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**Reinventing the Book: Towards a Novel Immersive
e-educational Environment**

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**Reinventing the Book: Towards a Novel Immersive
e-educational Environment**

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Thesis Approval

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Dedication

To the soul of my beloved mother, I wrote this thesis by your bedside while you battled a malignant illness.

Your voice and prayers strengthened me to push through and stay strong. You left before getting the chance to see me finish it.

Though I finished it because I knew this is what you would have wanted to happen. I hope you are happier and well-rested now. I miss you and I miss your prayers.

To my father, I hope I can draw a smile on your saddened face by completing this thesis.

To my best friend, my husband, Husam. Without your support, encouragement, and belief in me, nothing would have been accomplished.

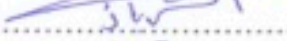
To my kids, Mariam, Mohammed and Youmna. Thank you for letting me borrow long hours from your playing time; I will make it up to you.

To my brother, sisters, and my friend Mariam Abuhamed. Thank you for caring.

The researcher : Doa' Sharabati

Declaration:

I Certify that this thesis submitted for the degree of Master, is the result of my own research, except where otherwise acknowledged, and that this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Signed: 

Doaa Hatem Naser Al-Sharabaty

Date: 13 Jan 2022

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Abstract

The legacy of the book is inspiring. We reinvent the textbook drawing on the very long history of books that demonstrate the power of print medium in education. The thesis uses the book's legacy as inspiration in designing a new educational environment based on the book as a renewable medium. This kind of communicative, educational medium requires more than a design process. It is a shift toward a more humanistic, immersive, and educational environment.

Even though schools shifted to online education during the COVID-19 school closure, the digital tools used did not provide an optimal learning environment.

Using the influential medium of education (the textbook), the thesis proposes a novel educational immersive environment to overcome current e-learning challenges.

The study formed a methodology of three phases. It began by diagnosing the problems associated with online education. Following that, it analyzed the needs and objectives for the new environment. Lastly, it proposed a conceptual model that creates an immersive educational experience. A pedagogical and communicational theoretical framework is the backbone of the design process.

إعادة اكتشاف الكتاب: نحو بيئة تعليمية غامرة وجديدة.

إعداد : دعاء حاتم ناصر الشرباتي

المشرف : د. نادر صالحه

الملخص

ميراث الكتاب ملهم ، نحن نعيد اكتشاف الكتاب المدرسي بالاعتماد علي التاريخ الطويل للكتب والذي يظهر قوة الوسيط المطبوع في التعليم. هذه الرسالة استخدمت تاريخ الكتاب كإلهام في عملية تصميم بيئة تعليمية جديدة ، رجوعا إلي فكرة إن الكتاب وسيط متجدد .

على الرغم من أن المدارس اتجهت نحو التعليم الإلكتروني خلال فترة الإغلاق بسبب انتشار جائحة كورونا، لكن الأدوات الرقمية التي تم استخدامها لم تخلق البيئة الأفضل للتعليم. بالرجوع إلى الوسيط المؤثر في التعليم (الكتاب المدرسي)، تقترح الرسالة بيئة تعليمية غامرة لحل مشاكل التعليم الإلكتروني و تحدياته.

استخدمت هذه الرسالة منهجية مكونة من ثلاثة مراحل . في المرحلة الأولى تم بها تشخيص المشاكل الناتجة عن التعليم الإلكتروني. ثم تم تحليل حاجات المستخدم المنشودة من البيئة الجديدة وأهدافها. أخيرا تم عرض واقتراح تصميم نموذج مفاهيمي يخلق بيئة تعليمية غامرة. اعتمدت عملية التصميم هذه على إطار نظري ذو شقين؛ اتصالي و تربوي.

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Chapter 1: Introduction & Motivation

Subject matter and context

Using a specific medium instead of another in education is an old debate. Socrates preferred oral medium, while his student Plato decided to write Socrates' dialogues (Fisher, 1996; Vandendorpe, 2009; Eco, Afterword, 1996). Gutenberg's invention of printing was an introduction to producing books. Seymour Papert (as cited in Kestenbaum, 2005) explains that writing is the extension of what was said orally, and printing is the extension of writing. At the same extension pattern, computers raised enormous contributions that affect education. Computers are tools for constructing knowledge and a medium for communicating at the same time (Kay, 2003).

Schools have used textbooks for a long time; it is one of the fundamental mediums in education. Eco (1996) argues that books are essential to read on a subject, receive information, and reflect. He also argues that print books are good enough because humans can carry them and have them with their speed, whenever they are, even in the middle of a desert with no electricity or connection. This thesis considers books a renewable medium; it uses its legacy as inspiration in designing a new educational environment.

The invention of the book was not just an invention of a tool to literate people and save ideas (McLuhan, 1967). It extends our memory; it provides space for virtuality. Virtual is not a fantasy, and it is not just a technical term; it has its roots in old philosophies. Virtual is real. It is a state of potentiality not by actuality (Yoh, 2001; Vial, 2019), precisely as sight when your

eyes are closed; it is real in a potential way. Moreover, like a kid hiding from his friends when playing hide and seek, he is real and exists but not apparent (Vial, 2019).

Why do we need to reinvent the book if it is such a powerful influencing medium? The reason that made us think of reinventing the book, not because it is not suitable for education, it is always good. However, the fact that digital media changed us and our perception. It created much wider spaces for virtuality. We need the virtual environment because reality is restricted; reality is limited by materiality, space, and time, while virtual is unlimited.

Education is a humanistic experience, and digital technologies can humanize education more. There is a persistent need to use digital technologies for education. These technologies form our being and whether we admire the book and whether religions gave such unique holy space in our perceptual structure. We cannot resist the intense power of digital technologies to shift education to a more social and humanistic area.

Using the suffix (book) in the names of many innovative technologies and tools such as Notebook, Macbook, and Dynabook give us an idea about the power and influence of the book as a medium for transmitting the information. These technologies used the book as a metaphor, and they borrow from the book what makes it such an accessible medium to use (such as its portability).

Other innovations such as the vast social media platform (Facebook) used the book-suffix. It borrows from the book the idea of authoring and reading. The book is a medium that has considerable reliability. The fact that books in most religions are the medium between God and people gives it another advantage. Writing and publishing a book for many readers is not a fast

or easy process, making writing a book linked to brilliant, specialists, and highly intellectual persons. Facebook gives regular and average people this opportunity; it allows everyone to be a writer. It made it easier for writers to spread their words faster. Facebook took advantage of the very long successful history of the book. Books are platforms for both the author to represent his thoughts and ideas and for the reader to reflect on and construct his ideas in the virtual spaces that the book offers.

New media live and grow slowly under old media shadows, but at some point, its power becomes more muscular to make the shift toward a new environment. Debray argues that environments create their own media spheres that define the most influential media in a specific age (النشوى, 2012).

UNESCO's perspective of the future of education is humanistic. Brâncoveanu (2020) argues that after digitalizing the content, such as giving online using an online platform is almost the same, the next shift will be in virtualization. He explains how such new technologies have the power to deconstruct the centralized society structure that produces and distributes knowledge. Education will be individual-centered. New technologies will offer individuals different opportunities to experience new virtual situations (Brâncoveanu, 2020).

E-education before COVID-19

Today, as never before, we rely on digital technologies. Our planet's many disasters become a barrier for many learners to learn. Online education fulfills the prophecy of McLuhan (1970) when he predicts a change in the attendance system of schools. He claims that “in education the penitential method of enclosure in time and space is probably going to be dropped. We have really created a school system that is amazingly like the penitential system of enclosure”.

In the Palestinian context, the Palestinian educational system faced many problems by the Israeli occupation and the ongoing conflict between Palestinians and the military occupation. In 2000, schools and universities were highly influenced by the restriction on mobility and military checkpoints during the Intifada. The separation wall that cuts through the cities made it immensely harder for Palestinian educators and learners to move between cities -and in some cases, even in the same city (Affouneh , Salha, & Khlaif, 2021).

Distance education became vital for these situations. Moore, Dickson-Deane, & Galyen (2011) define distance learning as the ability for those geographically distant to access and become involved in the learning process. The development of distance education is affected by the media used to deliver educational material, such as printed or electronic (Shahin, 2012). The invention of the World Wide Web in 1992 had a significant impact on the spread of online education due to its ease of use and the ability to use multimedia. However, the origin of online education is before the web and after the invention of computer networks and e-mail (Harasim, 2001). Online learning is considered a version of distance learning and is accessing the experience of learning by using types of technology (Moore, Dickson-Deane, & Galyen, 2011)

Palestine has received help from national and international organizations to improve e-learning. Two platforms that were developed for educators, learners, and parents are (elearn.edu.ps) and (eschool.edu.ps), with the support of the Belgium government. Universities also adopted supplementing education with Information and Communication technologies that Palestinian learn things that the geopolitical context and the occupation's restrictions prevent them from learning (Palkova, et al., 2019).

E-education after COVID- 19

In 2020, all educational systems were forced to close the doors in the face of their learners. Education was facing a humanistic crisis. The education system in all countries, including Palestine, is now shifting emergently towards online education due to the Covid-19 pandemic and school shutdowns. School as the primary environment for teaching is presently facing a reformation worldwide. Some countries had taken significant steps toward reforming schools before and after the strike of Covid-19, while others are still struggling and confused about this not optional shift; Palestine is one of them. The renewal of different mutations of the Coronavirus poses a real challenge to education. The epidemic is an absolute nightmare in the face of the present and future of education.

This shift generated new problems (see page 14 for literature about online education problems at the time of lockdown), using the ICTs as additional tools for education is producing a colossal problem. While it is expected that digital technologies will make education more social and humanistic, the facts reflect otherwise.

Kay (2013) explains that the most fabulous idea in the history of education is Maria Montessori's idea about the environment: children learn better in rich environments; they try to learn about it and explore it. According to Papert, shifting from 'paper-based technology' to 'electronic-based digital technology' will create that rich environment (Kestenbaum, 2005). Minor changes in paper-based technology will not be helpful. Many initiatives around the world are done to make digital books. Digitizing the textbook is not the solution. The solution is by understanding the importance of having a new notion of literacy, as the psycholinguist Frank Smith explains (as cited in Kay, 2013). He argues that the need to read and write comes from having new ideas we desire to share. Hence, the writing system was invented, and the

necessity of literacy became a must. Today, new ideas straining the current system of thought force us to have a new field of thinking and new technologies to represent the new ideas. The thesis proposed an immersive educational environment. This environment is created by a new model that always referred to the textbook; it is a reinvention process (of the book as a renewable medium).

The present thesis will diagnose and analyze the problem with using online educational technologies, then propose a new model that creates a rich, immersive educational environment based on a deep understanding of the power of the textbook and the virtual space that a book creates. The proposed model is considered as a reinvention of the textbook. The textbook is the inspiration of this thesis, and digital technologies are rich enough to extend the power of media in education.

The shift of education from learning by receiving to learning by doing was the area for the pioneering trio Seymour Papert, Marvin Minsky, and Alan Kay. They are scientists in computer science, artificial intelligence, and human-computer interaction (Kestenbaum, 2005). One of the ideal proposals for a medium for learning is Alan Kay's Dynabook. Its idea was that children should not be tied to desks while learning; they should learn by constructing. Papert's question inspired Kay, "It is easier to learn French in France, so shouldn't we make a MathLand?" (Kay, 2013). The novelty of this research lies in proposing a design for a new model that creates an immersive educational environment; these virtual spaces that learners interact in are considered lands of knowledge, are inspired by the textbook.

Discourses about school reformation using digital technologies are categorized into two ideas: the discourse of digital re-schooling and the discourse of digital de-schooling. Digital re-schooling has a vision of having ‘School 2.0’, an individual-centered, creative, and connected formal educational system. It is an education model based on learning with a tech-savvy attitude (Selwyn, 2015; Adams, 2012). In contrast, digital de-schooling is a radical discourse that refuses institutionalized education and is found in digital technologies that complement the formal system (Selwyn, 2015; Jandrić, 2014). It is a self-determined learning system, originating in 1971 when Ivan Illich called for creating non-institutional and vast educational infrastructure (Kostakis & Pantazis, 2021; Atasay, 2013).

