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Article

A Review of Literature on Co-Design Process for Education

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Abstract

The educational institutions in the Philippines continue to have all preparations in full swing as it ensures learning continuity amid the pandemic and even beyond. With technology as one of its aids and learning as its central concern, continuous exploration of technology use in various learning modalities might be co-designed with its learners, teachers, and researchers. This article contained a review of six studies centered on the co-design process in integrating technology for education. The review focused on examining technology inclusions as to the process and outputs, exploring different co-design frameworks, and elaborating its implications to the Philippine basic education research agenda and the current learning modalities. With the gleam that the educational landscapes may eventually gain from collaborations among its stakeholders, this article explored the applicability of the co-design process in the context of basic education.

Keywords

Co-design, co-design framework, Design-based research, Technology integration, Basic education

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Introduction

Amid the digital rise in education, teachers and students can maximize the use of technology if they participate in the design process. As Kennedy and Dunn (2018) found that students had a sure stand on how they wanted to improve technology-enhanced learning, designing its use with the students through the co-design process might yield promising results. Digital technology has brought a magnitude of support to education, and its optimization is being taken into greater use as the world faces a pandemic. Furthermore, since the Department of Education announced learning continuity through varied learning modalities (Department of Education, 2020), teachers have organized capacity training. Some of these are webinars about going virtual (EdutechAsia, 2020), the preparations for flexible classes (Peac.org.ph, 2020), online teaching (UPOU, 2020), and distance learning (Cañete, 2020).

Technology utilization is successful in education (Young & Nichols, 2017; Nicolaou, Matsiola & Kalliris, 2019; Pechenkina & Aeschliman, 2017; Nueva, 2019). As Nueva (2019) reviewed, technology is integrated into the classroom to provide instructional support, information referencing, and communication and collaboration platform; this era of online learning and blended learning might capitalize on its continuous utilization for education. Technology users might be the most opted voice to pinpoint what works and does not with its utilization in education. With that, the careful planning of technology use may play a crucial role in the design process. Co-design (Reeves, 2006) calls for enabling the users to collaborate with the researcher or the teacher in designing technology integration. Moreover, this review focuses on the enormous possibility of the co-design process' usefulness in the field of educational technology, specifically in the Philippines, and its efforts to promote learning continuity (Department of Education, 2020).

In particular, this review aims to (1) describe the co-design process as design-based research; (2) explain technology integration through co-design; (3) identify the processes in co-designing, and (4) provide implications for its use in the Philippine basic education context.

Method

The six reviewed studies came from 2013-2019 published articles on co-design as design-based research, co-design as technology integration and educational tool development, and co-design as a process. This paper reviewed six studies. It provided an overview of the technology integration aspect of its project output or the process itself. In addition, the iterative cycle of different frameworks and the implications of their use in the context of the Philippine basic education landscape were part of the review.

A review of the Definitions of Co-design

The co-design or co-creation approach in research involves the collaboration of researchers and the end-users by allowing a detailed specification of interventions and outcome measures from the onset of the study (Goodyear-Smith, Jackson & Greenhalgh, 2015).

Naranjo-Bock (2012) defined co-design as allowing users to be an active part of a product's creative refinement, bringing out diverse points of view in the design process and its output. This approach is under the umbrella of design-based research. Design-based research is an approach that backs the exploration of educational problems and refining theory and its application by defining a pedagogical outcome and then focusing on creating a learning environment that supports the outcome (Reeves, Herrington, & Oliver, 2005; Wang & Hannafin, 2005). Kennedy-Clark (2013) noted that design-based research is anchored on the fundamental principles enumerated by Reeves (2006). The fundamental principles of design-based research are to address complex problems in real-life contexts in collaboration with practitioners, integrate general and hypothetical design principles with technological advances in rendering plausible solutions to complex problems, conduct a rigorous and reflective inquiry in testing, refine innovative learning environments, and define new design principles.

Since co-design is under the category of design-based research, its phases are similar to the preliminary phase, prototyping phase, and assessment stage (Plomp, 2017). According to Alghamdi and Li (2013), Reeves (2000; 2006) developed design-based research and suggested phases. These phases include analyzing practical problems by researchers and practitioners, developing a theoretical framework, evaluating and testing solutions, and documentation and reflection. Furthermore, with these phases, one of the goals is to suggest new 'design principles.' The co-collaborator between the two designs sets each apart. The co-collaborator for design-based research is an expert or group of experts, while the co-design process involves the end-user.

Co-design and its similar notions were also explored in other fields. For instance, co-design was explored in products and services by checking the involvement of users in the design process (Sanders & Stappers, 2008), see figure 1. Its landscape was also explored among the participative, co-operative, and co-creation as applied to service designs (Holmlid, 2009), the benefits of co-design in service design projects (Steen, Manschot, & De Koning, 2010), and the effect of customer involvement in service design teams (Trischler, Pervan, Kely, & Scott, 2018). It was also studied in public service by exploring public service design ideas (Trischler, Dietrich & Rundle-Thiele, 2019) and the potential impacts of digital technologies for public service (Lember, Brandsen, & Tõnurist, 2019). Finally, co-design is also explored in the field of engineering, particularly in the engineering design process (Garcia-Sanz, 2019), in computer-based representations of products (Gyi & Campbell, 2010), and in co-designing the requirements and architectural objects (Pohl & Sikora, 2007).

