The possibilities of 21st century skills 2.0 by systems thinking toward new pedagogy

The magnitude and significance of the impact of the new type COVID-19 pandemic

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OIDA International Journal of Sustainable Development, Ontario International Development Agency, Canada.
ISSN 1923-6654 (print) ISSN 1923-6662 (online) www.oidaijsd.com
Also available at http://www.ssrn.com/link/OIDA-Intl-Journal-Sustainable-Dev.html

Abstract: The sudden appearance of COVID-19 is becoming a driving force for change in the global learning environment. The challenge of this crisis has already been heightened in Japan since the Great East Japan Earthquake of 2011, when the country was hit by the triple disaster of earthquake, tsunami and nuclear power plant accident, and a runaway object of COVID-19 and the earthquake require a synchronic transformation of the two through the simultaneous interaction of individuals and society. In this context, 21st century skills need to be exercised and trained. At this time, systems thinking, which breaks the negative chain of connections by looking at the big picture of a phenomenon and changing the mindset to do so, has been expected to be an innovative pedagogy. However, since thinking and performance are highly socio-cultural practices prior to domain specificity, this concept must be formulated in a way that is linked to culture. The integral consideration of thinking and culture is one of the issues that are essential to the proper execution of pedagogy, but are not discussed in detail in the current 21st century skills. Therefore, the purpose of this study is "How can systems thinking as a socio-cultural practice be explained and observed in practice?".

First, the socio-cultural tendencies of systems thinking are theoretically examined from the perspective of the unique Japanese value system called "*kankei* (the Japanese word for inter-relationships)". The first author has prepared the figure of the doors of 20 (omitted in this abstract) by combining abstract jargon of pedagogical concepts, not just lectures in pedagogy textbooks, but project work towards deep learning. *Kankei* is centrally located as a world views. in Japanese culture, on the doors of 20 such as curiosity (individual development and characteristics) and innovation (social process and structure). Curiosity are therefore founded upon the value attached to *kankei* and the fundamental concept of 'good living'. In Japan, social and learning interactions are considered 'successful' when they can be described as equitable, reciprocal, harmonious, stable and balanced. The emphasis on the quality of relationships promotes effective interaction, revealing the recondite knowledge of learners to their teacher, and to each other (Arimoto & Clark 2018).

These themes are pervasive in Japanese culture, naturally consistent with a persistent emphasis on equitable social- relationships (*kankei*) and holistic inter-connectedness (*tsunagari*). It is Japanese tradition that the sustainability of one's life, the perceived quality of one's existence as a 'connected being' are states of *tsunagari*. Such overarching philosophy impacts. not only classroom assessment (becoming more interactive/ verbal), but also how its application might transform the focus of curriculum design.

As such, young people should learn in environments founded upon carefully realised theories that go beyond the maintenance of a 'common' social connection (*kankei). Kankei* is, therefore, the traditional belief, or "background theory", that creates a 'spectrum of legitimacy'; sanctioning social-interactions to the extent that they are equitable, mutual, reciprocal, inter- subjective, or harmonious, stable and balanced. The Japanese classroom, as a microcosm of wider social life, is fully engaged with interactions that preserve *kankei*, assuring group connection and consensus (Clark, Nae & Arimoto 2020).

Next, the authors will elucidate the outcomes and possibilities of socio-cultural systems thinking practices, using examples from the author's own educational experiences at high schools and universities.

Finally, the author will point out the challenges of integrating context-dependent systems thinking, which is the impetus for a sustainable society, into educational design, and the issues to be considered in the future.

Keywords: coronavirus pandemic as a disaster for the world, *kankei*, pedagogy and visualization of worldview Risk of emerging infectious diseases (EIDs), systems thinking