The thesis proposed a new model with a new discourse of digital education that mixes the de-schooling perspective with the re-schooling perspective. Formal curriculums and outputs required from the students are vital. Besides, encouraging learners to decide on what to learn more than what was determined, also giving context to what he learns are also vital. Our proposed vision is inspired by textbooks and uses digital technologies to create an immersive communicational educational environment.

Importance of the Research

The thesis's practical importance is to give policymakers in the formal educational system and the experts in educational technologies a proposed model (KnowledgeLand) that will shift the educational environment towards a more communicative and immersive environment.

The theoretical importance comes from using pedagogical, media, and commutation theories to define the relationship between the power of media over the educational environment. It proposes a design for a model that creates an immersive communicative environment as a reinvention of the giant medium for education (the textbook).

Purpose of the Study

The purpose of the study is to reinvent textbook in order to create an educational environment that is suitable for the learners of 21 century and to have a detailed description of the features of the new model (KnowledgeLand), based on a deep understanding of medium and communication philosophies are the objectives of the thesis.

The simplicity and usability of the print book and the virtual space it provides to learners as an educational medium are inspiring. Shifting into online education emergently after the COVID-19 pandemic was a field of study. Literature indicates that online education also has sociality and communicative problems. The thesis revisited the textbook as inspiration for proposing a new model for online education. The model proposed to create an immersive communicational educational environment, which will work to solve the problems of current online education technologies.

Problem Statement and Research Questions

We are not shifting optionally to online education. Online education results in many problems (see chapter 2, page 14). The thesis diagnoses the problem of online education and analyses them, then proposes a reinvention of the textbook that creates an immersive educational environment, which will improve the learning skills of 21-century learners.

The thesis is inspired by the giant medium of education, the textbook, to develop a new novel educational immersive environment that overcomes current problems of e-educational challenges.

Methodology

This thesis is a ‘research into design’ or ‘research about design.’ This kind of research is made by scholars, not designers, from other fields such as humanities and social sciences. They aim to establish a deep understanding of their topic and the feature differentiating this kind of research from others; ‘research for design’ and ‘research through design’ (Volonté, Rampino, & Colombo, 2018).

This qualitative descriptive research uses an inductive approach to define the characteristics of the suitable model for use in the online education system as a reinvention of the textbook.

Qualitative research started to be visible in research in the 1990s. Humanities, anthropology, and sociology are the origin of using the qualitative approach. (Creswell & Creswell, 2018).

The thesis process includes three sequential phases:

Phase I: Diagnosed the current online education platform problem by reviewing literature about online education during school closure. The list of problems will help us define the users’ needs from our new model.

Phase II: classified the characteristics of the new model by analyzing the list of potential obstacles a user’s need from online education created from phase one under the light of the theoretical framework to add other objectives of the new educational environment.

Phase III: Conceptualized a detailed new model of the immersive educational environment, using phase I and phase II and their results. This phase used (*elements of user experience*) model of Garrett (2000) to propose the conceptual model of the textbook reinvention new model.

Chapter 2: Literature Review and Theoretical Framework

Chapter Overview

This chapter begins with the literature review section, in which the researcher organized literature pieces based on different themes and commented on identifying the knowledge gap in the field of the research. The researcher then built a two-dimensional framework composed of the pedagogical dimension that includes a detailed description of the appropriate theories and models used in answering the research question. The communication dimension includes interrelating theories and models that assist the researcher in defining the main concepts of the research and answering the research question.

Literature Review

Gosden (2005) explains that objects have power through their forms to affect how they are used and influence users' senses and emotions. Objects have the power to channel people's actions and put constraints over them in the way they use the object or deal with others through them. Mitchell (as cited in Gosden, 2005) claims that objects' desires should be analyzed seriously because they affect our everyday lives (Gosden, 2005). While Gosden's study was general about the sociology of things and the agency of objects, Silva (2016) concentrates on books as objects with the agency because of their sociality and materiality. He argues that meaning is produced by the interaction between humans and things surrounding them; it is the "materiality of meaning-production." Books' meaning is a production of three factors: content, context, and form. In other words, the interaction between the book and the reader is affected by the idea that the book is a thing, content, or discourse, while the meaning is affected by every new reader's context. The dialectic between the book and people is essential; the book's

form affects the people's understanding of it. Order of books results from the materiality of meaning production, the materiality of 'order of discourse.' In the Hegelian perspective, objects and things have the power to make us as we make them, almost like a debt. There is a debt on those who consume things to those who produce them (Silva, 2016).

In previous literature, Gosden (2005) asked, "what do objects want? While Silva (2016) asked, "what do books do?" Both questions argue the power of the object over humans and its environment for interaction, both work parallel with McLuhan's medium theory, which is part of the thesis theoretical framework. What is different in this thesis is the reversal of the question, asking what we want from the object to help list the new model's characteristics (The KnowledgeLand) that will create a rich environment for educational purposes.

Digital Books, with their various forms, interact differently from print books. What we gain and lose when shifting to digital reading is a field of research. Westin (2012) argues that converting analog books to digital books means that the cultural values essences tied to the physical book are translated to the digital realm. The question here is whether these 'socio-cultural expressions' are negotiated in this transformation as this process means detaching the content from the culture. In his study, Westin focuses on the book's format and the cultural aspects of digital books. He argues that the new generation is coined as 'cultureless' not because of the content they read but because the content format is not what older generations used to use. Westin (2012) did not focus on the book as a medium but the book's format. It is a non-human factor whose role in shaping society and culture. This idea was introduced by referring to Actor-Network Theory (ANT) and the role of the non-human actors.

While Westin used Actor-Network Theory, Scolari (2009) studied the digital book, digital textualities, human-computer interaction (HCI), and new media under the light of semiotics.

He claims that old theories of media, linguistics, and semiotics must study new media. He considers HCI a semiotic process where the interface is the textual network or the device of meaning production, and interaction is the interpretation (a designer-interface-user interaction). Scolari's approach to answering the question of the future of publishing is conducting interviews with readers. He found that 50% prefer using a digital book through these interviews. Simultaneously, the publisher believes in print publishing (Scolari, 2009).

Both studies focus on the cultural aspects of using a specific medium and the importance of form over content. Both print and digital cultures will be discussed from the perspective of medium theory in this study. The importance of non-human actors in education is a core idea in this thesis. The use of connectivism theory focuses on the idea that educators may be non-human nodes in a vast network. As for designing such mediums, HCI principles are vital in allowing learners to have a rich and communicative experience full of interaction with different nodes of the knowledge network.

Modern literature analyzes study cases of developing digital textbooks or e-textbook. Zarzour, Bendjaballah, & Harirc (2020) explain the importance of the features of social network platforms in enriching the e-book system. This study analyzed students' behavior while using Facebook-based books and found that social network features such as liking, sharing, and commenting are highly engaging. On the one hand, this study's importance is that few studies have studied students' behavioral patterns using e-book with social network features. On the other hand, this study focused on university textbooks, not school textbooks. Other studies focused on supplementing education with technological experiences such as virtual reality, gaming (Foster, et al., 2018), and immersive mixed reality (Khan, Trujano, & Maes, 2018). Some studies also discussed the use of big data in education, such as (Yin, Okubo, Shimada, OIa, & Hirokawa, 2015). They argue that replacing textbooks with digital textbooks will

produce 'Educational Big Data' with learning logs. Analyzing big data will give the education system a deep understanding of students' behavior and interests. Other studies such as (Mouri , et al., 2019) focus on how digital textbooks can automatically generalize quizzes and reduce the teacher's workload.

Previous studies focus on the importance of using digital technologies to develop digital textbooks. In this thesis, the proposed model used the power and long history of the book. Using digital media is not the goal; the thesis diagnoses the digital media's environment and uses this deep understanding to improve the learning experience.

The proposed design of the model aims to let the content be the king, even over the medium is the message.

The Covid-19 pandemic and associated lockdowns threatened the educational process. Using distance education methods was the only solution. Like many other countries, the case in Palestine was that an unplanned shift to online education took place, also referred to as Emergency Remote Teaching (ERT). This unplanned shift was made without any preparation of content or activities for online education (Affouneh , Salha, & Khlaif, 2021). Microsoft Teams was adopted by the Ministry of Education (MoE) (Affouneh , Salha, & Khlaif, 2021), and other tools were used by teachers such as Zoom, Google Meet, YouTube, and Facebook groups (Khlaif, Salha, Affouneh, Rashed, & ElKimishy, 2021).

Many papers and articles studied the use of various online learning technologies in many countries worldwide, including Palestine, and identified the disadvantages of these platforms and software. Social isolation and lack of communication between learners are disadvantages discussed in many pieces of literature, such as (Alodwan, 2021; Kang & Duong, 2021; Sobaih,

Salem, Hasanein, & Abu Elnasr , 2021; Hikmah, Wuryandani, Zubaidah, Herwin, & John, 2021).

The lack of interaction and participation in the online class is another disadvantage of online learning technologies such as Microsoft Teams, Zoom, and others (Farrah & Jabari, 2020; Sobaih, Salem, Hasanein, & Abu Elnasr , 2021). In their quantitative study, Farrah & Jabari (2020) identify that most students agreed that they got bored during online classes and sometimes fell asleep.

One of the disadvantages of online classes highlighted in studies is the difficulty and inability to learn some subjects and topics (Lassoued, Alhendawi, & Bashitialshaaer, 2020; Radwan, Radwan, Radwan, & Pandey, 2021; Kang & Duong, 2021; Widikasih, Widiana, & Margunayasa, 2021).

A study of primary and secondary classes in Gaza argues that students had a moderate to a high level of stress while using online learning technologies during the lockdown, and the inability to understand and study some topics was one of the obstacles they faced (Radwan, Radwan, Radwan, & Pandey, 2021).

All previous literature emphasized the dark side of online education during the pandemic from the perspective of the educators and learners from many schools and universities in Palestine and other countries. Hamad (2021) distributed a questionnaire to 131 mothers of students from 1st grade to 4th grade in Ramallah and interviewed a sample of 8 mothers. She observed that mothers considered e-learning extremely challenging. 48% of mothers agreed that school did not consider the children's well-being and emotions. Most of them agreed that kids were just listening, watching lessons, or having assignment explanation videos. Hamad indicated that the most focused-on subjects in schools were Arabic, English, and Maths. Mothers indicated that about 1% of educators gave interactive classes. Mothers agreed that learning online was uninteresting to their kids and did not consider their abilities and learning speed.

Theoretical Framework

Pedagogical Dimension

Connectivism Theory

It is impossible to think about learning technologies or environments without returning to the learning theories. Any research in education and schooling aims to make the learning process more effective. Therefore, defining the learning process differs a learning theory from another.

Learning theories used for utilizing the educational environment such as; behaviorism, cognitivism, and constructivism. Behaviorism suggests that learning aims to change the learner's behavior. Cognitivism considers learning to manage short-term memory inputs and code them for long-term memory.

On the one hand, behaviorism considers knowledge as external to learners, to which learning is the process of internalizing knowledge. On the other hand, constructivism considers knowledge internal to the learner, and the learning process creates meaning (Ertmer & Newby, 1993; Siemens, 2005).

A new theory¹ that considers learning as an internalizing process of external knowledge is connectivism. With this theory, knowledge never existed in the person's mind, but it distributed across networks' connections. In the connectivism perspective, learning means knowing how

¹ While many researchers considered connectivism as a learning theory (Shepard, 2012; Trestini, 2018) , others consider it as a new and emerging theory that is not being empirically grounded theory yet (Ng, 2015; Kop & Hill, 2008).

to connect to these networks (Homanova, Prextova, & Klubal, 2018; Duke, Harper, & Johnston, 2013).

Connectivism is a learning theory for the digital age, where knowledge life is diminishing, and the amount of information doubles every 18 months, as Gonzalez explains (as cited Siemens, 2005). This change in knowledge lifespan and information amount are directly affecting learning. Siemens (2005) explains that because of the short lifespan of knowledge and the considerable amount of increasing information, there is a need for focusing on information management and a need for a theory to study the relationship between individuals and organizations as learning organisms.

The representatives of the connectivism theory are George Siemens and Stephen Downes². They use the network of nodes as a metaphor for learning while considering the role of the social and cultural context in learning (Huang, Spector, & Yang, 2019). Siemens (2005) explains how today's learners are different, and a new set of skills is needed from him. The 'meta skill'³ for digital age learners is to assess the worthiness of learning something before learning. He argues that the advantage of connectivism over other learning theories is the focus on the value of what will be learned.

