ul>	Al, Beth and the principals communicate a new vision of "Caring for People and the Planet" to all stakeholders in a series of face-to-face meetings and social media. Everyone moves 1 space, except Carol, Irene, Pat, Will. Gain 200 Bennies.

<p>From our Hands to Sufficiency Project is extra practice for pupils:</p> <ul style="list-style-type: none"> <li>⇒ Colorful toilets</li> <li>⇒ Growing vegetables towards Sufficiency</li> <li>⇒ Fun science experiments</li> <li>⇒ Junior tour guides</li> </ul>	<p>The School Support Group shares practices aimed at reducing the use of plastic to show Caring for the Planet. This leads students to share ideas on reducing the use of plastic bags and containers with vendors at the local market. Participants each move 1 space and gain 250 Bennies.</p>
<ul style="list-style-type: none"> <li>• project 3R (reduce-recycle-reuse), design environmentally friendly project</li> <li>• understand of limit of resources, local resources</li> <li>• do planting, dam building, soil stabilizing</li> <li>• go to forest, name and count tree</li> <li>• keep insects =&gt; biodiversity</li> </ul>	<p>These stakeholders use the garden to teach students about sustainable growing techniques, the dangers of toxic chemicals and pesticides, and the importance of maintaining biodiversity in agriculture. Participants each move 2 spaces. Gain 150 Bennies.</p>
<p>School carry out the Bio Way project to sustainably developed for aspects of economic sufficiency, namely husbandry, environment fishery and plants.</p>	<p>The School Support Group shares practices with colleagues that show Caring for the Planet by initiating a school and community garden. Participants each move 1 space and gain 250 Bennies.</p>
<p>The school has SEP corner/area with clear appropriate explanation for visitors.</p>	<p>People are glad to know that the administrators remain committed to One Future. Visitors to the District Office, pilot schools, and their websites are now greeted with the Caring for People and Planet themed mission statement. Everyone moves 1 space in the Awareness, Interest or Preparation stage.</p>
<p>The school organizes learning activities outside the school.</p>	<p>The stakeholders commit to working with local companies in a program that aims to make education more meaningful and develop 21st century job skills. Participants each move 2 spaces. Gain 150 Bennies.</p>
<p>Use recycle bin 3 color</p>	<p>These stakeholders commit to join in 'Trash hack' project to reduce food waste and rebuild the school garden to support the canteen. They propose to use three-color Recycle Bins to classify biodegradable waste, bottle, and paper. Each participant moves 2 spaces. Gain 150 Bennies.</p>
<p>Pupils learn to help society, family and the underprivileged.</p>	<p>These stakeholders commit to conduct participate in the UNESCO-sponsored 'Learning for Empathy' project. This project aims to develop student values for cultural diversity and non-violence in schools and society. Participants each move 2 spaces. Gain 150 Bennies.</p>
<ul style="list-style-type: none"> <li>• Talk to old people about the past, tradition, with community</li> <li>• Field trip to community</li> <li>• Talk to soil doctors, local wisdom</li> </ul>	<p>The Workshop presents how to teach a project-based learning unit on National Culture and Local Wisdom. Teachers are excited to have a creative way of increasing national pride and respect for traditions. Gain 200 Bennies. Each participant moves 2 spaces.</p>
<p>Urban school: believe in very competitive education, focus about ranking, performance, university entrance, extra activities is waste of time</p>	<p>Carol says, "We can't afford to waste time and money on projects that might lower our student test results". Carol doesn't move.</p>
<p>Policy: discontinue, inconsistent, so many educational approach (e.g., Buddha school, white school) =&gt; people confused, many reports</p>	<p>Carol says, "I heard that in other provinces, school performance ranking went down in the first year when they tried this project. So, they gave up. Honestly, I hate to see you waste effort on a project that may go nowhere". Carol doesn't move.</p>
<p>Principle: Successful implementation supports the use of more engaging learning strategies.</p>	<p>A team of teachers from the school share the results of using project-based learning on the effects of climate change on flooding in Vietnam. School stakeholders in Preparation Stage or beyond move 1 space. Gain 50 Bennies for each person in Practice and 100 Bennies for each person in Sustainability.</p>
<p>Teachers change teaching style, 2-way communication -&gt; see results own eyes -&gt; convinced.</p>	<p>Nora says, "I like the idea of giving more emphasis to environmental projects. But I don't know how the teachers will feel about losing classroom time for instruction in basic subjects. Nora moves 2 spaces.</p>