Introduction

The sudden appearance of COVID-19 is becoming a driving force for change in the global learning environment. The challenge of this crisis has already been heightened in Japan since the Great East Japan Earthquake of 2011, when the country was hit by the triple disaster of earthquake, tsunami and nuclear power plant accident, and a runaway object of COVID-19 and the earthquake require a synchronic transformation of the two through the simultaneous interaction of individuals and society. The former is related to mainly SDGs 1 : End poverty in all its forms everywhere, 11: Make cities and human settlements inclusive, safe, resilient and sustainable, 13: Take urgent action to combat climate change and its impacts and the latter is related to SDGs2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture, 3: Ensure healthy lives and promote well-being for all at all ages,15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss at least.In this context, 21st century skills need to be exercised and trained. At this time, systems thinking, which breaks the negative chain of connections by looking at the big picture of a phenomenon and changing the mindset to do so, has been expected to be an innovative pedagogy. However, since thinking and performance are highly socio-cultural practices prior to domain specificity, this concept must be formulated in a way that is linked to culture. The integral consideration of thinking and culture is one of the issues that are essential to the proper execution of pedagogy, but are not discussed in detail in the current 21st century skills. Therefore, the purpose of this study is "How can systems thinking as a socio-cultural practice be explained and observed in practice?".

1. the socio-cultural tendencies of systems thinking from the perspective of the unique Japanese value system

First, the socio-cultural tendencies of systems thinking are theoretically examined from the perspective of the unique Japanese value system called "*kankei* (the Japanese word for inter-relationships)". The first author has prepared the figure of the doors of 20 (omitted in this abstract) by combining abstract jargon of pedagogical concepts, not just lectures in pedagogy textbooks, but project work towards deep learning.

Kankei is centrally located as a world views. in Japanese culture, on the doors of 20 such as curiosity (individual development and characteristics) and innovation (social process and structure). Curiosity are therefore founded upon the value attached to *kankei* and the fundamental concept of ‘good living’. In Japan, social and learning interactions are considered ‘successful’ when they can be described as equitable, mutual, reciprocal, inter-subjective, or harmonious, stable and balanced. The emphasis on the quality of relationships promotes effective interaction, revealing the recondite knowledge of learners to their teacher, and to each other (Arimoto & Clark 2018).

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microcosm of wider social life, is fully engaged with interactions that preserve *kankei,* assuring group connection and consensus (Clark, Nae & Arimoto 2020).

2. Examples from the author's own educational experiences at high schools and universities.

2-1 High schools

Since 2014, the authors have remained concerned about the OECD Tohoku school 2.0, which is the foundation of the OECD Future of Education and Skills 2030 project (Arimoto et al 2017). Experiments were carried out in pilot schools, ranging from the local community, Asia to the world as practical objects. On this basis, the Japanese typical cause-and-effect diagram is characterized by its geographical location surrounding the ocean and its habit of eating fresh fish, which makes it easier to understand the problem of overfishing. Students'voice were so positive as follows.

> Firstly, when I took on the work and saw other people's worksheets for the first time, I thought it was great that they had a completely different point of view, and had drawn their lines in ways that I would never have thought of. I thought it was very nice that everyone would always include what I had done too when we were making them together.
>
> For example, mine didn't have a lot of lines coming from one part when I compared it to what everyone else had done, but I still thought it would be good to connect them together in a loop as well. I was left with the realization that globalism and the environment are very closely related. For example, with the advancement of globalisation comes benefits such as exports, but the increase in industrialisation needed to obtain such benefits has an increasingly negative effect on the environment, and that's how I considered the two to be connected.
> So, with regional studies etc., where the way of thinking about studying has changed, I investigated the internationalization of regional studies, taking "Society and Akita" as a theme, and researched about global water issues. Then my studies focused on Ethiopia, and I learned many things that you cannot fathom while leading a normal life. Take drinking water for example, in truth there are only 13 countries that can drink the water that comes out of their taps. I never would have thought that. I don't think you can learn things like that from normal classes at all, so that was useful.
>
> After I took on the work, I realised it's important to have a multifaceted perspective. If I just think by myself, I feel things are going to go in one direction no matter what happens. So, not surprisingly, when everyone was together and contributing, I felt able to see things from perspectives that I couldn't see for myself before. This experience has made me want to have a flexible way of thinking that considers things from other sides, rather than thinking about the future arbitrarily as one outcome. How does that sound? With this loop picture, at first I had the somewhat biased view that it was =increasing=, no matter what. Yet, as expected, when I changed my perspective I found a variety of ways of looking at it, like, "Really, it's decreasing here," "This is interrelated," and, "It's unilateral here," etc. Lastly, I feel I could have expanded more on even the =words= which, regrettably, I couldn't allude to. That may be something I regret slightly.