Another skill needed is to learn how to use the information and make connections outside your primary knowledge scope. Acting outside the learner's knowledge area is a prosperity of this

² George Siemens and Stephen Downes are the founders of the first Massive Open Online Course (MOOC) in 2008, the course name was (The Connectivism and Connective Knowledge) (Ng, 2015).

³ Gustavo Razzetti (as cited in Senova, 2020) defines meta skill as "a master skill that magnifies and activates other skills... a high order skill that allows you to engage with functional expertise more effectively... a catalyst for learning and building new skills faster".

age. Therefore, having the skill to make connections and recognize patterns between disciplines is vital. To know where to find the needed knowledge is more important than knowing how and what (Siemens, 2005; Utecht & Keller, 2019).

Learning is the ability to connect various network nodes (information sources). These sources may not be human educators; they may be non-human nodes. Learning happens when one is exposed to many ideas and interpretations. Maintaining connections and making new ones is a needed skill. The best connections required to happen are between diverse disciplines, and seeing a pattern between them is vital. These connections give learners the ability to focus on knowing more. The quality of knowledge is vital; knowledge has to be accurate and up to date. Learners' decisions about what to know and the meaning of knowledge change depending on the information environment changes. What is presently correct may be changed depending on the context (Siemens, 2005; Utecht & Keller, 2019; Downes, 2019).

The 21 Century Learning Skills

Many skills are required to prepare learners to live in a constantly changing world with complex work and life environments. The Partnership for 21st-Century Learning (P21) organization developed a framework for learning in the current century. They define a list of the learning skills required, also known as the 4Cs: critical thinking, communication, collaboration, and creativity (Partnership for 21st century skills, 2015).

The framework of P21 explains that thinking creatively means a learner has the ability and techniques to create new ideas such as brainstorming (Partnership for 21st century skills, 2015). It also includes analyzing, evaluating, and refining his ideas. This framework also emphasizes

the importance of communication and collaboration for creative work. Learners have to develop, implement, communicate their ideas, and accept feedback from others with different perspectives. Failure and mistakes are part of the long-term process of innovation and learning. Innovation is a series of failures and small successes. A learner should work on his/her creative ideas to create a tangible contribution (Partnership for 21st century skills, 2015). Stepping outside the learner's comfort zone and being brave enough to accept failure is the only way to learn creativity (Redlo, 2021).

Critical thinking uses the appropriate reasoning, such as inductive or deductive reasoning based on the situation. It also means to produce outcomes based on analyzing the parts of the whole and their interactions. Making judgments and decisions is part of critical thinking; it involves analyzing arguments and claims, as well as evaluating various points of view, to then interpret the information and making conclusions based on the analysis that will affect the learning experience. (Redlo, 2021; Partnership for 21st century skills, 2015)

This thinking is connected with Gestalt philosophy, which indicates that perception results from the mind's job to get the big picture by figuring out details and finding patterns in noisy environments (Rosli & Cabrera, 2015).

Communication skills are the expertise of articulating ideas orally, written, or nonverbally. To be an active listener and a good communicator for many aims such as persuading, informing, or instructing. It is also about learning how to use various media technologies and deciding on their effectiveness (Partnership for 21st century skills, 2015; Sahin, 2009).

Collaboration is having the skill of working with others effectively and respectfully. It

demands being flexible, responsible, and conscious of others' contributions in order to achieve the teams' goals (Partnership for 21st century skills, 2015; Sahin, 2009)

Communication Dimension

Medium Theory⁴ and Mediology

What differentiates medium theory from media theory is the focus on differentiating the content (the message) over the communicating technologies conveying the medium and emphasizing the influence of these technologies. All medium theorists consider medium more than a transition channel. They are social and psychological environments that encourage some forms of interaction while discouraging other forms of interaction and mediums. This theory precisely defines the differences between various communication environments (Meyrowitz, 2008).

Marshall McLuhan explains the specific characteristics of the various types of medium and the kind of sensory information that the medium transmits or influences. While understanding the characteristics of every medium, the unique uses and responses to the content that included differ (McLuhan, *The medium is the message*, 1967; Meyrowitz, 2008). McLuhan expanded the concept of medium to include all things, including the clock, the pen, and non-print objects such as TVs, computers, and other familiar media. All media types are extensions of the human body and senses. While McLuhan defines medium as the extension of the human body, he defines the message as the change media made in human's societies and cultures (Meyrowitz, 2008; McLuhan, 1967; Gordon, 2012; McLuhan, 1964).

⁴ Meyrowitz (2008) explains the use of the singular word (medium) in the name of the theory to clear the differences between it and the media theory. This theory concentrate on the characteristics of each medium.

McLuhan (1967) argues that “the medium is the message,” which puts attention over the medium itself as the most potent part of the communication. He claims that the discovery of typography and writing made a paradigm shift in education in terms of reasoning and thinking. The shift from oral medium to writing means shifting from an unstructured environment to a linear and structured environment. Printing is all about standards and rules of correctness, a shift from illiterate to literate culture (Soukup, 2008; Gordon, 2012; McLuhan, 1962).

McLuhan (1970) explains how technologies create a unique environment. In the time of railways, people’s consciousness was connected and continuous, as everything was connected and continuous, including time and space. The shift toward electronic technologies meant that consciousness now contains many unconnected things. Low speed makes everything centralized and continuous, while high speed creates an environment of separation and decentralization.

McLuhan (1970) explains how electronic technologies affect education and learners. He argues that the speed of information movement made education unstructured and dependent on discovery and research, even for elementary learners. In his writing, McLuhan focuses primarily on the effects of media on education and school. He argues that kids refuse instructions, and the only way to motivate them to learn something new is by convincing them that their job is to know the answers nobody knows. Asking them to find the correct answer will not motivate them. Educators should let their learners wear their wits even if it does not match their wit (McLuhan, 1970).

Similarly, McLuhan (1967) schooling is connected with the glum. He lights on the opportunity to teach kids by humor and joy. “a perceptive or incisive joke can be more meaningful than platitudes lying between two covers ” (McLuhan, 1967, p. 10).

Another theorist, Rudolf Arnheim, explains a particular form of the medium theory called 'materialtheorie.' He argues that the medium of representation portrays reality and defines its artistic and scientific descriptions (Meyrowitz, 2008).

The French theorist Debray (1996) focuses on the power of the sign more than the meaning of the sign. Mediology explains why there is something symbolic in every field or circulation and how symbols cause effects through symbolic efficacy (Debray, 1996). Mediology replaces the term 'communication' with 'mediation.' Debray explains how the message is determined by mediation. He considers that "it is bodies that think and not the mind" (Debray, 1996, p. 6).

Mediology is the field that deals with the higher social functions and their relationship with transmission's technical structure. The mediology method deals with the relation between three levels: the symbolic activities, the organization's forms, and the mode of archiving traces and putting them in circulation. He argues that the third level influences the first two levels. This means that the symbolic production of any time can never be explained in a separation of the technologies of memory (Debray, 1996). Mediology manages the clarity and ambiguity in speeches/actions by understanding the symbolic efficacy and the materiality power of thoughts (1997، دوبريه).

The media's role is not mechanical; instead, it is to reshape and construct. Mediation is an uncontrollable role; it may revolute over its programmer. Debray also explains that media sphere enables to define the nature of specific age and the most powerful medium and its effect. It is impossible to separate the media sphere of previous ages from the current media sphere; previous media spheres give to the current one its uniqueness (النشوى, 2012).

Not so far from the idea of medium theory, a new theory explains how the medium has the power to shape our perception and being, also referred to as the ontophany theory.

Ontophany Theory

French theorist Stéphane Vial explains that the digital revolution is considered a philosophical event more than just a technical event (Vial, 2019).

Vial (2019) argues that ontophanic matrices are vital concepts that consider digital devices as reality generators or ‘philosophical machines.’ They are the pre-perception structure. This theory classifies our relation to the world as a phenomenological relationship with things, tied with technologies.

The digital revolution reveals how ‘technical issue’ and ‘being issue’ are the same, which is not a new concept.

Perception in the digital age is not about perceiving new things, rather about shaping new perceptions instead. It is a phenomenological act to know how to perceive new digital things. Vial argues that technology is the perception structure. While the reality is the result of shaping perception by technology, digital natives do not have difficulty using apps and devices because they have the perception structure (Vial, 2019).

Vial (2019) argues that technology is a system of interdependencies and a network of relationships, not just an independent technology system. He refuses the idea of technofetishism, which means considering technology as a separate and independent technical system. Gilbert Simondon argues that it is not acceptable to consider technical subjects separately from semiotics and define their uses and jobs (Vial, 2019). He highlights the importance of being aware of the meaning of technical objects. Vial (2019) defines a designer as the one whose project is to propose reality.

Design, which results from the technology-art alliance, stands against technophobia. It forces technological culture to be part of the world of meanings and semiotics. Designers of digital devices and technologies are philosophically responsible for experiences and perception. Since digital technologies shape our perception and being, they cannot be separated from the creative act of design. Design is about creating the effect and the experience more than creating the objects and their appearance (Vial, 2019).

Our experiences are shaped by interactive situations ontophanically, produced by the digital interface. Virtual environments of the digital interfaces shape our experience in life to be immersive. Immersion is the requirement of the simulation. Immersion is an ontophonic condition that will become more regular and acceptable (Vial, 2019).

Vial (2019) considers virtuality as property of digital media, which make it a perception structure of reality. While the word's origin is philosophical, Vial claims that virtual is an ontological system, a special kind of being, it about existing but not apparent. Virtual is real (Vial, 2019).

Semiotic Theory and HCI (Human-Computer Interaction)

Semiotics theory is a meaning-making theory; it studies signs (Chandler, 2017).

Eco (1976) argues that semiotics considers all cultural processes as communication processes and study the underlying signification of the process. Semiotics has two primary models by the structuralism co-founders: the Swiss linguist Ferdinand de Saussure and the American philosopher Charles Sanders Peirce. Post-structuralism theorists inspired by Peirce's Model (Chandler, 2017).

Studying media from a semiotic perspective was initiated by Roland Barthes in 1950. Barthes focused on pop culture and studied it as a system of signs that recreates meanings within the western culture for commercial purposes (Danes, 2002, p. 23). The semiotics perspective studies verbal and non-verbal communication such as gestures, dress, colors, layout, and sounds (Chandler, 2017).

Eco argues that new media technologies must be studied under the light of semiotics beside other fields such as media (Scolari, 2009). He explains that semiotics has two thresholds, the upper and the lower. The lower is when interpretation is not at the whole level; it relies on cognitive and psychological science. The upper one is related to anthropology and sociology; it refers to culture as a “textual network” that we can read. Scolari (2009) argues that user interface is considered as a textual network and meaning producer, while Human-Computer Interaction (HCI) is a semiotic process.

Julia Kristeva argues that text includes two perspectives: the horizontal one between the writer and the reader and the vertical one that connects the text with other ones, and that is the intertextuality (Chandler, 2017).

Metaphor and conceptual model

We borrow things from common fields when proposing a new idea, invention, or concept. The similarity between what people know and what we want to introduce will help figure out the new thing (Carroll, Mack, & Kellogg, 1988). This has been referred to as a ‘metaphor’ for a long time. Arnheim (1969) explains that thoughts need a realm of existence; metaphors give that space to our new concepts and ideas.

The word metaphor means to carry across from one field to another. Aristo considers metaphor a semiotic displacement when using a signifier of an object or experience into another; it moves the signifier vertically from one domain to another (Veale, Shutova, & Klebanov, 2016).

Metaphor explicit its structure over the target domain, it maps the conceptual structure of the common domain into the target domain (Veale, Shutova, & Klebanov, 2016). Arnheim argues that metaphors help recognize similar structural qualities in sensory situations (Arnheim, 1969).

A metaphor is a conceptual reference for the system; it is about how the user thinks of the proposed system (Johnson & Henderson, 2012). The conceptual model aims to define the relations between concepts in the working framework (Sharp, Preece, & Rogers , 2019).

Garret (2011) argues that using a metaphor can reduce the user's mental effort.

User experience design

HCI is an umbrella term as Cocton (2008) described it for many research disciplines. It is rooted in ergonomics, which is concerned with research for the relation between design and human attitude and satisfaction (Cocton, 2008).