Project based learning: teacher guide, students come up with solutions QPAR technique => stimulus student learning,	These stakeholders engage students in a 'clean river project'. This aims to raise awareness of a clean river's contribution to the community health and the economy. Participants each move 2 spaces. Gain 150 Bennies.
People of different age and gender think differently. Therefore, our opinions heard by others may be unexpected ones.	The School Support Group shows Caring for People by highlighting the need for change in policies and informal practices that reduce opportunities for female and minority group staff. Participants each move 1 space and gain 250 Bennies.
Start from the top, apply from personal life first -> have faith, do it yourself -> can explain to others wholeheartedly -> be role model	Jan says, "I'd love to see our students win an environmental award with a 'Green Forest' project. I've started telling other teachers that we should give it a chance, but it's going to take time." Jan moves 2 spaces. Her friends each move 1 space, if you know who they are.
Director has to encourage teachers by the role model, convincing them, persuading them	Beth says, "When I mentioned One Future to several European school administrators on my trip, I was amazed at how far they have gone in educating for sustainability. They emphasized the need for a clear picture of stakeholders' attitudes and practices. What do we know about what our people think and are doing about sustainability?" Beth moves 1 space.
Directors: take teachers to other SEP learning center	You have top management support, but only a few of people are interested in going on the School Visit. The trip turns out to be a "just-for-fun" trip. Make sure there is enough interest among the group you select before trying another School Visit. Nobody moves.
<ul style="list-style-type: none"> <li>School management: participatory style. Teachers are involved in decision making.</li> <li>School leaders: open minded, open, 2 ways communicate, play important role to initiate</li> </ul>	Gary is excited to talk again. He says, "One thing I really like about One Future is the involvement of community and parents in decision-making. But I'm not sure how the administration and other teachers may feel about that." Gary moves 1 space.
The parents help support and encouraged the school.	Mia says, "Our hotel group is well known for our innovative recycling and waste management practices. I'd be happy to share some with our schools if you are interested. Just let me know how I can help!". Mia moves 5 spaces in Awareness or Interest stage.
The school implemented SEP in three levels of personnel: managers, teachers, and pupils. We put a great emphasis on practices in their lives.	You've done careful planning and have broad support. School principals and teachers take the initiative in planning. Parents and guests from the community join in activities. Carol, Irene, Pat & Will move 1 space. Everyone else moves 2 spaces. Gain 10 Bits. Gain 50 Bennies for each person in Practice and 100 for each in Sustainability.
encourages pupil to maintain their moral principles; put health, working skills and love for their work	The Ministry of Education accepts the Committee's proposal to integrate active citizenship, social participation, and gender equality competencies into the National Curriculum. Everyone moves 1 space. Gain 2,000 Bennies.
school collaborates with community and other organizations and develop itself to become a role model for other schools and organizations to make study visits.	The Chair agrees to let you present a proposal to include sustainability standards in the annual School Report required of all schools. With Dave's support, and the demonstrated success of the One Future project, the District Political Committee accepts your proposal. Everyone moves 1 space. Gain 1,000 Bennies.
The school has activities that encourage learning of local culture and tradition, continually promote the love of Thainess, and emphasize on teaching of Thai music and dance	These stakeholders begin to integrate activities for learning about Vietnamese values and culture through music and dance. Students are happy to learn by doing instead of listening to lectures about culture. Participants each move 2 spaces. Gain 150 Bennies.