In the Disaster Science Course at the Miyagi Prefectural Tagajo Senior High School, which was newly established in 2016, the authors reported that in the new course called "life & disaster", we have prepared and worked on tasks to look at tsunamis and other disasters in total, and have interviewed students (Note 1). In 2011, the Great Eastern Japan Earthquake (GEJE) changed the perception, learning, and worldview of students and teachers. With the focus on overcoming the exam-oriented learning skills and after-effects at universities, as a starting point, it coordinates with knowledge acquisition and participation, as well as the knowledge and cultural creation, and even extends the perspective of solution to learning.

It is widely recognized that the COVID-19 pandemic has had a dramatic impact on various parts of the world. Specifically, many schools decide to suspend classes as coronavirus precaution and encourage staff to work from home, which have greatly changed people' sense of value. As an applied science, Pedagogy must not to be helpless, and it is necessary to propose a so-called "21st century skills 2.0", package them up and scoops them up without falling over.
Japan has been learning through trial and error for the new forms of educational system where schools, teachers and students solve global issues. The purpose of this study is to explore a profile of 21st century skills 2.0, which is an extension of the devastating earthquake, tsunami and nuclear accidents in Japan.

2-2 University

The crisis situation we care tring to get out of require a new approach to teaching that enable students to master complex systems made up of a large number of elements. How teachers smoothly invite students to the real life is crucial for fostering their higher-order thinking. However, teaching is a paradoxical profession. Indeed, today it is a uniquely paradoxical profession. Of all the jobs that are professions or aspire to be so, teaching is the only one that currently undertakes formidable task of creating the human skills and capacities that will enable societies to survive and succeed in the age of information. Indeed, teachers, especially in developing countries, have more hope than anyone else to build learning communities, create the knowledge society and develop the capacities for innovation, flexibility and commitment to change that are essential to economic prosperity in the 21st century. Meanwhile, public expenditure, public welfare and public education are among the first expendable sacrificed casualties of the slimmed-down state that informational societies and its economy seem to require. Just when so much is expected of them, teachers appear to be being given less support, less respect, and fewer opportunities to be creative, flexible and innovative than before.

Teachers, in other words, are caught in a dilemma. They are expected to be leading catalysts of the informational society, yet they are also one of its prime casualties. This is a daily challenge for teachers themselves and a policy challenge for those who want to reform and improve teaching (Hargreaves & Lo 2000). Traditional 21st century skills 1.0 does not appear full-fledged in that we cannot reconcile skills with their assumptions, or our mental model and mind set.

To reconstruct their interactive relationships, the first author has developed the framework to open the capabilities for living after the GEJE, which could be utilized to critically analyze the dynamic connection between society and person (Fig.1). This lens would make us point out the limitation of the 21st century skills 1.0, and reconsider the 2.0 as a new perspective.