Nake & Grabowski (2001) argue that semiotics is vital to understand HCI and digital media. The interaction between humans and the computer results from humans' sign process and interpretation. Moreover, the signal process is produced by the computer itself. Here come the fields of digital design, such as usability and functionality design, due to the coupling processes of sign and signal (Nake & Grabowski, 2001).

While digital media differs from traditional media like television, user engagement does not change the broadcast. In the case of digital media, HCI results from what the user input into the computer, the processing of the computer side, and the output from the computer to the

user. User engagement and interaction can change the state of the medium, such as computer games. Interactive media has a multi-layered structure that conveys experience and meaning. Many models and frameworks define the experience and layers of interactions, one of them is Garrett's model, the elements of user experience (Cocton, 2008)

Garret's (2011) model consists of five planes/layers, bottom to top, from the abstract to the concrete design: the strategy plane, the scope plane, the structure plane, the skeleton plane, and the surface plane. These planes draw the conceptual model, which lists the user's needs and problems, along with a way to solve them. All planes are divided into the information part and the function part.

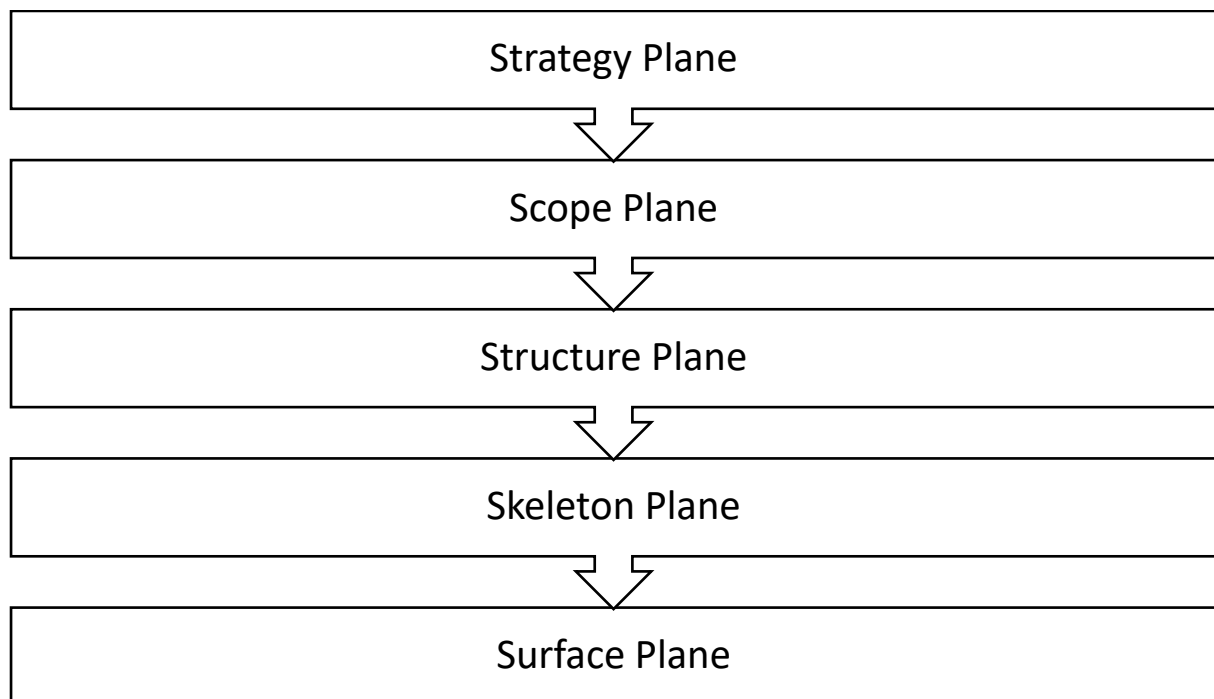


Figure 1. A simplified diagram of Garret's Model

The strategy plane must be formed before coding or making graphics, and It is all about the system objectives and the user needs. To step up from the strategy layer to the scope layer, functions should be defined. It details the features specifications and the content requirements (Garret, 2011).

The scope plane makes the design process clear due to defining the requirements. It is also considered a valuable step because it diagnoses all the potential conflicts and difficulties early when the innovation is hypothetical. In this step (Scope layer), we shift from why to what we are making? (Garret, 2011).

Like other layers in this model, the scope plane is divided into two parts to treat the proposed model as a functional and informational model. Therefore, in this step, a list of features is made to accomplish functions based on the strategy plane. Every user need/ objective from the proposed system should be aligned with the functional specifications of more than one function/feature from the scope plane. This stage describes what the proposed system should do. At the same time, information and content requirement should be defined. (Garret, 2011)

The next step is more concrete than the previous ones. The structure plane defines the user experience. It contains interaction design and information architecture (Garret, 2011; Cocton, 2008).

Interaction design is about describing how the system will respond to user behaviors. This stage describes what the proposed system does, then asks how it does it. Designing a conceptual model of the system at this level benefits from real-world analog to use it as a metaphor (Garret, 2011).

Information architecture is about designing navigational and organizational schemes to enable users to move through the content quickly. Information structure is a relation between the nodes, while the node is the basic and elementary unit of the structure. The nod may contain one piece of information or a library of corresponding data (Garret, 2011).

Organizing nodes have many forms: hierarchical, matrix, organic, or sequential. The simplest one is the sequential form, such as books and videos. The hierarchical structure is based on child/parent relations with nodes. While parents are general nodes, child nodes narrow down

the concepts. This is also referred to as the tree form. The matrix structure enables nodes to connect in a multidimensional pattern; two or three dimensions of relations are used in websites with the ability to sort objects using more than one criterion. The last form is the organic structure; nodes relations depend on every case. No pattern of connection can be determined (Garret, 2011).

While the structure plane decides what the proposed technology will do, the skeleton layer decides on the form of the functions. It provides more details on the representational plane. It is divided into the interface and navigation designs; the third part, which overlaps with the other parts, is information design. Interface design arranges the task elements on the screen to notice the important ones. While navigation design aims to enable users to go from one place to another within the system, represent the relations between elements, and communicate the relations between the users and the elements of the system. The last step in this stage is to make things more concrete by wireframing, which is designing the layout of the entire system (Garret, 2011; Cocton, 2008).

This model can help transform the vision of an immersive educational environment by building a model based on Garret's one.

Gamification and immersive

Games used for education satisfy the learner's need to learn by enriching the process with enjoyment, motivation, structure, adrenaline, emotion, and ego satisfaction. Games that developed for other purposes than playing and entertainment. These games have special agendas, such as educational purposes (Goethe, 2019).

Shantanu lists the common feature in serious games to achieve their goals as the following: story, risk, interactivity, competition, rules, and immersive (Goethe, 2019).

Big data and algorithms are usually used to study users' behaviors for business purposes. Games users give much information about their interests (Goethe, 2019).

Interactive narratives and transmedia stories are strategies used in games and many aspects of media production. The Transmedia storytelling concept is more than just publishing one story on many platforms. Every text shared through multiple mediums gives a new perspective of the same story (Pamment, 2015).

Jenkins (as cited in Pamment, 2015), in his theory of transmedia engagement, explains that the increase in the depth of the user's experience motivates the user to consume more. This happens when multiple texts from multiple media give a new value and perspective.

Immersion is "a psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences" (Witmer & Singer, 1998, p. 227)

Immersive technology involves the user in intensive sensory information, which blurs the virtual and physical worlds includes different technologies such as virtual reality and augmented reality (Suh & Prophet, 2018).

People react to immersion experiences differently. On the one hand, some people accept it and deal with it. On the other hand, some people feel afraid of separating from reality. Immersion means nothing if it is not blended with other disciplines that encourage our life experiences.

To refuse living outside the current ontophonic culture means living in a culture resulting from other technologies and media (Vial, 2019).

Chapter 3: New reality, what is going wrong?

Chapter overview:

This chapter aims to diagnose the problems that learners face while learning online, after the initiation of school lockdown following the COVID-19 pandemic. This chapter also aims to define the characteristics and objectives needed from the new educational environment. Based on chapter two (Literature Review and Conceptual and Theoretical Framework), phase one and phase two of the methodology will be accomplished.

Age of anxiety and the new migration

Countries worldwide were supplementing schools with Information and Communication Technologies (ICTs) and e-education tools to enhance learning. Palestine was also trying, but with slower steps. Suddenly the Covid-19 pandemic forced all countries with rich and scarce e-education experience to leave school and migrate to online schooling.

We left the school buildings, playgrounds, classes, and whiteboards, only packing with the print textbook for our migration.

Schooling depends heavily on the textbook as the primary source of information. It is the main reference for students. It contains the content of the subject and all the activities that help students make sense of the lessons, along with lots of questions and exercises to assess their understanding (Maxwell, 1985).

When students meet their teachers online and have classes using their PCs or tablets, they hold their print textbooks in their hands. Their teachers give them assignments from the pages of

these books. Some students rely on a digital copy of the textbook instead of the print one (Murphy & Shelley, 2020; Dunn, Brunton, & Farrar, 2021).

In the Palestinian case, print and digital textbooks were also used during the lockdown (Khlaif, Salha, Affouneh, Rashed, & ElKimishy, 2021).

McLuhan (1962) argues that print medium transformed societies from illiterate to literate; it significantly impacted education. Furthermore, he argues that after shifting to the electric age of tv generation, significant problems arose in education (McLuhan, 1967). The technologies changed, the perception changed, but the environment inside schools remained the same.

What was familiar and useful in the past may slow down today's learning process. What was needed from students in the past is different from today. This is what McLuhan (1967) called the 'age of anxiety. Educational technology is a field of experiments and research; we are forced to use new technologies. Many factors, such as the nostalgic factor, limit us to yesterday's tools. Today's students live and struggle in the 'age of anxiety .' This thesis works hard to figure out the characteristics of today's best model for education.

Today's students at school use the same medium (the print book) that their parents and grandparents used when they were students. McLuhan (1970) argued that the gap between children of the current generation and their parents is not because of ideas and mind, but it relates to sensory life changes. New technologies create a new environment and new sensory life. In the past, people's consciousness was continuous and connected because everything was connected (i.e., railways, time, and space). However, in the electric age, time and space are not connected or continuous, so people's unconscious contains many unconnected things.

McLuhan (1970) argues that information outside school is much heavier than inside school. Real education takes place in the environment of electronics outside school. What happened at school is essentially an interruption of education. Student alienation in the educational system stems from refusing the identity that classifies him in a way in not like his inner life. He lives in a world of diversity and decentralization, the opposite environment made by textbooks in the classroom.

Stop eating the turtle, stop the alienation

Eating the turtle will not let us construct an esthetic opinion about the beauty of its back's design, just stepping back from it and taking a look will do the job. This is the metaphor McLuhan(1951) used to explain the importance of stepping back from any medium to perceive its environment.

After shifting emergently to online education technologies, new problems appeared. Again, we need to step back from these technologies and applications adopted from education systems worldwide to diagnose the problems. Did the alienation stop?

To diagnose the problems resulting from using online technologies for education such as Microsoft teams, Zoom, Google meet, etc. A list of problems was collected from the literature in chapter 2: lack of communication and participation, social isolation, the complexity of some subjects that make it harder to learn through the used online learning technologies, ignoring the learner spatiality and abilities, ignoring the learner's well-being and emotions, and above all these online technologies were uninteresting. The following figure lists the problems that the literature indicated.

Table 1. Online educational platforms problems, at the time of COVID-19 school closure

1- The social isolation and lack of communication
2- Lack of interaction and participation
3- Difficulty and inability to learn some subjects and topics
4- Did not consider the children well being and emotions
5- Did not consider the child's abilities and learning speed.
6- Uninteresting

Living the reality, designers are leading

Digital media is changing many aspects of the student's life outside school. At school, the learner uses the print book as the primary medium, and many ICTs are included, but still, as mentioned, the student faces problems and lives alienation and anxiety.

Digital media shape the student's perception. Vial (2019) considers digital devices as reality generators or 'materialized theories' of reality. They are the pre-perception structure.

The gap here is that the students have a new perception system shaped by digital technologies; simultaneously, the schooling system depends greatly on the print and the environment print created.

Using technical tools, every generation negotiates its relationship with reality (Vial, 2019; McLuhan, 1970). When designing a new digital medium, we seek a new environment for the new generation with a different perception and new reality. Our experience is affected directly

by mediums and tools, which also determine how we perceive the world. The ones who design and make these phenomenological technological tools affect our experience; they produce our being in the world.