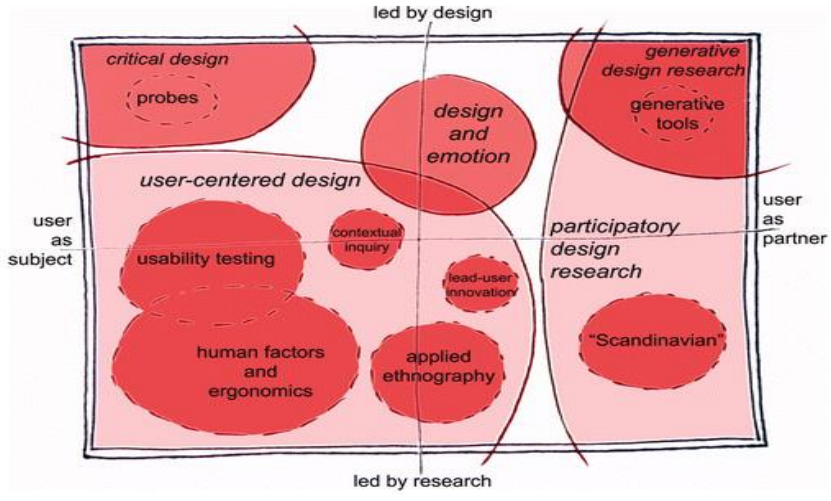

Figure 1: The current landscape of human-centered design research as practiced in the design and development of products and services. (Sanders & Stappers, 2008)

Co-design also shares the view with the participatory educational design (Janssen. Könings, & van Merriënboer, 2017), where varied stakeholders generate and consider alternative learning spaces. It aims to create a mutual learning process and high-quality and usable designs. This educational design sprouted from the notion that the proposed change in education is straightforward, but its implementation is complex, and its sustainability is way more complicated. Therefore, Janssen, Könings, and van Merriënboer's (2017) paper laid out tools that may facilitate participatory educational design for classroom teaching. For example, the laddering tool aids the participants to have a deeper understanding of each other's experiences which may eventually result in better decision-making. In contrast, the building block tool provides the non-professional participants with customary language to better discuss current and desirable teaching practices. Meanwhile, in a study by Könings, Brand-Gruwell, and van Merriënboer (2011), they identified the perceptions of teachers and students in the co-designed instruction as they called it 'participatory instructional redesign.' Then, they took the perceptions of both co-designers and examined their congruence to re/design the instructional co-design.

It is also important to note that though co-design and participatory design are similar designs. However, Bäck, Friedrich, Ropponen, Harju, and Hintikka (2013) discussed their slight difference. Their study emphasized that co-design focuses on the collaborative nature of design activities across the entire span of the design process (Sanders & Stappers, 2008). Co-design pays special attention to the early phases of the design process where ideas are yet to be formulated (Sanders and Stappers, 2008). Co-design is collaborative, methodologically transparent, continuous, and has multiple viewpoints (Bradwell and Marr, 2008), while the participatory design may focus on one phase and may not always be open to multiple viewpoints.

Taking the internet into great use is the web-based co-design (Friedrich, 2013). Web-based co-design refers to designing new products and services with users by applying social media tools and collaborative practices. "It includes early ideation (user innovation), active participation by users (participatory design), and systematic design process and methods (user-centered design)," as illustrated in figure 2.

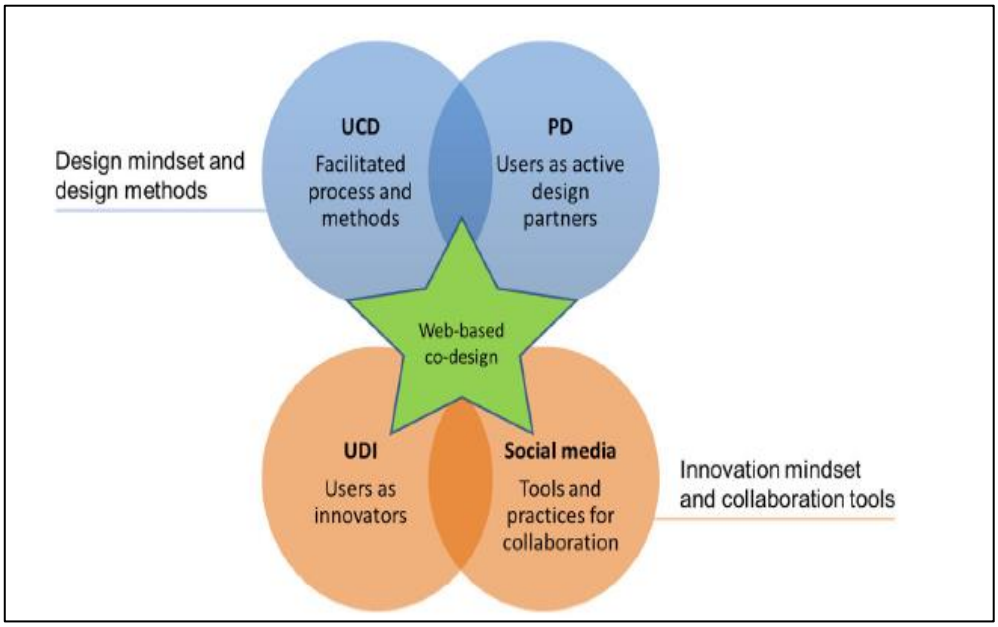

Figure 2: Web-based co-design framework by Friendrich (2013)

Co-Design for Technology Integration

The co-design process also sprouted from the idea of Carl Rogers (Rogers, 1969; Rogers & Freiberg, 1994), who proposed the facilitative learning theory. The facilitative learning theory states that learning may occur when the teacher acts as a facilitator of learning by establishing a safe environment in which learners have the opportunity to acquire new knowledge and experience (Miller, 2001).