A. Activities in education version

Activity-Business version	Description	Activity-Education version	Description
Create Shared Vision	At a company retreat, representatives of management and staff discuss what sustainability would mean in their work and in their personal lives. They begin to create a shared vision of what the Best Co. would look like if sustainable practices were widely adopted. Select 8 people. Cost: 6 Bits.	Create Shared Vision	At a District Meeting, school principals and District Dept of Education administrators discuss what education for sustainability would mean in their work and in their students' lives. They begin to create a shared vision of what the schools would look like if sustainable practices were widely adopted. Select 8 people. Cost: 6 Bits.
Gather Social Information	Information you obtain from colleagues about the informal relationships among the people with whom you're working. Cost: 1 Bit.	Gather Social Information	Information you obtain from colleagues about informal relationships among the people with whom you're working in the One Future project. Cost: 1 Bit.
Talk to First Time	Your first conversation with individual people to introduce sustainability issues. Choose 3 people. Cost: 2 Bits.	Talk to First Time	Your first conversation with individual people to introduce issues about economic, social and environmental sustainability, as well as education for sustainable development. Choose 3 people. Cost: 2 Bits.
Talk to Second Time	A follow-up conversation to discuss questions about what sustainability means for people in different departments. Note: You must have talked to each of these people 1 time before you can talk to them again. Choose 3 people. Cost: 2 Bits.	Talk to Second Time	A follow-up conversation to discuss how sustainability issues impact our lives and answer questions about what educators can do. Note: You must have talked to each of these people 1 time before you can talk to them again. Choose 3 people. Cost: 2 Bits.
Talk to Third Time	A third conversation to further discuss how to make the change to more sustainable practices. Note: You must have talked to each of these people 2 times before you can talk to them again. Choose 3 people. Cost: 2 Bits.	Talk to Third Time	A 3rd conversation to discuss the progress of One Future and gain support for practical steps to make the change happen in schools. Note: You must have talked to each of these people 2 times before you can talk to them a 3rd time. Choose 3 people. Cost: 2 Bits.
Sustainability Survey	Survey staff, suppliers and customers concerning their knowledge and attitudes about sustainability in the company and society. Cost: 2 Bits.	Sustainability Survey	Survey teachers, staff, and parents to find out what they know about sustainability issues, and how they feel about their importance for the school and society. Cost: 2 Bits.
Assess Sustainable Practices	All departments and suppliers complete a sustainability assessment template to identify current practices related to energy conservation, use of recyclable materials, waste disposal, and equitable labor practices. Cost: 3 Bits.	Assess Sustainable Practices	Stakeholders complete an assessment to evaluate the school's strengths and weaknesses which leads to planning, operation, improvement and application of ESD in teaching, organizing learning activities and managing educational institutions. Cost: 3 Bits.
Field Visit	Staff visit organizations that have won sustainability awards. Select 8 people. Cost: 5 Bits.	School Visit	Selected stakeholders visit to a school that has won sustainability awards. They have a chance to see sustainable practices in the school and classrooms, and ask questions of the school's staff. Select 8 people. Cost: 5 Bits.