Digital technologies create a virtual and immersive environment. The goal is not to design immersive experiences. Instead, it is to use immersion and incorporate it into other disciplines (Vial, 2019). This will result in a new hybrid system of experiences that make our being in the world much better.

What is needed in schooling is not the immersive environment by itself; the goal is instead to use it to make learning new things a much better/smooth experience.

Designers and engineers of new technologies make projects which aim to restructure uses and offer an experience to satisfy the needs or improve quality of life. The designer proposes a reality, a potential future that can be achieved. The designer puts a plan to achieve his vision of the future. (Vial, 2019).

The design is a future-oriented action to improve life environments (Vial, 2015); it is a cultural process (Murray, 2012).

The thesis is a three-phase process to design a new educational environment that will decrease learners' alienation and anxiety while learning.

Based on Garret's (2011) framework, the first layer of designing new technology is the strategy layer, which defines the needs of users and the objectives of the technology.

The list of problems of the technologies and applications used at the time of school closure is considered the user's needs from the new model and its educational environment. These needs are the result of studying the problems of online education (see page 14).

Table 2. The list of user needs from the new

User Needs	
1	The need for communication and collaboration.
2	The need for participating and experimenting.
3	The need for facilities that make complex topics more accessible.
4	Considering the learner's emotions and well-being.
5	Considering the learner's abilities and learning speed.
6	The need for an interesting technology to use.

The second part of the strategy layer is the technology objectives. These objectives are defined depending on the connectivism theory and 21-century learning skills. The objective of the new model and its environment is to reinforce the student with a new set of skills required in the digital age that work parallel with its sensory life that is affected highly by digital media outside school.

Table 3. The model's objectives based on connectivism theory and 21-century learning skills

The model's Objective	
1	Help learners to communicate more and make connections with many nodes on the knowledge network, not just educators or peers. Educators can communicate with any node on the network, such as non-human nodes.
2	Let the learner share his own opinion and interpretations.
3	Make connections between various disciplines.
4	To decide what to learn besides the learning outcomes of the subject.
5	Data should be accurate and updated.

As mentioned in the theoretical framework, the strategy layer is the most abstract layer of the model, and it is a base for the next layer. The table below shows the design of the strategy layer, which summarizes the first two phases of the methodology.

Table 4. The Strategy Layer of the proposed model

Strategy Layer	
The Model Objectives	User Needs
Help learners to communicate more and make connections with many nodes on the knowledge network, not just educators or peers. Educators can communicate with any node on the network , such as non-human nodes.	The need for communication and collaboration.
Let the learner share his own opinion and interpretations.	The need for participating and experimenting.
Make connections between various disciplines.	The need for facilities that make complex topics more accessible.
To decide what to learn besides the learning outcomes of the subject.	Considering the learner's emotions and well-being.
	Considering the learner's abilities and learning speed.
	The need for an interesting technology to use.

This chapter diagnosed the problem of the current online educational technologies, and problems analyzed the proposed model's characteristics depending on connectivism theory and

21-century learning skills (4Cs). All those results are summarized in Garret's framework's first plan; the strategy layer. The next chapter will take this layer as a base to shift toward other layers and propose the new model's final description.

Chapter 4: Generating reality

Chapter overview:

This chapter aims to accomplish the third phase of the research methodology to have a concrete design of the proposed model. The process will rely on designing the other layers of Garret's framework, noticing that the first layer was designed in the previous chapter.

The strategy layer was the result of diagnosing the problems learners face while using online education technologies during COVID-19 school closure 2020-2021. Moreover, the first layer of the model was done.

To step up to the next layer, the scope layer, functions of the proposed model, including the features specifications and content requirements, must be defined.

This step is based totally on the strategy layer. To list the features, needs and objectives must be considered. Every strategy content matches one or more feature and function that aims to achieve it. It is a process of transforming the “why to do” into “what to do” (Garret, 2011).

To analyze the feature and functional specifications, every strategy element will be discussed according to the conceptual and theoretical framework to match it with a specific feature. These strategy elements are considered as criteria for designing the model.

1) The need for communication and collaboration:

- Using Immersive and Virtual Reality (VR) technologies to engage learners' participation in virtual space even if they are in separated places. Virtual condition increase students' engagement (Allcoat & Mühlenen, 2018)

- The Multiplayer feature facilitates collaboration and communication while doing teamwork tasks.
- Multidisciplinary challenges that require collaborating with other nodes out of the field of the study.
- The suggestions feature suggests nodes with common interests or abilities based on the user's achievements and other connections, and these nodes may be peers in the same classroom or other local schools, also may be other educators in the network, or non-human nodes such as digital libraries, videos, etc.

2) The need for participating and experimenting:

- VR technologies
- Three-Dimensional Simulation.
- Gamification features just like game-like tasks and badges for achievement.
- Instant feedback
- The city metaphor and the ability to develop the learner's land by expanding his knowledge and bridging between fields (other subject areas). Every student starts with a single block of land, after finishing the lesson's tasks another block of land is added to his land. The learner can expand his land by accomplishing tasks and learn different topics.

3) The need for facilities that make complex topics more accessible.

- VR technologies
- Three-Dimensional Simulation
- Gamification features

- Transmedia Storytelling
- The suggestions feature nodes to communicate with, such as other educators, other learners who got badges in those topics for help, or other non-human nodes.
- The search bar facilitates the way to connect with other nodes that may help to answer questions. These nodes may be educators, learners with high performance in the needed topic, or non-human nodes such as digital libraries and videos.

4) Considering the learner's emotions and well-being.

- The character design and avatars they use to themselves is a self-expression method that communicates information about their emotions to other human nodes.
- The possibility of delaying the lesson or task if the learner's conditioner is not helping.

5) Considering the learner's abilities and learning speed.

- The suggestions feature nodes that may give extra help and support.
- The Transmedia storytelling feature lets the learner engage with the knowledge using different methods and ways of representation.
- The replaying or reexperiencing option gives the learner who needs repetition another choice.
- The ability to access related lessons from previous stages to figure out the current topic.

6) The need for an interesting technology to use.

- Gamification features

- Transmedia storytelling
 - Challenges and experiments.
 - Socialization
- 7) Help learners communicate more and connect with many nodes in the knowledge network, not just educators or peers. Educators can communicate with any node in the network, such as non-human nodes
- Using Immersive and Virtual Reality (VR) technologies to engage learners' participation in virtual space even if they are in separated places.
 - The multiplayer feature facilitates collaboration and communication while doing teamwork tasks.
 - Multidisciplinary challenges that require collaborating with other nodes out of the field of the study.
 - The suggestions feature suggests nodes with common interests or abilities based on the user's achievements; these nodes may be peers in the same classroom or other local schools, other educators in the network, or non-human nodes such as digital libraries, videos, etc.
- 8) Let learners share their own opinion and interpretations.
- The reward system gives badges to learners for having their interpretations.
- 9) The city metaphor consists of showrooms, museums, and conferencing rooms that facilitate connections between various disciplines.
- The creativity badge is the reward system that encourages making projects and tasks with implementing various study fields.
 - The suggestions feature of nodes that may help in accomplishing tasks and projects that require multidiscipline knowledge.

10) To decide what to learn besides the learning outcomes of the subject.

- The suggestions feature of nodes with common interests or abilities.
- Big data analysis about the learner suggests new fields and topics to discover.

The table below summarizes all the functional specifications of the proposed model.

Table 5. model's Features - Scope layer

The model's features	
1	Virtual Reality (VR)
2	Augmented Reality (AR)
3	Multiplayer feature
4	Multidisciplinary tasks & challenges
5	Nodes suggestions feature
6	Three-Dimensional Simulation
7	Gamification features
8	Instant feedback
9	City metaphor and visualizing the learner's land and others' lands.
10	Transmedia Storytelling
11	The search bar
12	Character design and avatars
13	The possibility of delaying the lesson or tasks
14	Challenges and experiments.
15	The replaying or reexperiencing option
16	The ability to access related lessons from previous stages
17	Showrooms, museums, and conference rooms for participating ideas, projects, and interpretations.

18	The creativity badge
19	Big data analysis of learner's logs

The presented features above result from analyzing the needs and objectives of a new environment. Keep in mind that the virtuality of the book first inspired this model. All the virtual environment is a reinvention of the textbook.

The content requirement part includes data from the Palestinian science textbook of the 6th grade. The lesson used as a sample is the (Photosynthesis lesson).

الدَّرْسُ الأَوَّلُ

عملية البناء الضوئي

نشاط (١): الحصول على الطاقة

١. أكوّن سلسلة غذائية مُستعيناً بالكائنات الحيّة الآتية:



٢. أصنّف الكائنات الحيّة في السلسلة الغذائية السابقة إلى منتج ومستهلك في الجدول الآتي:

المستهلكات	المنتجات

٣. تُعدّ جميع النباتات منتجات، لماذا؟

Lesson one

Potosynthesis

Activity (1): Getting Energy

1. Create a food chain using the following organisms



2. Classify the organisms in the previous food chain into producers and consumers in the following table.

Consumers	Producers

3. All Plants are producers. Why?

* أقرأ النَّصَّ الآتِي، وأجيبُ:

تحتاج جميع الكائنات الحيّة إلى الطّاقة التي تحصل عليها من الغذاء، حيث تحصل الحيوانات على غذائها بالاعتماد على النباتات وحيوانات أخرى. بينما تصنع النباتات وبعض الأنواع الأخرى من الكائنات الحيّة غذاءها بنفسها من خلال عمليّة البناء الضّوئي باستخدام ضوء الشّمس ومواد أخرى.



١. تحتاج الكائنات الحيّة إلى الطّاقة، لماذا؟

٢. من أين تحصل الكائنات الحيّة على الطّاقة؟

٣. من أين تحصل الحيوانات على غذائها؟

٤. من أين تحصل النباتات على غذائها؟ ماذا نسمّي هذه العمليّة؟

٥. أكتبْ بلُغتي تعريفاً لعمليّة البناء الضّوئي

أفكرُ أناقشُ:

توجد كائنات حيّة أخرى تحصل على غذائها بعمليّة البناء الضّوئي.

Read the following text then answer:

All living things need energy that they get from food, as animals get thier food by relying on plants and other animals. On the other hand, plants and some other types of living organisms create their own food through the process of photosynthesis using sunlight and other materials.



1- Living things need energy, why?

2- From where do living things get their energy?

3- From where do animals get their food?

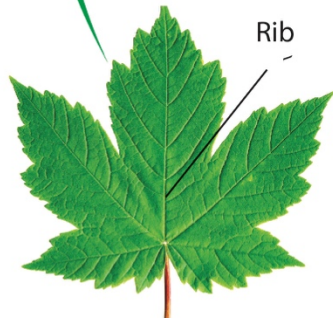
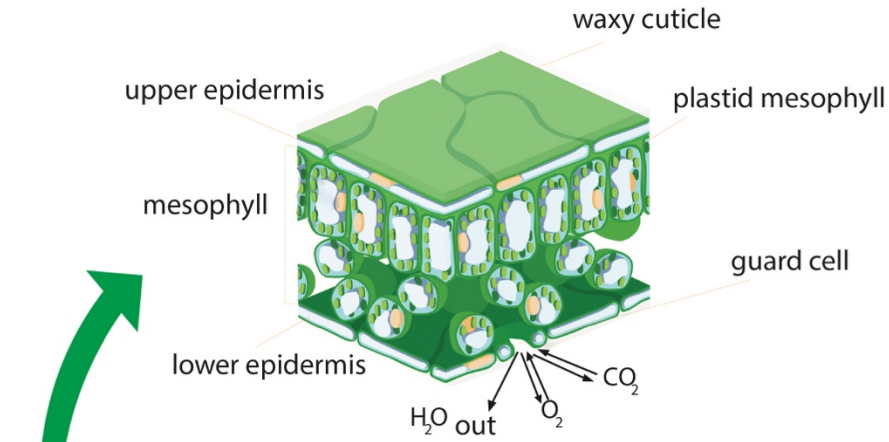
4- from where do plants get their food? what do we call this process?

5- Write in my own language a definition of photosynthesis?

Think and discuss

Are the other organisms that obtain their food by phosynthesis.