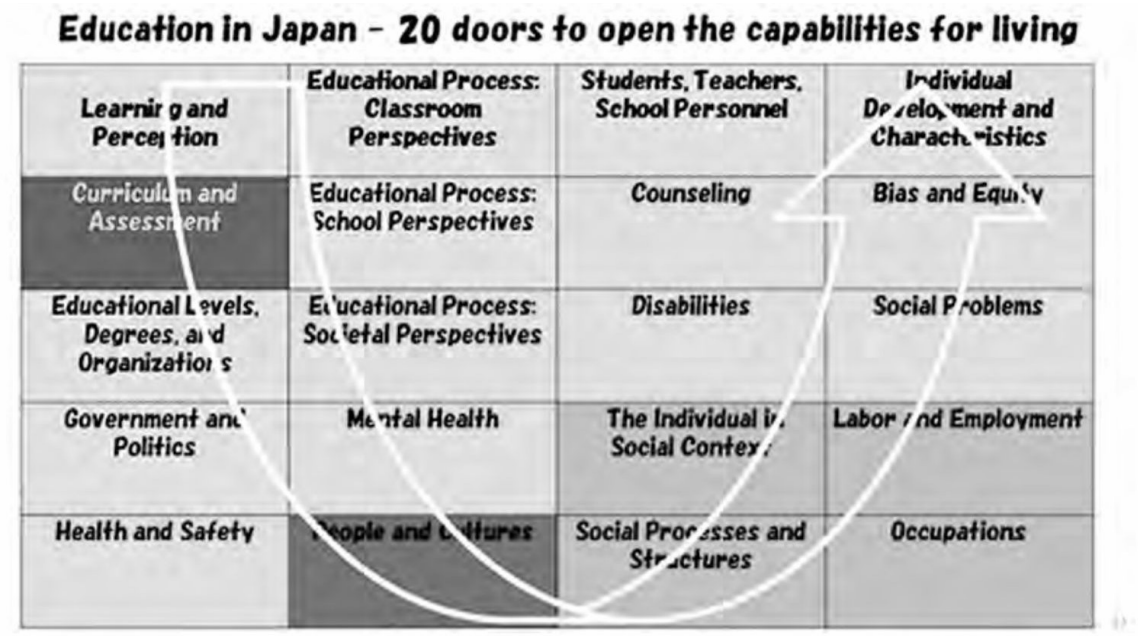

Fig.1 “Curriculum and assessment” and 19 other components (Arimoto & Xu 2016: 11）

The author posed a question as to how far the "practitioner" 's perspective and practice-driven sense could be scooped up by the Western-style social science abstract concept and system-boundary initiative. Aiming to move back and forth between theory and practice, I aimed to stay on the same table as in the West.

Furthermore, the "worldview", which is a comprehensive belief and value by individuals and groups, which was developed at various levels as a process based on historical social culture, was included. The main premise was to perceive and interpret life and the universe and start from one's own reality.

Therefore, the author attaches great importance to the “local area” such as the historical stage, health and safety, labor and livelihood, and social economy.

Then, the product is designed to include psychological personality characteristics and 21st century skills by emphasizing environmental sustainability rather than only employability, in short introducing the dimensions of viable, *equitable*, and *bearable* as forms of unsustainability.

Students’voice were so positive as follows.

> I would like to think about what kind of education is that respects the individuality of each student and establishes an identity and one's own goodness. In summary, I would like to learn how education should help students build relationships of trust with teachers and classmates, and establish themselves while learning how to deal with stress and anxiety. I enjoyed studying.

The added important door of doors 20 is safe and health. Japan has a history of struggling with environmental changes and disasters in the geology and geopolitics of its land since ancient times. Its history has been described as “bearable, durable, and equitable” through three social cultural and economic aspects:
Helping each other, “Caring” and “sympathy”, which have influenced mindsets such as the so-called nexus of mind and heart and spirit, effort, tolerance, and ambitions.
Hazards includes pandemics shown in intersection of multiple hazards and coupled human-natural systems that create risk with society (USGS, 2018). However, in East Asia, especially in Japan, historically, society has inseparably overlapped with human views, and its relationship with Western Europe have different worldviews

One can probably assume that the most significant threats in the future are potentially related to nuclear pollution, epidemics, and disasters related to global warming (such as polar ice caps melting, floods, and heavy storms).
An earthquake may cause power blackouts, fires, landslides, floods, or water shortages. Thunderstorms may result in blackouts, fires, landslides, or floods. Floods may lead to shortages of drinking water, blackouts, landslides, or epidemics.

Pogroms in the population may occur, if it makes certain minorities responsible for the disaster. And that is particularly relevant for certain diseases, religious or racial affairs. Epidemics are a typical problem after disasters, either because water is contaminated, or because a large number of corpses cannot be buried fast enough, or because the health of the population is on all accounts challenged (e.g. due to hunger or cold). Finally, disasters have the most economic serve consequences, sometimes over many years. Due to this and in case of problems in disaster response management, the state may lose reputation and the governing party may lose its power.
The potentially most significant disasters are epidemic diseases, as they can easily spread across countries. Epidemics have sometimes determined the result of wars or the rise or fall of people or cultures (Helbing, Ammoser & Kühnert 2006).