Sustainability Training	Workshops are offered for staff on 'how to use sustainable practices' including energy conservation, recycling and reuse, and use of sustainable values in their decision-making. Choose 5 people from one Branch. Cost: 5 Bits.	Sustainability Workshop	Workshops are offered for school stakeholders on how to integrate sustainability issues into teaching and learning as well as school management. Choose 5 people from one School. Cost: 5 Bits.
Sustainability Retreat	Staff attend a day-long retreat that raises awareness of how sustainability challenges impact the company. The Caring for People and Planet vision is communicated and participants develop personal action plans. Cost: 5 Bits.	Sustainability Retreat	Stakeholders from the project schools attend a day-long retreat that raises awareness of how sustainability challenges impact the school and society. The Caring for People and Planet vision is communicated and participants discuss what they could do at their schools. Cost: 6 Bits.
Communicate Vision	A series of meetings with staff and a social media presentation highlight how a sustainability focus can improve long-term performance and strengthen the company's contribution to society. Cost: 1 Bit.	Communicate Vision	A series of meetings and informal conversations that communicate how the vision of Caring for People and Planet can strengthen the school's contribution to society. Cost: 1 Bit.
Use Sustainable Practices	Staff begin using sustainable practices in their daily jobs. Select 3 people. Cost: 2 Bits.	Use Sustainable Practices	School stakeholders begin using sustainable practices in their daily jobs. Select 3 people. Cost: 2 Bits.
Benchmark and Plan	Form a Committee to assess success, benchmark progress against industry standards, and develop a long-range plan for achieving Sustainable Development Goals. Form a Committee of 5 people. Cost: 5 Bits.	Open Class Demonstration	School teachers and staff attend a demonstration lesson taught by a senior teacher from the school. The lesson shows how environmental and social sustainability issues can be integrated into the existing curriculum. Choose a school. Cost: 4 Bits.
Share Sustainability Success	Staff in the selected business unit contribute to a company-sponsored sustainability social media platform that shares and publicizes successful practices. Choose a Branch. Cost: 4 Bits.	Share Sustainability Success	Teachers and staff in the selected school participate in a District Competition which shows how schools are using sustainable education practices. They can learn and share success in integrating sustainability topics in teaching. Choose a school. Cost: 5 Bits.
One Future Week Celebration	A major event showcasing successful sustainability projects undertaken at Best Co., and in partnership with the business partners and the community. Cost: 8 Bits.	'One Future' Festival	A District Festival is organized to showcase the benefits of environmental, economic, and social action projects started at the schools. The Festival is attended by parents, educators and community members from throughout the District. Cost: 8 Bits.
Strengthen Sustainability Mindset	Staff who are using new sustainability practices form a Green Action Committee. They meet weekly to share strategies, solve problems, and think of new ways to influence others. Choose 5 people from one branch. Cost: 4 Bits.	School Support Group	People who are using new sustainability teaching and practices form a Green Team. They meet weekly to share strategies, solve problems, and think of new ways to apply sustainable practices and inspire others. Choose 5 people from one school. Cost: 4 bits.

Sustainability Report	Data collected from all business units are combined to create a Corporate Sustainability Report organized around the company's sustainability goals. The Report is presented to the Board for approval. Form a Committee of 5 people. Cost: 6 Bits.	Revise School Report	A committee is formed to propose changes in the Annual School Report to the District Political Committee. The revised School Report will include school progress on standards in educating for sustainability in curriculum, teaching, stakeholder engagement, and school operations. Form a Committee of 5 people. Cost: 6 Bits.
Policy Revision	Seek Board approval to revise company policies to support the change to sustainable practices. Form a committee of 5 people. Cost: 8 Bits.	Policy Revision	Select a group of people to propose revisions to current policies that will support sustainability in the education system. Form a Committee of 5 people. Cost: 8 Bits.

#### D. Simplified Summary of Instructions for Player

- You are a change team implementing education for sustainable development in an educational organization.
- There are 24 people in three units of the organization in which you will pilot the new approach: The District Office, Primary School, Secondary School.
- Five Stages of Use in adopting change across the top of the game board.
- Goals: Over a 3-year period you want: to get people to use sustainable practices and to increase productivity.
- Budget of bits: year one 35 bits; year two 30 bits; year three 25 bits.
- Choose one activity at a time from 18 activities
- Select activities that match people's needs given where they are in the change process.
- Feedback: As you select activities, bits will be taken from your budget, people will move" and you'll receive feedback on the results of the activity.
- After 3 years, we'll assess your success.