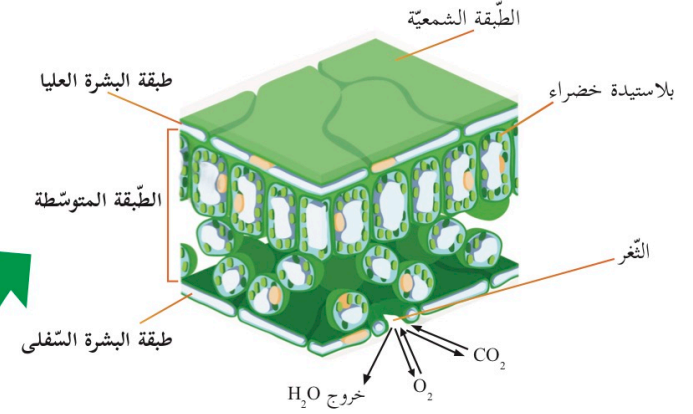
Activity (2): Structure of the leaf



- 1- the color of the leaf of most plants is green. explain.
- 2- Write the main layers of the leaf.
- 3- The leaf is covered with waxy layer. Why?
- 4- the rib of a leaf is made of wood and bark. What is their function?

نشاط (٢): تركيب الورقة

* تأمل الصورة الآتية، وأجب:



١. لون أوراق معظم النباتات أخضر. أفسر.
٢. أكتب الطبقات الرئيسية التي تتكون منها ورقة النبات.
٣. تُغطى ورقة النبات بطبقة شمعية. لماذا؟
٤. يتكون العرق من الخشب واللحاء، ما وظيفة كلٍّ من الخشب واللحاء في الورقة؟

5- There are openings in the upper epidermal layer and the lateral epidermal layer of the leaf called stomata. Why is it important?

6- There is an abundant vacancies in the labial epidermis of the leaf. Why?

Useful



Information

- 1- Water and material salts move to the leaf through the veins through the wood vessels, and the sugar (food) resulting from the photosynthesis process in the leaf moves through the pholem vessels to other parts of the plants.
- 2- Persistent leaves are green in color because they contain the green pigment chlorophyll found in the plastids of the leaf.
- 3- vacancies are abundant in the labial epidermis to reduce water loss.
- 4- The upper epidermal layer is surrounded by a waxy layer that reduces water loss from stability.

٥. توجد فتحات في طبقة البشرة العليا وطبقة البشرة السفلى من الورقة تسمى الثغور. ما أهميتها؟

٦. تكثر الثغور في طبقة البشرة السفلى في الورقة. لماذا؟

معلومة مفيدة



- * ينتقل الماء والأملاح المعدنية إلى الورقة عبر العروق من خلال أوعية الخشب، وينتقل السكر (الغذاء) الناتج من عملية البناء الضوئي في الورقة من خلال أوعية اللحاء إلى أجزاء النبات الأخرى، كما في الثمار والجدور.
- * لون أوراق النباتات خضراء بسبب احتوائها على صبغة الكلوروفيل الخضراء الموجودة في البلاستيدات في الورقة.
- * تكثر الثغور في طبقة البشرة السفلى للتقليل من فقدان النبات للماء.
- * تحاط طبقة البشرة العليا بطبقة شمعية تقلل من فقدان الماء من النبات.

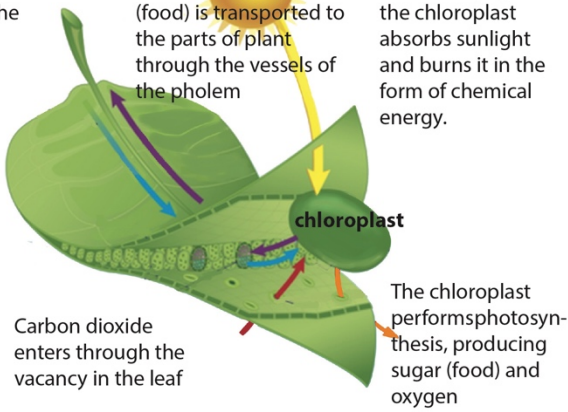
Activity (3) Leaf Mechanism

Observe the following pictures and answer *

Water enters the leaf through the vessels of the wood

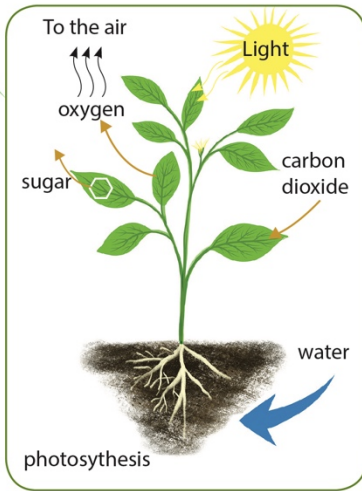
The resulting sugar (food) is transported to the parts of plant through the vessels of the phloem

The chlorophyll in the chloroplast absorbs sunlight and burns it in the form of chemical energy.



Carbon dioxide enters through the vacancy in the leaf

The chloroplast performs photosynthesis, producing sugar (food) and oxygen

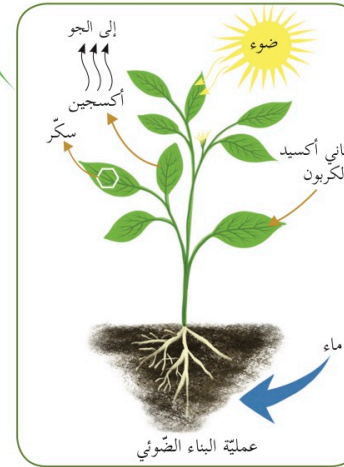
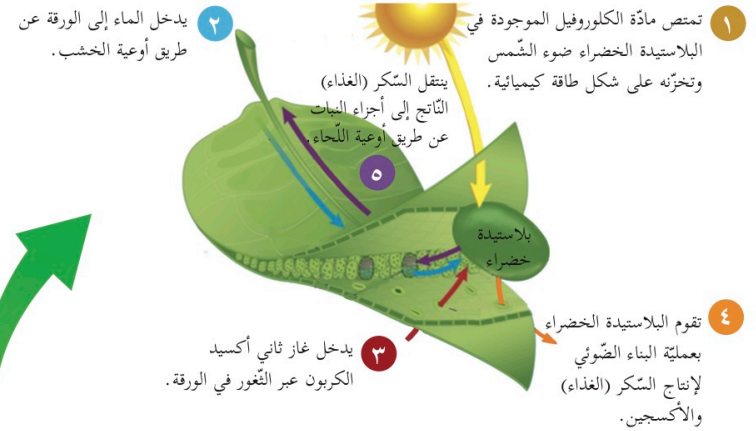


1. From where does carbon dioxide enter the leaf of the plant?

2. Write the importance of chloroplasts in photosynthesis.

نشاط (٣): آلية عمل الورقة

* أتملُ الصور الآتية، وأجيب:



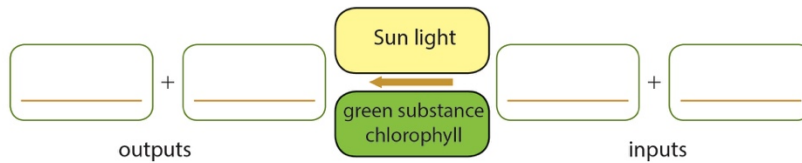
١. من أين يدخل غاز ثاني أكسيد الكربون إلى ورقة النبات؟

٢. أكتب أهمية البلاستيدات الخضراء في عملية البناء الضوئي.

.3 What is the gas produced by photosynthesis?
From what part of the leaf does it come out?

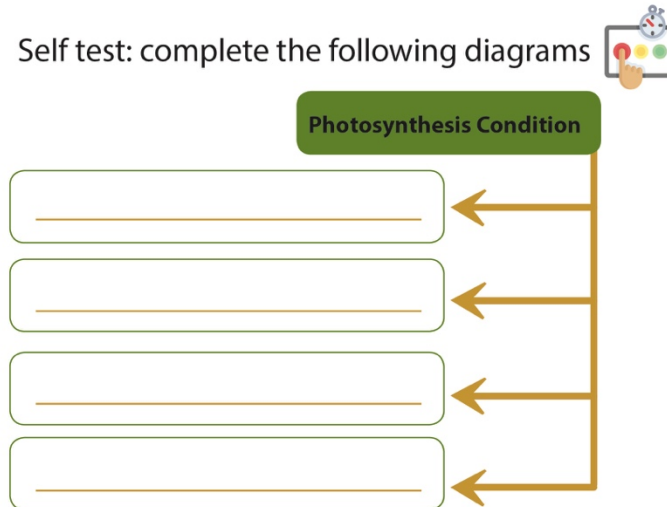
.4 What food does the leaf produce?
Where does it proceed to ?

.5 Complete the following equation for photosynthesis?



.6 What is the importance of photosynthesis?

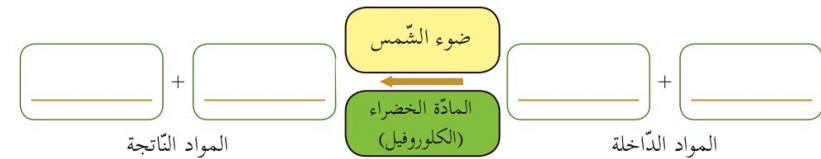
Self test: complete the following diagrams



.٣ ما الغاز الناتج عن عملية البناء الضوئي؟ من أي جزء من الورقة يخرج؟

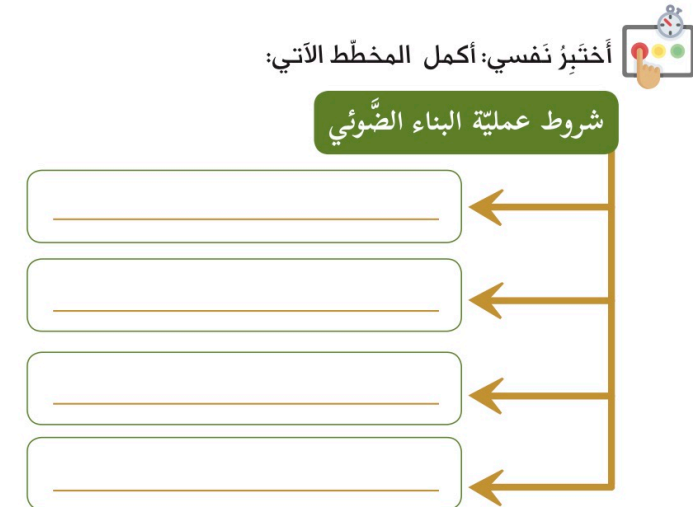
.٤ ما الغذاء الذي تنتجه الورقة؟ وأين ينتقل؟

.٥ أكمل معادلة البناء الضوئي الآتية والتي تمثل المواد الداخلة والمواد الناتجة.



.٦ ما أهمية البناء الضوئي؟

أختبر نفسي: أكمل المخطط الآتي:



The content of the sample lesson is divided into three parts: the food chain, the structure of the plant leaf, and the process of photosynthesis.

The skeleton layer consists of interaction design and information architecture. Interaction design, as mentioned in the theoretical framework, is about how the model responds to user's behaviors. The conceptual model relies on using a metaphor from the real world.

The proposed model will use the concept of the city as the primary metaphor for its immersive virtual environment. The educator meets his students at a specific city location related to the subject they study. For example, if the topic is about geology, the lesson will be in nature, full of stones and stuff related to the topic. If the topic is about planets, they will ride a spaceship and go to space. If the topic is about fish, they will virtually meet in the sea's depth.

During a lesson that is held in a specific virtual location relevant to a specific topic, the proposed model enables learners to engage with the topic in an immersive way; facilitating the active interaction with the material by, for example, touching it, going inside it, and exploring it freely. This overall benefits and teaches the learners through simulation and virtual reality technologies.

If the learner did not figure out the topic, the system suggests to him alternatives:

1- Node suggestions:

a. Human node

- i. Another educator with different methods and different environments or locations.
- ii. Other learners who gain a badge for accomplishing the lesson to communicate with.

- b. Non-human nodes such as digital libraries or videos on different platforms.
- 2- Extra challenges and tasks.
 - 3- Previous elementary material from previous years as a base for the current topic.