3. the challenges of integrating context-dependent systems thinking

Humans are able to see patterns, congruences, and inconsistencies while still focusing on the whole. This capacity allows them to consider many perspectives and to imagine how changing one element can have an impact on the total system. For example, we can see the genomic epidemiology of novel coronavirus Animation in progress. However, systems thinking is now considered as a worldview in a sense. Mahmoudi et al. said, “Systems thinking is a way of thinking, worldview or paradigm. In other words, independent of specific methods, tools or techniques used for modeling systems, systems thinking has a separate nature, which can be learned and practiced.
Although similar in the representation of systems thinking as a skill set, the definitions commonly used in assessment cover a variety of skills which sometimes extend way out of systems thinking, especially as a worldview

- Comprehensive belief/ value systems held by individuals or groups - fundamental frameworks for perceiving and interpreting life and the universe. Systems thinking is, in nature, a part of our unconscious worldview which can be taught and practiced independent of system methodologies such as system dynamics.” (Mahmoudi et al 2019)

Of course, students have no chance against figuring out the unconscious worldview alone. In light of that, The National Curriculum Guidelines since 2020 in Japan has a strong affinity for systems thinking. The new teaching guidelines place importance on active learning methods, in which students learn proactively through debates and other learning activities, in order to nurture their intellectual ability to find and resolve problems themselves. For this purpose, many of the new textbooks present learning challenges at the beginnings of chapters and subchapters, and encourage students to have debates in groups after the end of the sections to deepen their understanding.

By contrast, as previously indicated, it is notable for revisiting the concept of systems thinking, which would be regarded as one including cultural aspects, for culturally recontextualized pedagogical approach. Let us give you one example with room for improvement.

In one report, the situation of the new coronavirus was visualized to confirm the systemic features of the new coronavirus infection from two perspectives with causal loop diagrams (Fig.3). The first one is the loop diagram of the pandemic "infection model" and "patient response model". It turned out that there were serious system weaknesses that occurred at the interface between the two models. For instance, raising the hurdle for testing will increase the number of mildly ill persons who are active in the market without undergoing testing, increasing the chances of infection and increasing the number of new infections. This creates a new spread of infection. The second one is the loop diagram that shows Japan's economic destruction due to a pandemic (the Japanese turning point, or corona shock). According to this, the use of telework may be the key to transform the loop of the "Nippon Keizai Naraku" (Japanese economic abyss). Indeed, merely switching to teleworking under the current system may result in a decrease in efficiency due to the division of employees and confusion among managers, which may lead to a "business stagnation". Nevertheless, a distributed organization may shift to "self-organization" or "organizational response" (Note 7).

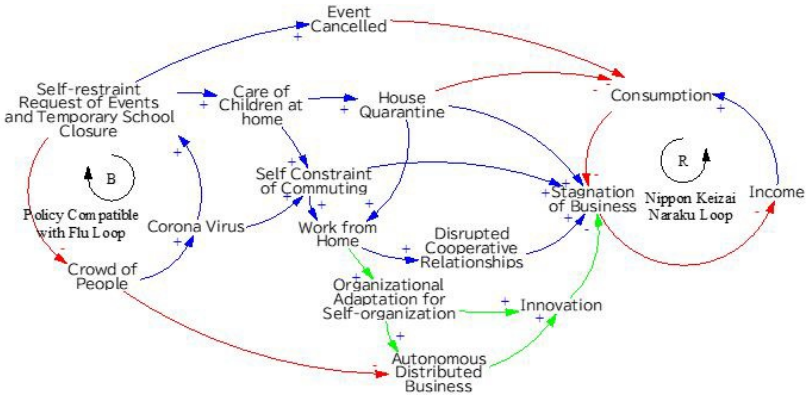

Fig.2 Corona-shock impact on society (Note 7, translated by the authors)