Rogers (1969) argued that educators should encourage learners to plan for their directions based on their interests. The use of co-design processes may enable learners as users of technology to be responsible for their learning by planning and designing it with the teacher ahead of the instruction proper. It is congruent with how students viewed technology-enhanced learning when Kennedy & Dun (2018) found that students had a clear stand on what they wanted to improve. However, the study shows a gap in understanding how students want to use technology and how frequently they decide not to engage with technology-enhanced learning. This section reviews the technology integration in the co-design studies.

Co-designing Inquiry-Based and Technology-Enhanced Learning Scenario (Barbera, Garcia & Fuertes-Alipse, 2017). With the help of CompendiumLD software to represent and share prototyping activities in a graphical manner, the study focused on a detailed analysis of the co-design process. The paper identified the moments of change during co-design and described the agents and causes that motivated them. Also, the study is part of a broader research project on re-designing a Sustainable Development online course delivered via a virtual campus.

Co-designing TEL Resources (Treasure-Jones & Joynes, 2017). In health care education, the co-design process can develop technology-enhanced learning tools with the users in the research project called The Learning Layers. The paper highlighted the collaborative development approach, which gives importance to the expertise and creativity of the learners. It also focused more on the process of co-design rather than the output of the project.

Co-designing Virtual Manipulatives (Hansen, Mavrikis & Geraniou, 2016). The paper delved into the impact of the co-design process in a virtual manipulative named Fractions Lab on professional development and teaching and learning of fractions. It is vital to note that this study involved 21 primary mathematics specialist teachers as co-designers of the virtual manipulatives while checking their technological pedagogical content knowledge using the TPACK framework (tpack.org, 2012).

Co-designing Mobile Educational Tool (Mwandosya, Montero & Mbise, 2019). The paper focused on the participatory approach in co-designing the CBE (College of Business Education) Mobile Educational Tool, a mobile application prototype that helps access departmental-related materials and other teaching and educational functionalities. The process involved lecturers, researchers, and mobile application developers.

Co-designing Online Environment (Kyza & Nicolaidou, 2017). The study involved the researchers and three Science teachers co-designing a web-based learning environment on Biotechnology, Genetic Engineering, and Genetically Modified Organisms (GMOs) for Grade 11 students in Cyprus. The STOCHAMOS, a web-based teaching and learning platform, was used as an authoring platform. Students in this study acted as users, testers, and informants rather than design partners.

Co-designing via Web (Friedrich, 2013). The study examined the use of social media for user-centered design, participatory design, and user-driven innovation. The Owela (Open Web Lab), which includes blog-based discussion tools, user diaries, chat, questionnaires, and polls as web-based tools, were made and used for the co-design process. However, the study pointed out that it is not a substitute for the face-to-face method but a compliment to secure constant user interactions.

Co-Design Process

For the overview of the co-design methods and practices, the article of Naranjo-Bock (2012) enumerated the different stages involved in the co-design, starting with self-reflection research methods. The process starts with reflective prompts that may enable the co-designers to reflect on their previous and current experiences and problems related to the current topic or concept at hand. The organization of co-design workshops is the next phase. In 90 minutes to 120 minutes, co-designers undergo workshops depending on the project's goal. The strategies include collages, cognitive and context mapping, storyboards, inspiration cards, modeling, paper prototyping and sketching, and games. These strategies will unlock the ideas and concepts of the users as they co-design the project. Finally, it elaborates that pilot testing is typical in the co-design process to examine the effectiveness of the designed output, the time allocation, and the physical locale. The data obtained from these phases are tangible representations of the co-design aims.

Co-designing Inquiry-Based and Technology-Enhanced Learning Scenario (Barbera, Garcia & Fuertes-Alipse, 2017). As participated by one teacher, two students, and the researchers, the study applied the co-design methodology and various cited design models (Cober et al., 2015; Emin-Martinez et al., 2014; Spinuzzi, 2005; Zaphiris, Laghos, & Zacharia, 2005).

The research consisted of five iterative cycles, as shown in figure 3—the first phase, with two workshops, comprised of the introduction to the dynamics of co-design. The second and third phases have three workshops focused on designing the learning scenarios. The fourth phase, with two workshops, dealt with prototyping the learning scenarios using the Compendium LD program. Finally, the last phase, with four workshops, focused on critiquing the prototypes.