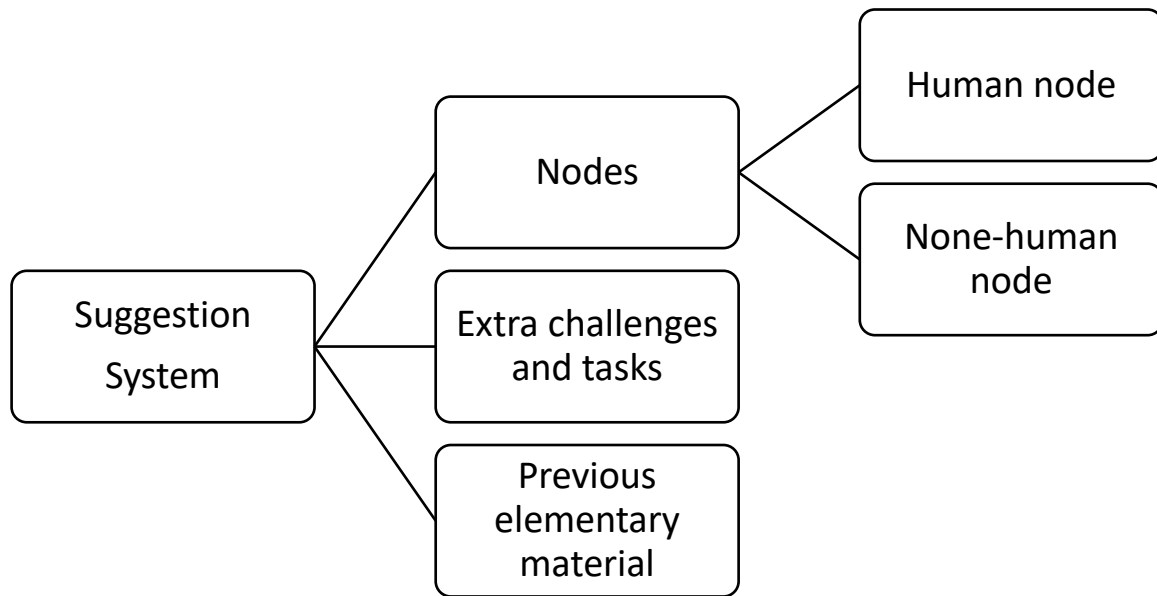


Figure 2. The model's suggestion system

Every topic discussed appears immediately in the learner's land in a symbolic way. The symbol will remain uncolored until the learner/student accomplishes all tasks and challenges. After figuring out the topic and accomplishing the tasks, the symbol of the topic will become colored and shiny, as the figure below represents the learner's land after accomplishing the lesson's task, and before getting the special badges (See the figure in page 72).

Special badges are given to learners for doing one of the following:

- 1- The thinker badge is given to those who (write a report, film a movie, or make a presentation) about the topic studied. The report should include the learner's claims and arguments, his ability to analyze information and interpret them in his way to form a firm conclusion.

- 2- The communicator badge is given to learners with a wide range of connections with nodes to help other learners figure out a topic they have already accomplished.
- 3- The creativity badge is given to those learners who do extra research and projects that require critical thinking, problem-solving skills, and bridging the topic with other disciplines by himself or by borrowing the knowledge from other nodes.

The reward system aims to encourage the learners to get the needed skills. These skills are discussed in the theoretical framework. The skills that are needed from learners based on the connectivism theory and the 21 century learning skill (the 4Cs).

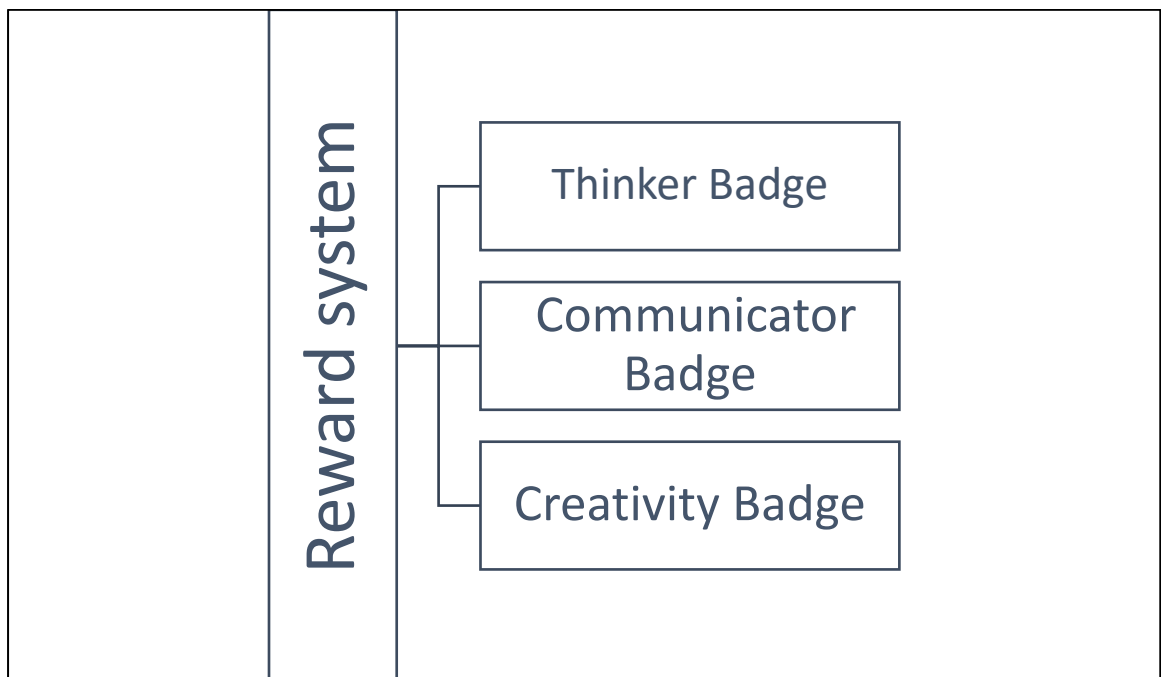


Figure 3. The Reward System of the proposed model

The information structure part of the structure layer is about how information nodes are connecting. As mentioned in the theoretical framework, a node may contain a piece of information or a library of data. Also related to connectivism theory, nodes may be any source of information, including human and non-human nodes.

In the proposed model, learners also can be a source of information for other learners. The model enables the learner to get information from multiple nodes, and the model has a rewarding and suggestion system that encourages connections between nodes.

The most appropriate form of organizing information nodes is the organic form, which enables making various connections with nodes based on the case of the learner.

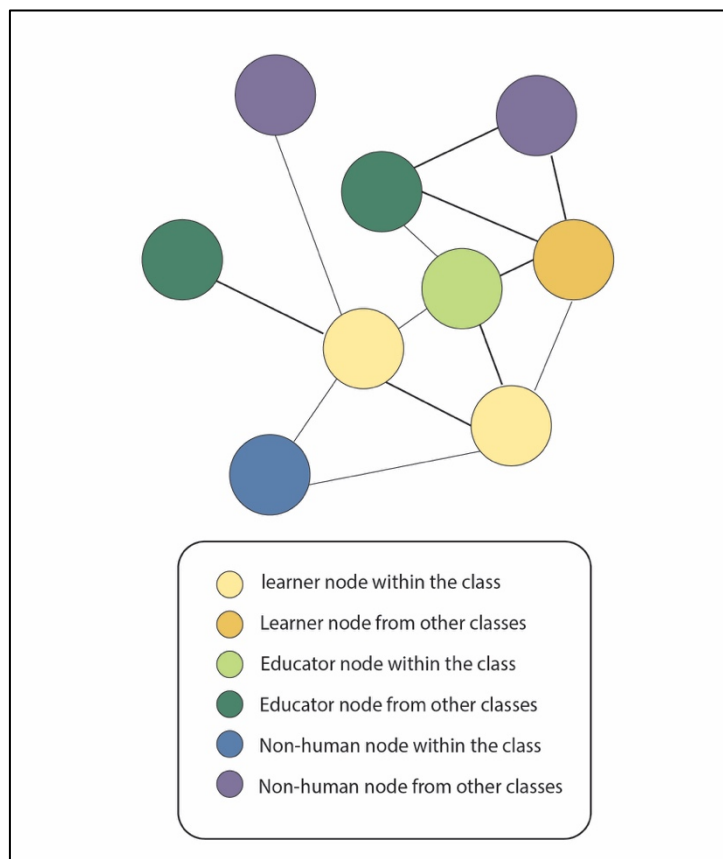


Figure 4. Example of the connection of different kinds of node within the proposed model

The information design of the sample lesson is divided into three parts; each part includes tasks as shown in the bellow figure.

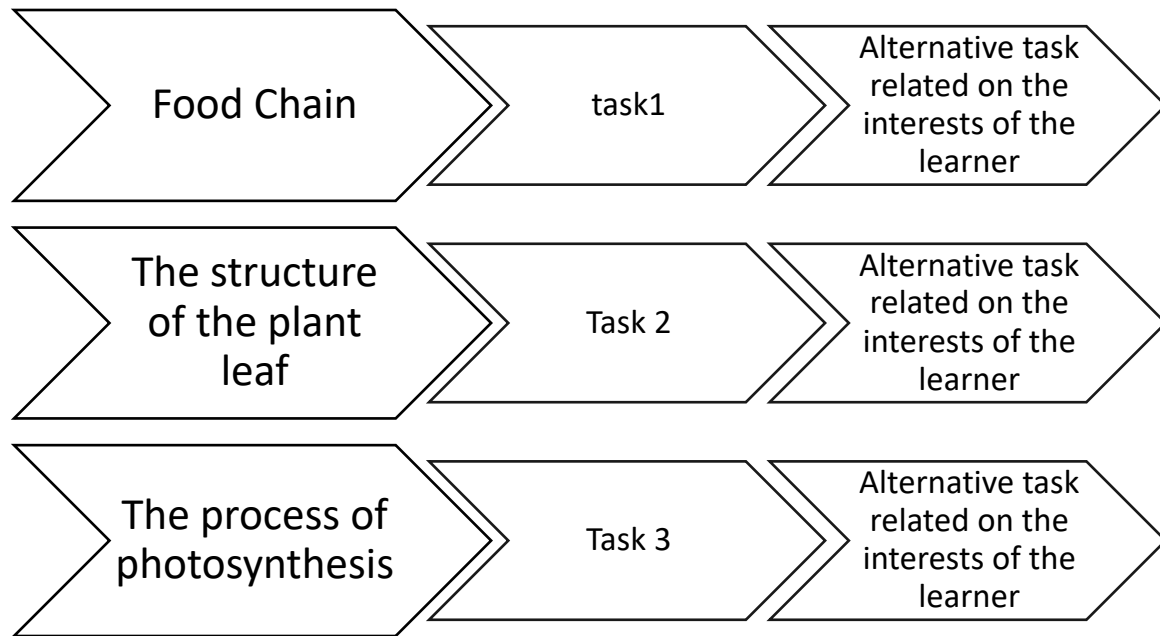


Figure 5. Information design of the tasks

The navigational design uses the GPS map of the virtual city as a metaphor. Maps provide a top view of any place in the city and indicate the locations of learners and their lands, educators, and non-human nodes.

The navigation system includes a search system that allows the user to search by a specific name of any human or non-human node, and the result will show the location on the map of the required name.

The other option is to search by topic. The result will be sorted into the educators' results tab, the learners' results tab, and the materials' results tab. Every tab contains a checklist to help sort and narrow the search results.

Every tabs' checklist provides the ability to sort the results by the node's location and whether something belongs to the school or outside the school. Furthermore, the learners' results can be sorted by the type of badge the learners have, in case that a user wants to find peers with a communicator badge to assist him/her in figuring out a complex topic.

The material results tab's checklist includes different media materials, digital libraries, other learner's reports, and the museums of the learners' projects in the needed topic.

The figure below shows the structure of the search system.