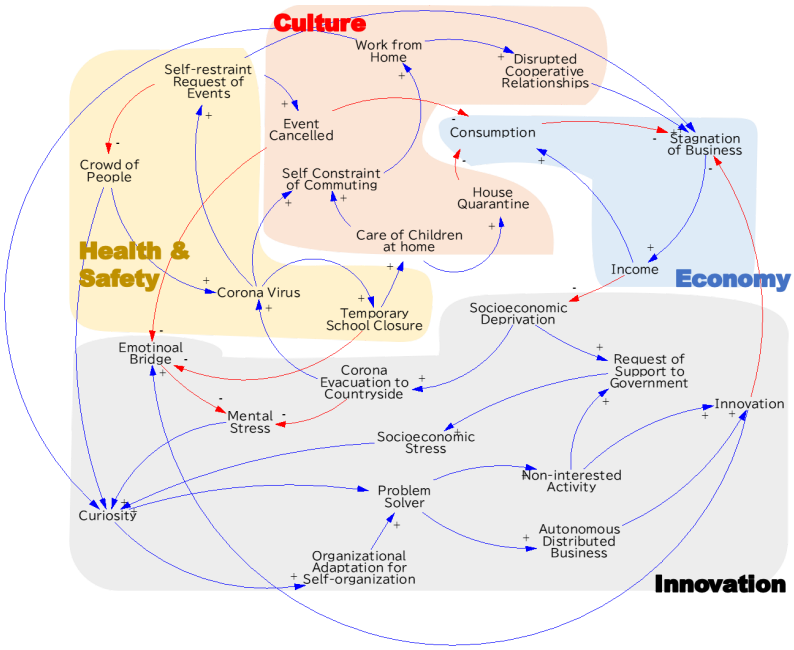

Fig.3 Modified version of Fig.3: focusing on culture and innovation

Figure 3 shows a modified version of new causal loop diagram that takes into account the cultural bedrocks that partially control thoughts, such as mental models and mindsets. In addition to Health & Safety and Economy categories drawn in Figure 2, Innovation and Culture will have to be redesigned to work and encompass the entire system. However, since social processes and structures are intertwined with more complex contexts, the Innovation and Culture must be explained from multiple dimensions.

Regarding the relation between Figure 3 and Figure1, the author put a kind of prerequisite. In short, author expansively emphasized student 'taking ownership' of their learning: personalising learning, so that all students are able to progress, achieve and participate as well as mutual ownership of the educational process. Curiosity is considered as personality traits, and one of the key representative 21st century skills. Curiosity itself, which is an important factor, was supported not only by self-efficacy but also by collective efficacy through the shared property of human resources, intellectual property, and local property. Goods were read as services and tried to prepare a dynamic framework for value creation.

Figure 1 intends to see the whole beyond the parts or events by leading wholes, especially adopting a multidimensional view (educational process: classroom, school, societal perspectives). That supports to see the parts in the context of the whole by assessing significances, which influence indirectly (ex. health & safety, and labour & employment).