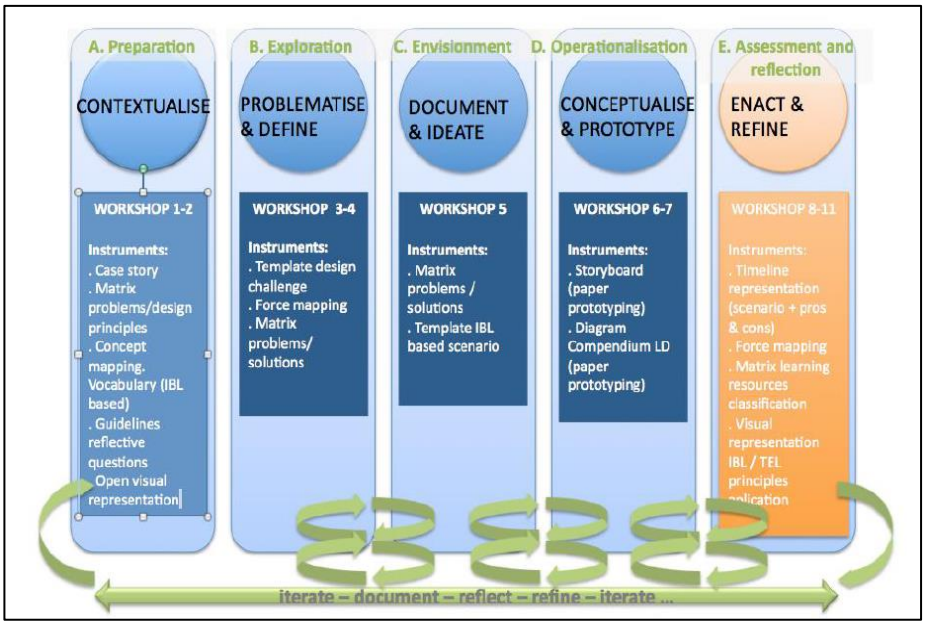

Figure 3. Co-design Process from Design-Based Research Framework (Barbera, Garcia & Fuertes-Alipse, 2017)

The iteration cycles of Barbera, Garcia, and Fuertes-Alipse (2017) were well-defined, citing the changes within the three versions. One of the study's strengths was when the design iterations clearly showed the processes in each phase and the instruments needed. The CompendiumLD software (Conole, 2009) to visually illustrate the intermingling ideas, arguments, and issues during the design process was also worth noting. It made the storyboarding, prototyping, and enactment time-saving and convenient. Since the co-design was utilized not to form or create new learning scenarios but to strengthen and refine the then learning scenarios, the co-design has enriched the learning scenarios, defined the agents' roles, and figured that it acted as the mediator in the entire study.

Co-designing TEL resources (Treasure-Jones & Joynes, 2017). With a total of nine design iterations involving storyboarding, paper prototyping, and software prototyping, the study pointed out that the co-design process requires time investment and openness to novel ideas and compromise. The co-design loops in figure 4 centered on four core processes, namely analyze, design, develop, and test. These were supported by design tools, namely storytelling, storyboarding, games, paper prototyping, and design testing.

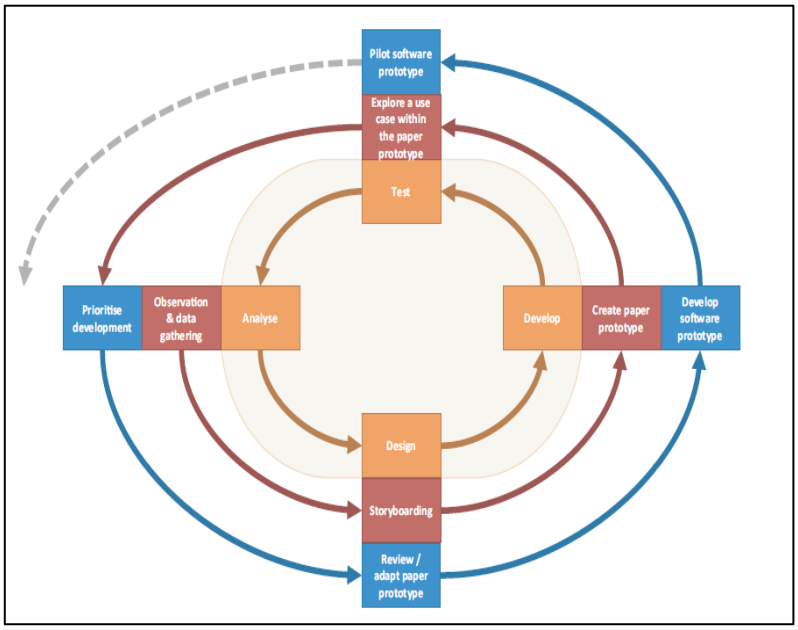

Figure 4 Agile development and Co-Design Process (Treasure-Jones & Joynes, 2017)

Co-designing Virtual Manipulatives (Hansen, Mavrikis & Geraniou, 2016). The study reported the transformation of the Fractions Lab as a virtual manipulative. However, it has provided more discussion on the role of the co-designers, particularly the teachers' technological, pedagogical, and content knowledge using the TPACK framework shown in figure 5. Also, the learners ages 9-11 served as informants of the study and not as co-designers. The research followed the design-based method by utilizing the design-trial-reflection cycles comprising of four phases. These phases were (1) inquiry on teaching fractions, (2) observation and recording of actions, (3) immersion and engagement with experience, and (4) consideration of ideas.