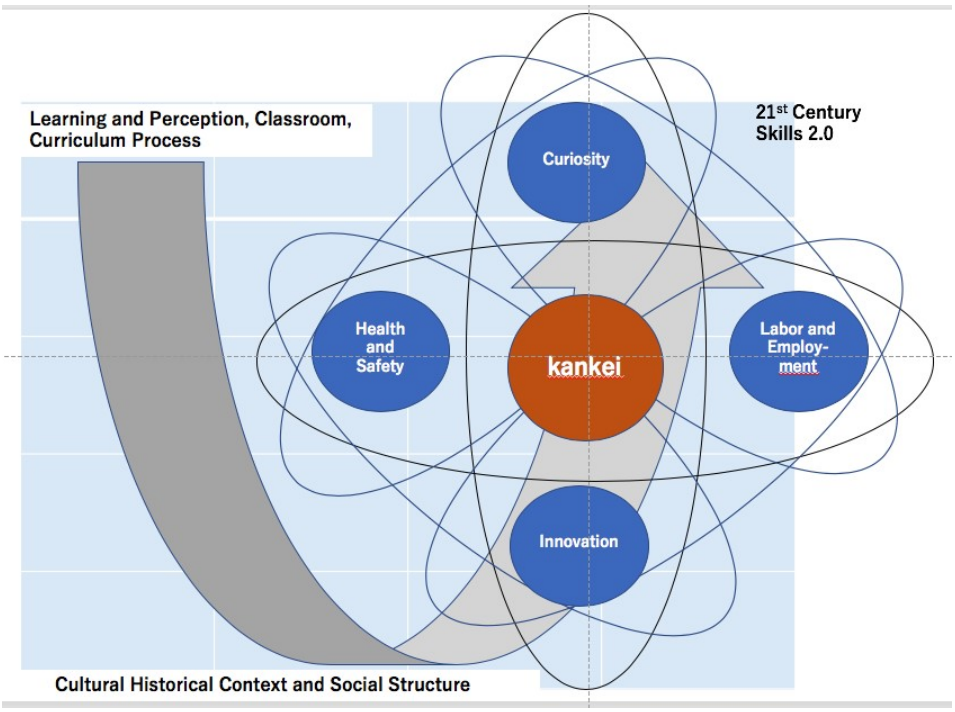

Figure 4 *kankei* as socio cultural value concepts on doors 20

In the Figure 4, *Kankei* is centrally located as a world views In Japanese culture, on doors 20 such as curiosity (individual development and characteristics) and innovation (social process and structure).
Curiosity are therefore founded upon the value attached to *kankei* (the Japanese word for inter-relationships) and the fundamental concept of 'good living'. In Japan, social and learning interactions are considered 'successful' when they can be described as equitable, reciprocal, harmonious, stable and balanced. The emphasis on the quality of relationships promotes effective interaction, revealing the recondite knowledge of learners to their teacher, and to each other (Arimoto & Clark 2018).

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Moral education in the Schools of Japan include respect for life, good manners, personal hygiene, individual freedom, respect for the advice of others, and rationality. Moral education is infused into such physical education activities as kendo and karate, into student-teacher interaction (Thomas 1985).

Regarding *Omoiyari* no leadership, compassion is becoming important. Compassion is sympathetic concern for the sufferings or misfortunes of others. Tibetan scholar Thupten Jina teaches that compassion has three components: cognitive (I understand you), affective (I feel for you), and motivational (I want to help you). The practice of compassion is moving one's concern from self to others. For integrative leadership, the essence of that pebble is "informed mindfulness"—a concept that connects mindful self-awareness and self-regulation with educated decision making. The mindful person is aware and non-judgmental of what is occurring in the present moment. In other words, he/she understands that his or her response is a choice. With informed mindfulness, as situations arise and decision points are faced, that same person is able to place what is happening in its larger context and, having clear values and being sufficiently educated, makes an informed choice within that moment. This concept—self-awareness and self-regulation coupled with knowledge, skills, values, and wisdom—forms the foundation of integrative leadership (Arimoto & Xu 2016).

At least, in this simplified diagram, we can mainly point out the following two respects.
The first is the relationship between culture and extraordinary activities such as self constraint of commuting and home quarantine. One of the reasons why Japanese government hesitates to forcefully declare the Lockdown is not only because of the democratic characteristics and its impact on economy, but also because of the premise that while Western people often build trust between individuals for constructing trust society, we tend to depend on the concept of safe society, where the safe atmosphere is originally embedded in the community (Yamagishi 1999). In the safe society, the closed community introduces the mutual monitoring systems, instead of establishing the trust relationship between citizens, so as to improve the awareness of cooperation and promote the adherence to the rules. In particular, Japan's tendency, which demarcates the *uchi* (inside) and *soto* (outside) of the group, motivates people to maintain a sanitary environment and inspires them to show *omoiyari* (anticipatory communication/ Japanese style sympathy), in order for individuals not to be precluded from their groups, and for them to keep caring each other and sustain the community (Arimoto 2017). The possible reason why individuals who become infected try to conceal their social status and action history might be due to the culture that is dreading being marginalized from the group.
The second is the relationship between curiosity and innovation. The curiosity under self-determination theory (SDT), which shows the stages of intrinsic motivation (Ryan and Deci 2000), is clearly united strongly with adversity and crisis in the context of COVID-19. Economy-oriented innovation in Japan includes young entrepreneurs collecting and selling crops online to reduce food loss, and opening up some services for free or at low prices to revitalize the company and relocate activity bases to virtual network for labor and education. However, innovation also contributes to non-economic activities rooted in the common good beyond capitalist economy. We can confirm that in Japan videos that tell us how to make handmade masks are shared quickly and spread nationwide via SNS, and voluntary neighbors and civic associations distribute sanitary goods without charge to people with disabilities and the elderly. Therefore, the accumulation of stress and unusual experiences can evoke curiosity and even arrange opportunities for wildfire activities that "pop up in unexpected locations at unexpected times and expand very rapidly" (Engeström 2009).

From the above, it is clear that the curiosity emerged from the community and supporting 21st century skills (Fadel, Bialik & Trilling 2015) has a strong relation with cultural structures. Therefore, it is needed to to apply cultural-based systems thinking to educational practices presupposing that the utilization of systems thinking inevitably entails inherent cultural uniqueness. Students put an effort to understand the complexity of the culture that underlies their social structure and processes as well as the complexities of visible phenomena, and handle them appropriately, so that they would develop skills optimized for the community of practice.
In this way, if pedagogy is based on powerful knowledge innovated by "Curiosity backed by Japanese culture" and "21st century skills 2.0" with system thinking as the core, regional revitalization may be created while changing 'existing' businesses.

Conclusions

All COVID-19 related matter depends on Japan's culture (Note 8). Particularly since the pandemic is likely to continue into 2021, this does not need to include limitations of the model, but it can include an acknowledgement of a "new normal" in teaching and learning. This study demonstrates that a scientific interdisciplinary approach relies on an understanding of mutual causality. Words like synergy, feedback, causal loops, symbiosis are now becoming part of our language as our thinking is changing dramatically (Thayer-Bacon 2003p.166). The concepts of

knowers as selves-in-relation-with-others (p.182). Because Buddhists believe in the interconnectedness of all things, they believe in compassionate caring for life in all life's forms (which includes nature).Monotheists no longer consider the environment divine, only God is divine (p.159). In Japan there is a saying that I pursued my studies to save the people to whom I am indebted. The best way is become aware of our own socially constructed "reality" and what we count as "knowledge" is to listen to others' voices that are outsiders to our own views (p.153).

At present, pedagogy has been restructured under the theme of "Identifying 21st Century Skills and *mikiwame* (find out the truth with your own eyes/ to see into the heart of things to have a clear view [picture] together/ group quest for knowledge)." We are promoting active engagement learning while collaborating with students on such plans. Thus, the authors are proposing this assessment and pedagogy as "three steps forwards, two steps back" (Shimojima & Arimoto 2017)

Note

(1) As of 2019, there are two high schools that establish the disaster science course in Japan. The course in Hyogo Prefectural Maiko High School, located in affected areas by Hanshin Awaji Earthquake Disaster in 1995, was set in 2002 as the country's first one.
(2) Title: Coronavirus forces Japan schools to grapple with online education. Available at:https://asia.nikkei.com/Business/Technology/Coronavirus-forces-Japan-schools-to- grapple-with-online-education [Retrieved on April 11, 2020]
(3) Title: Parents' voice towards suspension of class. Available at:https://www.channelnewsasia.com/news/singapore/covid19-coronavirus-education- learning-centre-tuition-enrichment-12587216 [Retrieved on April 11, 2020]
(4) Title: Coronavirus forces Japan schools to grapple with online education. Available at:https://asia.nikkei.com/Business/Technology/Coronavirus-forces-Japan-schools-to- grapple-with-online-education [Retrieved on April 11, 2020]
(5) Title: Facing the COVID-19 crisis in Japan with a disability. Available at:https://www.japantimes.co.jp/community/2020/03/30/issues/coronavirus-disability/ #.XpHLKiW-vDs [Retrieved on April 11, 2020]
(6) We saw the interesting picture at, https://www.facebook.com/597941924/posts/10157313027246925/?d=n [Retrieved on April 11, 2020].
(7) This interpretation was on the basis of following two websites, http://www.saltad.co.jp/systemthinking3/covid/ [Retrieved on April 13, 2020] and https://note.com/amacrinecell/n/ne66f7a9d001e [Retrieved on accessed at April 13, 2020].
(8) The Japan Times (2020) Does Japan's culture explain its low COVID-19 numbers? https://www.japantimes.co.jp/community/2020/04/01/voices/japan-culture-low-covid-19-numbers/
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