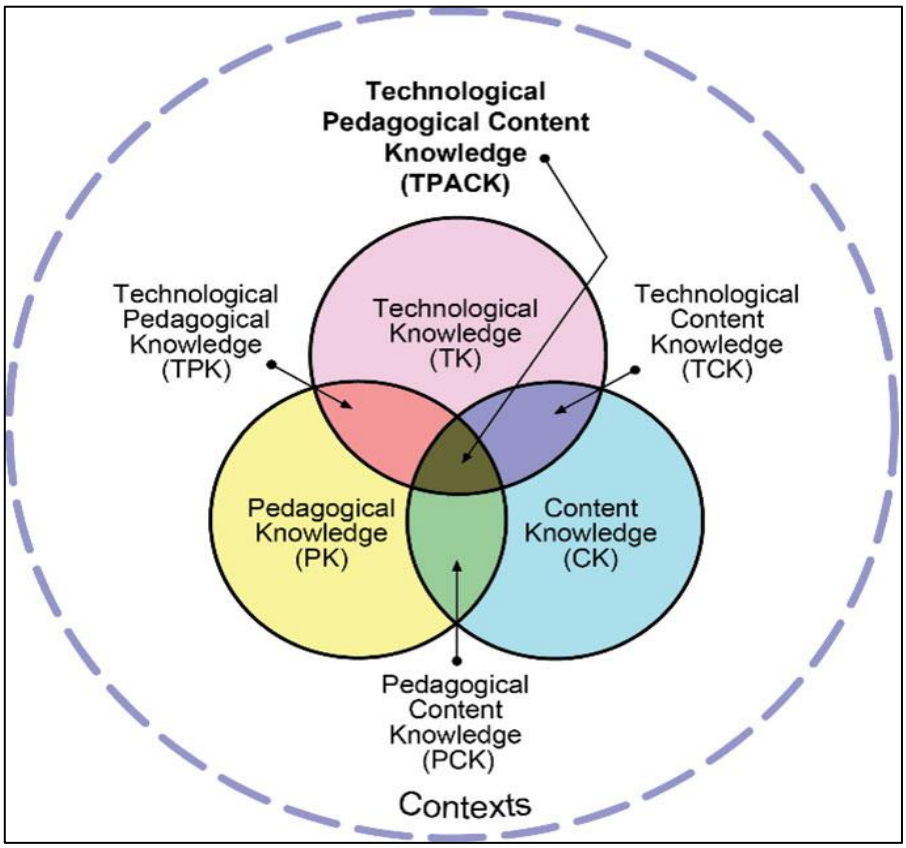

Figure 5 TPACK Framework (tpack.org, 2012)

Their paper suggests that virtual manipulatives for the Sciences and Mathematics, Reading, and Literature may be co-designed with learners. Young Filipino learners may point out what works for them, so if they have the opportunity to co-design virtual manipulatives with the teacher, there might be an added enjoyment and learning among them.

Co-designing Mobile Educational Tool (Mwandosya, Montero & Mbise, 2019). The participants were 25 lecturers, three researchers, and one application developer to develop a mobile educational tool. There were four workshops following the phases illustrated in figure 6. The process includes the explication of the problem, outlining the artifact, development of the artifact, and initial evaluation of the prototype.

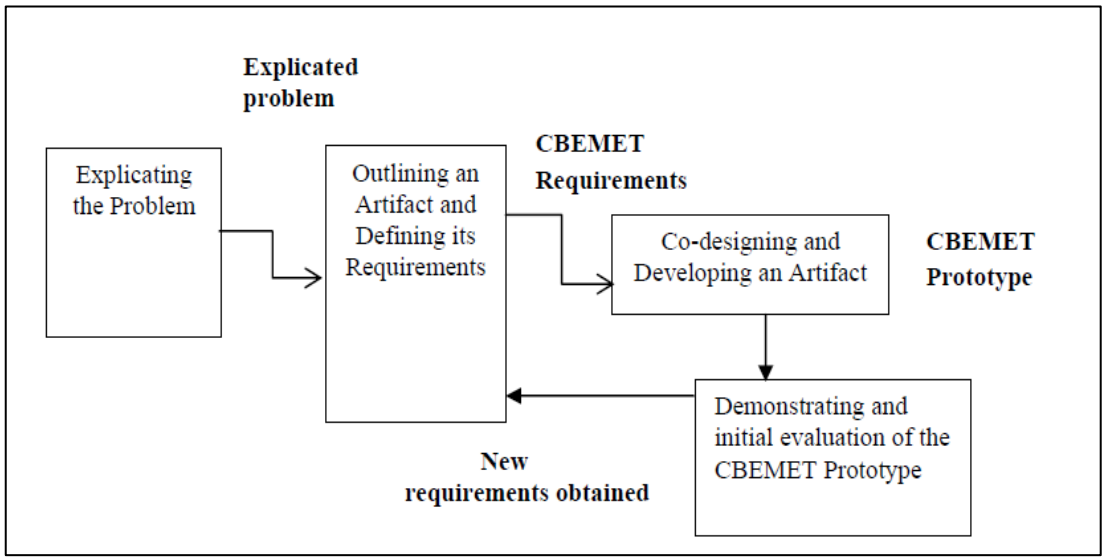

Figure 6. Design Science Research Framework (Johannesson & Perjons, 2014)

The study found it lacks the usual rigidity of the iteration cycles in other countries like the United Kingdom, England, Finland, and the US since Mwandosya, Montero, and Mbise's (2019) framework was limited to three cycles among lecturers and an application developer. However, co-design was taken into consideration to design a mobile education tool in Tanzania contextually. As handy and mobile as it is, applications utilizing smartphones or mobile devices may also be co-designed with the learners in the basic education in the Philippines. As a result, they may have a clearer view of what works for them as they learn. For instance, teachers may co-design flashcards, video lessons, games, or e-books that Filipino co-designers and learners can access using mobile devices.

Co-designing Online Environment (Kyza & Nicolaidou, 2017). Grounded from the Design-Based research method, the researcher used the Professional Development Design Framework (PDDF) of Loucks-Horsley et al. (2010), organized in six sequential but highly iterative phases. Design phases consisted of 31 design meetings among the researchers, and three science teachers followed different meeting foci. The team developed an inquiry-based learning space for grade 11 students using the Stochasmos web-based teaching and learning platform (Kyza & Constantinou, 2007) for Biotechnology, Genetic Engineering, and Genetically Modified Organisms (GMOs).

The development adhered to the four-phased design composed of the initial design, the first enactment, the redesign, and the second enactment. It is also important to note that students were not part of the design process but as members of the enactment process. The Philippine basic education may co-design an online environment with learners who will be using learning resource management systems and other online learning platforms to be at par with the changing educational landscape from traditional face-to-face scenarios,

Co-designing via Web (Friedrich, 2013). From the combination of user-centered design, participatory design, and user-driven innovation, the web-based co-design via Owela (Open Web Lab), as illustrated in figure 7, was used for innovation and design purposes among six case studies listed in table 1. Web-based co-design focused on how social media tools can support users' participation in the design and innovation processes and how collaborative channel changes the user participation during the design process.

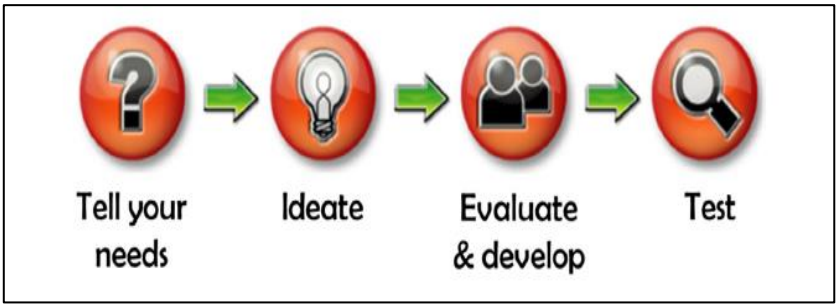

Figure 7. The Ideal Idea Tube Process of Owela in 2007 (Friedrich, 2013)

The first version of Owela was in 2007, and with the web-based co-design throughout six case studies on its use as a web-based co-design tool, it was iteratively developed by Friedrich (2013). Table 1 shows the key elements in using Owela. It capitalized the two primary case studies, which lasted for ten months and six months, having various participants such as the users, the researchers, and the software developers. Also, various phases were involved from one case to another, among user-participants ranging from 4 to 47.

Case study	Focus and objectives	Phases of the innovation process	Duration	Participants in online co-creation
Primary cases				
Mobideas	Co-design of a mobile social media service based on users' ideas and needs	Whole process: needs, ideas, concepts, features, prototyping	6 months	33 users online 4 software developers 2 researchers as facilitators
Monimos	Co-design of a social media service to support immigrant networking and civic participation	Whole process: needs, ideas, concepts, features, prototyping, launch	10 months (and on-going after the research project)	32 users online 8–14 users in the core team 1 designer 1 software developer 6–8 researchers
Supplementary cases				
Tilkut	Evaluation and further improvement of a social bookmarking service	Concept development and prorotyping	2 x 3 weeks	40 respondents in a survey 7 users in online testing
SuperF	Understanding of users' perceptions of cloud services and their security and collecting ideas for new services	Fuzzy front end: user needs, ideas, concept evaluation	1 month	47 end-users (in two groups) 4 company representatives 2 researchers as facilitators
Events	Development of a mobile event management service	Prototype testing	1 month	4 users 3 developers 3 researchers
City Adventure	Development of an adventure service based on a first concept	Ideation, concept evaluation and testing	2 weeks	47 users 1 company representative 1 researcher

Table 1. Key Elements of Primary and Secondary Case Studies on the Use of Owela in Web Co-design (Friedrich, 2013)

It is vital to note that the web-based co-design of Friedrich (2013) through Owela was heavily dependent on the active online users; therefore, internet connectivity would also play a significant role in the success of the online co-design. Filipino teachers and students may also use Co-designing web-based learning to continuously search for how learning may improve through online technology.

Co-Design Directions for the Philippine Education

This section elaborates how the co-design process might flourish in the Philippine educational landscape in the present time as to technology integration, involvement of students as co-designers, its applicability to the current delivery modalities in the Philippines, and the research agenda of the Department of Education.

All the reviewed papers used the co-design process in integrating technology whether on the project outputs (Friedrich, 2013; Kyza & Nicolaidou, 2017; Mwandosya, Montero & Mbise, 2019; Hansen, Mavrikis & Geraniou, 2016; Treasure-Jones & Joynes, 2017; Barbera, Garcia & Fuertes-Alipse, 2017) or the design cycles (Friedrich, 2013; Mwandosya, Montero & Mbise, 2019; Barbera, Garcia & Fuertes-Alipse, 2017). Therefore, the literature is rich with targeting technology as an intervening or an endpoint of the co-design process. In that same way, technology use becomes vital as the Philippines (Department of Education, 2020) ensures that learning should continue

amidst the COVID-19 pandemic. Safer access is the adherence to the safety protocols via varied learning modalities aside from face-to-face classes. Though Dotong, De Castro, Dolot, and Prenda (2016) noted that the ICT Development Index of the Philippines is 4.39, which is half of Singapore's 8.64, Nueva (2019) reported a digital divide among teachers. Carbonilla Gorra and Bhati (2016) found that students have disruptive activities while using computers, there are still many opportunities to deliver learning among learners. Moreover, these opportunities may be better explored through the co-design process involving learners.

The opportunity to explore technology integration in this time of shift in education caused by the pandemic is crucial. Future explorations on enhancing teaching and learning processes with technology use may be co-designed with learners who know how best to learn (Kennedy & Dunn, 2018). Therefore, teachers in the Philippines may consider collaborating with learners as the users of technology-enhanced instruction. The co-design process may also enable teachers to plan and design materials like games, online activities, or video lessons, whereby numerous studies have cited its advantages in enriching learning.

Learners as co-designers found from the works of Treasure-Jones and Joynes (2017) and Barbera, Garcia, and Fuertes-Alipse (2017) can play an important role. Their paper emphasized the importance of users in the collaborative effort of designing. The paper of Treasure-Jones & Joynes (2017) centers on the importance of involving learners in educational resource design and development. It gives importance to the definition of the design process. Moreover, the development of the tools anchors on the assessed needs and availability of opportunities and resources, emphasizing the belief that co-design tools are designed for users and with users. Meanwhile, Barbera, Garcia, and Fuertes-Alpiste's (2017) study has noted that some of the learners' proposals were not included as they were not feasible for short-term use. Other times, students' excessive, rigid preconceptions have hindered them from openly evaluating the alternatives and solutions.

In addition, co-design encourages the participation of learners in the design process. Teachers may also amplify the students' choice and application of technology to learn and learn or acquire skills. Teachers may also take the opportunity to develop and design tools, materials, or programs enhanced with technology, with the increased confidence that learners would enjoy the use and enjoy the learning process because they are part of deciding which portions are effective.

Just like how learners as users may benefit from the co-design process, it may also be beneficial to the professional development of teachers. The study of Kyza and Nicolaidou (2017) examined the contribution of the co-design process to the professional development of teachers with 31 design meetings over two years. The findings signified that the co-design approach addressed the professional development needs of the teachers, had a more significant impact on the teacher, and met students' learning and motivation needs. The finding is also parallel with the aims of the co-design process of Hansen, Mavrikis, and Geraniou (2016). Teachers may continuously gear up for the continuous adjustments brought by the changes in learning modalities through the co-design process.

It may help search for effective and relevant technology-enhanced techniques, tools, and practices aligned with what learners agreed upon or what they believe would work best. Suppose there is a collaboration between teachers and learners as to technology use. Regardless of the learning modality used, it may also help teachers' productivity, efficiency, and quality of instruction.

The Basic Education Research Agenda (Department of Education, 2016) calls for research capitalizing on various agendas: teaching and learning. Its central themes are instruction, curriculum, learners, and assessment. All of which can apply the co-design process involving teachers, researchers, curriculum makers, and learners. The co-design may provide an extensive search for evidence to determine how much a co-designed tool, material, or program would benefit the teaching and learning processes. Teachers can also undertake action research that deals with how learners collaborate in the design-making processes. Since there is a continuous encouragement of elevating the quality of education, co-design may be an interesting field of educational research to explore.

Conclusions

The co-design umbrella of design-based research extensively explored in the European regions centered on its process, key players involved, design iterations, and technology use. This review tackled the opportunities for the global South to explore the co-design process and expand the research fields in basic education using co-design processes. Though the process is rigid and time-consuming because of its iterative and reflective aspects and the need for online technology, there are still results indicating its benefits for learners and teachers as collaborators in the co-design process. Furthermore, this approach may be novel in basic education because teachers and curriculum planners are primarily involved in crafting and designing technology-enhanced learning tools, while learners remain recipients. Therefore, like the Philippines and most of the countries continue to grapple with pedagogical difficulties brought by the pandemic, co-designing newly explored modalities, online strategies, and platforms may continuously elevate the quality of basic education. Moreover, it may be an excellent opportunity to involve learners in the process of designing something they will be using.

References

Alghamdi, A. & Li, L. (2013). Adapting Design-Based Research as a Research Methodology in Educational Settings. International Journal of Education and Research. 1 (10).

Bäck, A., Friedrich, P., Ropponen, T., Harju, A. and Hintikka, K.A. (2013) 'From design participation to civic participation – participatory design of a social media service', Int. J. Social and Humanistic Computing, Vol. 2, Nos. 1/2, pp.51–67.

Barbera, E., Garcia, I. & Fuentes-Alpiste, M. (2017). A Co-Design Process Microanalysis: Stages and Facilitators of an Inquiry-Based and Technology-Enhanced Learning Scenario. International Review of Research in Open and Distributed Learning. Volume 18, Number 6.

Cañete, P. (2020). Google PH offers free webinars for schools and educators to encourage distance learning. NoypiGeeks. April 2, 2020. Retrieved from https://www.noypigeeks.com/apps-games-softwares/google-ph-free-webinars-distance-learning/.

Carbonilla Gorra, V. & Bhati, S. S. (2016). Students' perception on use of technology in the classroom at higher education institutions in the Philippines. Asian Journal of Education and e-Learning, 4 (3), 92-103.

Department of Education (2016). Adoption of the basic education research agenda. DepEd Order no. 39, s. 2016. June 10, 2016.

Department of Education (2020). Adoption of the basic education learning continuity plan for school year 2020-2021 in light of the COVID-19 public health emergency. DepEd Order no. 12, s. 2020. June 19, 2020.

Dotong, C., De Castro, E., Dolot, J., Prenda, M. (2016). Barriers for Educational Technology Integration in Contemporary Classroom Environment. Asia Pacific Journal of Education, Arts, and Sciences. Vol. 3 No.2, 13-20.

EdutechAsia (2020). Live Webinar Series. Retrieved July 24, 2020 from https://www.terrapinn.com/exhibition/edutech-asia/Webinar.stm.

Friedrich, P. (2013). Web-based co-design: Social media tools to enhance user-centred design and innovation processes. VTT Science 34. Doctoral Dissertation. Espoo, Finland. June 19, 2013. Retrieved from http://www.vtt.fi/publications/index.jsp.

Garcia-Sanz, M. (2019). Control Co-Design: An engineering game changer. Advanced Control for Applications. September 3, 2019. 1(1). Retrieved from https://onlinelibrary.wiley.com/doi/full/10.1002/adc2.18.

Goodyear-Smith, F., Jackson, C. & Greenhaulgh, T. (2015). Co-design and implementation research: challenges and solutions for ethics committees. BMC Med Ethics. 2015 Nov 16;16:78.

Gyi, D. & Campbell, I. (2010). The value of computer-based product representations in co-designing with older users. Journal of Engineering Design. Vol. 21, Nos. 2–3, April–June 2010, 305–313.

Hansen, A., Mavrikis, M. & Geraniou. (2016). Supporting teachers' technological pedagogical content knowledge of fractions through co-designing a virtual manipulative. J Math Teacher Educ (2016) 19:205–226. DOI 10.1007/s10857-016-9344-0.

Holmlid, S. (2009). Participative, co-operative, emancipatory: From participatory design to service design. ServDes.2009. DeThinking Service, ReThinking Design. Conference Proceedings. November 24-26, 2009. 105-118.

Janssen, F., Könings, K., & van Merriënboer, J. (2017). Participatory educational design: How to improve mutual learning and the quality and usability of the design? Eur J Educ. 2017; 52:268–279. https://doi.org/10.1111/ejed.12229.

Kennedy, M. & Dunn, T. (2018). Improving the use of technology-enhanced learning environments in higher education in the UK: A qualitative visualization of students' views. Contemporary Educational Technology, 9 (1), 76-89.

Kennedy-Clark, S. (2013). Research by Design: Design-Based Research and the Higher Degree Research student. Journal of Learning Design. Vol. 6, No. 2.

Kyza, E. & Nicolaidou, I. (2017). Co-designing reform-based online inquiry learning environments as a situated approach to teachers' professional development. CoDesign, 2017. VOL. 13, No. 4, 261–286. https://doi.org/10.1080/15710882.2016.1209528.

Lember,V., Brandsen, T., & Tõnurist, P. (2019) The potential impacts of digital technologies on co-production and co-creation, Public Management Review, 21:11, 1665-1686, DOI: 10.1080/14719037.2019.1619807.

Miller, C. (2001). The Application of Carl Rogers' Person-Centered Learning Theory to Web-Based Instruction. Annual Proceedings of Selected Research and Development [and] Practice Papers Presented at the National Convention of the Association for Educational Communications and Technology (24th, Atlanta, GA, November 8-12, 2001). Volumes 1-2. Retrieved from https://eric.ed.gov/?id=ED470102.

Mwandosya, G I., Montero, C. & Mbise, E. (2019). Co-designing of a mobile educational tool for innovative teaching and learning at the College of Business Education, Tanzania. TOJET: The Turkish Online Journal of Educational Technology. July 2019. 18 (3).

Naranjo-Bock, C. (2012). Creativity-based Research: The Process of Co-Designing with Users. UX Magazine. Article No. 820. April 24, 2012. Retrieved from https://uxmag.com/articles/creativity-based-research-the-process-of-co-designing-with-users.

Nicolaou, C.; Matsiola, M. & Kalliris, G. (2019). Technology-enhanced learning and teaching methodologies through audiovisual media. Education Sciences. 9, 196. doi:10.3390/educsci9030196.

Nueva, M. (2019). A Literature Review on the Current Technocology in Education: An Examination of Teachers Use of Technology and Its Association to Digital Inequality in School. 12th DLSU Arts Congress. De La Salle University, Manila, Philippines. February 20, 21 and 22, 2019.

Peac.org.ph (2020). PEAC to host free webinar series for K-12 teachers and school administrators. Private Education Assistance Committee. May 26, 2020. Retrieved from https://peac.org.ph/peac-to-host-free-webinar-series-for-k-12-teachers-and-school-administrators/.

Pechenkina, E. & Aeschliman, C. (2017). What do students want? Making sense of student preferences in technology-enhanced learning. Contemporary Educational Technology. 8(1), 26-39.

Pohl K., Sikora E. (2007) Structuring the Co-design of Requirements and Architecture. In: Sawyer P., Paech B., Heymans P. (eds) Requirements Engineering: Foundation for Software Quality. REFSQ 2007. Lecture Notes in Computer Science, vol 4542. Springer, Berlin, Heidelberg

Sanders, E. & Stappers, P.J. (2008). Co-creation and the new landscapes of design, CoDesign: International Journal of CoCreation in Design and the Arts. 4:1, 5-18, DOI: 10.1080/15710880701875068.

Steen, M., Manschot, M., & De Koning, N. (2011). Benefits of co-design in service design projects. International Journal of Design, 5(2), 53-60. Retrieved from http://www.ijdesign.org/index.php/IJDesign/article/view/890/346.

Treasure-Jones, T. & Joynes, V. (2017). Co-design of technology enhanced learning resources. The Clinical Teacher 2018. John Wiley & Sons Ltd and The Association for the Study of Medical Education. 15:281-286.

Trischler, J., Dietrich, T., & Rundle-Thiele, S. (2019) Co-design: from expert- to user-driven ideas in public service design. Public Management Review, 21:11, 1595-1619, DOI: 10.1080/14719037.2019.1619810.

Trischler, J., Pervan, S., Kelly, S., & Scott, D. (2018). The Value of Codesign: The Effect of Customer Involvement in Service Design Teams. Journal of Service Research 2018, Vol. 21(1) 75-100. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/1094670517714060.

UPOU. (2020). UPOU's Free Online Courses will Train Teachers in Online Teaching. University of the Philippine Open University. Retrieved July 24, 2020 from https://www.upou.edu.ph/news/upou-s-free-online-courses-will-train-teachers-in-online-teaching/.

Young, S. & Nichols, H. (2017). A reflexive evaluation of technology-enhanced learning. Research in Learning Technology. Vol 25.

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