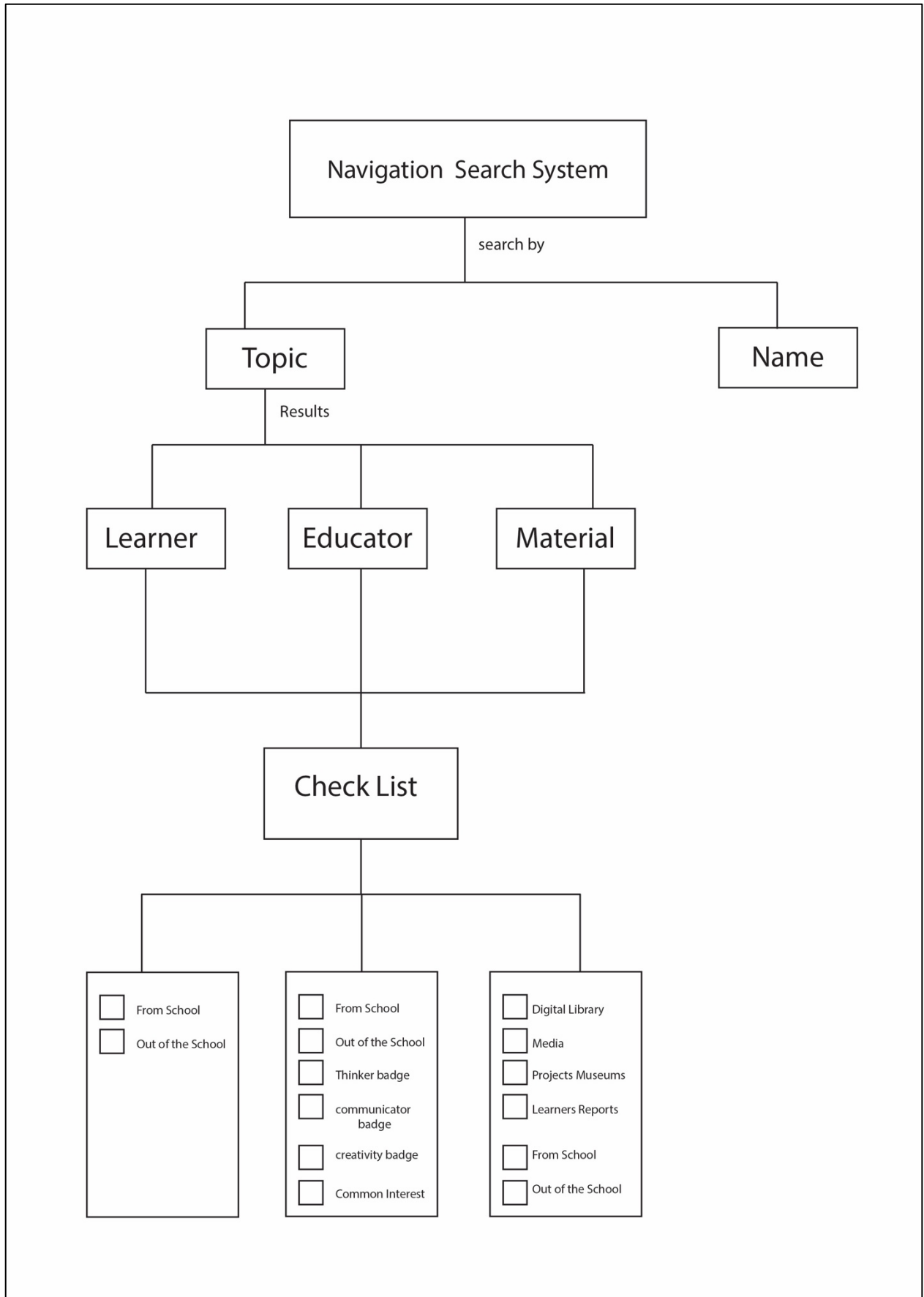


Figure 6. The search structure of the navigational system

The learner starts from his land, a notification from the educator appears to share the location of the lesson with learners.

Learners and their educators meet in a virtual place connected to the topic. The educator introduces the lesson and gives learners some hints and conditions to help them discover and solve the tasks and challenges.

If the educator achieves the mission of the first task, he will step up to the next task. Nevertheless, he will get a notification from the suggestion system to connect helpful nodes or take previous elementary lessons from previous years that helps in figuring out the current topic. After that, the replay option gives him another chance to do the task until he succeeds.

The learner can choose between alternative tasks based on their interests. Every alternative gives another sensory experience.

The learner is expected to pass all the tasks to do the last step. The suggestion system suggests to the learner another learner node who failed in accomplishing the tasks. Also, it suggests other nodes with a common interest to connect with, both human and non-human.

Also, it suggests extra issues and material connected to the topic to write a report or do a project about it.

Based on how the learner responds to the suggestions, he will take a badge from the reward system.

The bellow figure summarizes the educator's experience for any level (lesson). It is a general wireframe of the whole player journey in the given lesson.

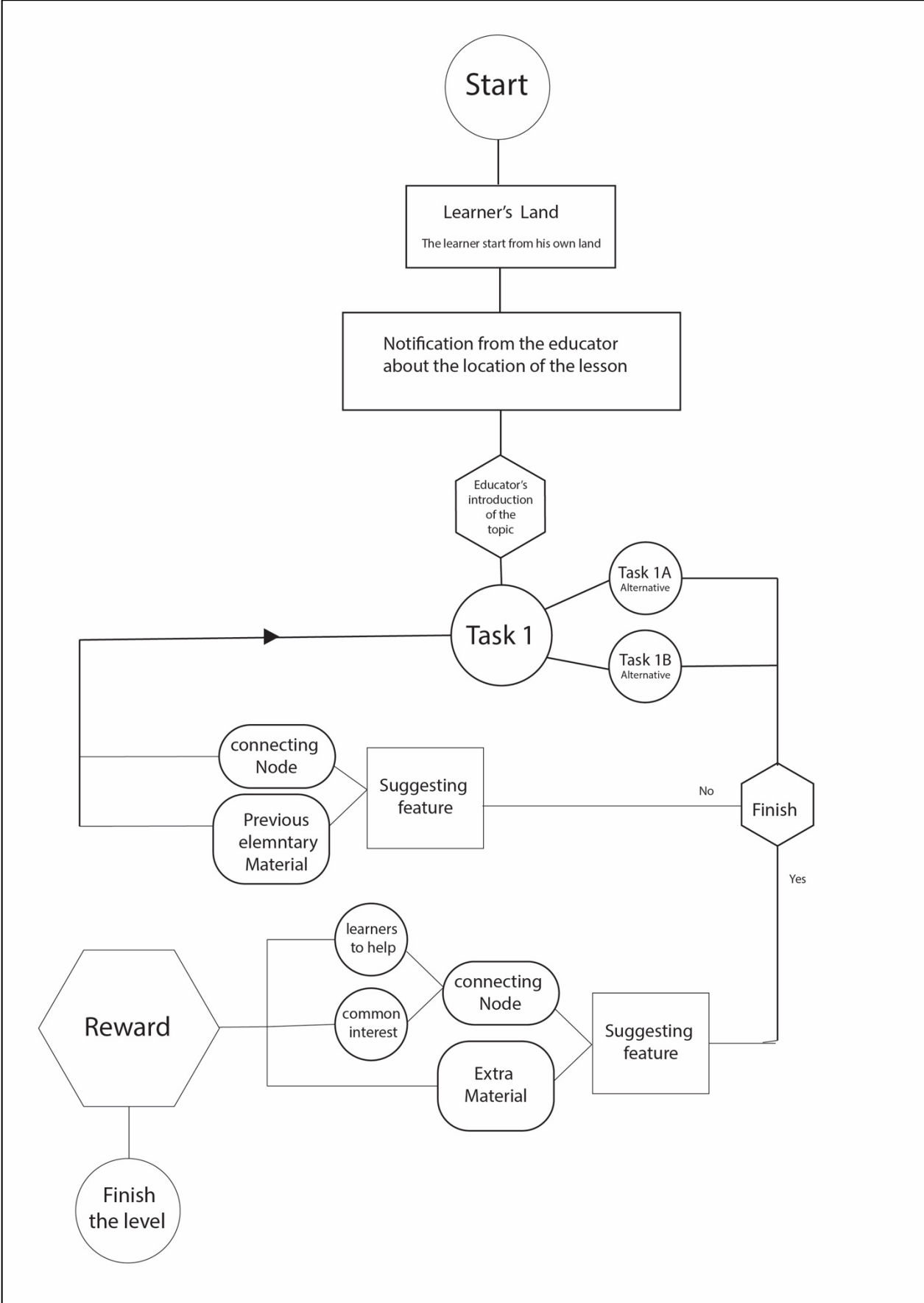


Figure 7. The wireframe of the model's level (lesson)

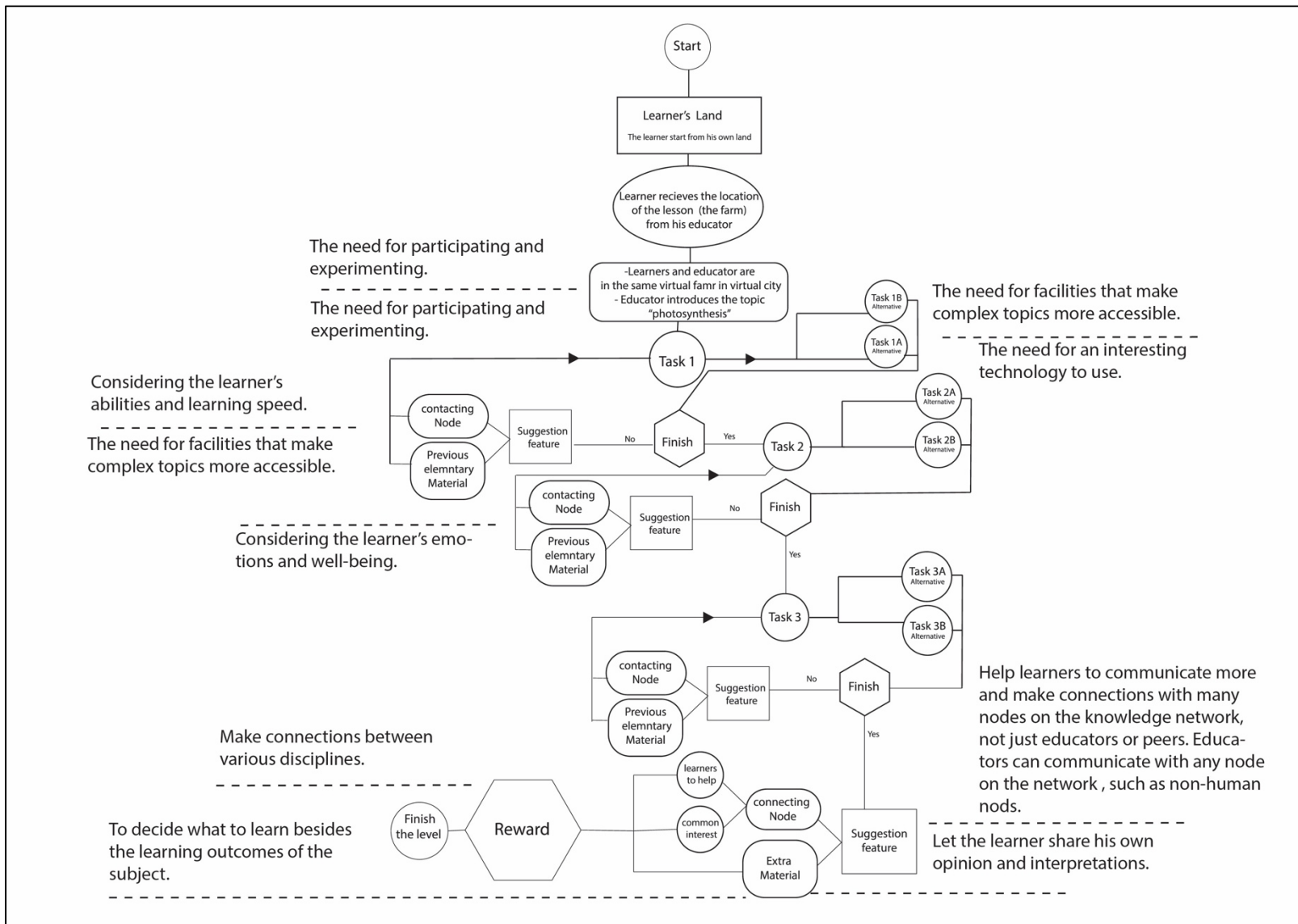


Figure 9. explaining how the lesson meets the criteria of the model (strategy layer)

The previous figure shows the wireframe of the sample lesson experience.

The following figures give a more concrete idea about the layout of the master steps in the user's experience of the sample lesson.

The educator starts her experience in the subject topic by topic, he starts with a small piece of land, and while he is accomplishing the levels, his land in the virtual city will expand. A piece of land metaphor conceptualizes every level (lesson).

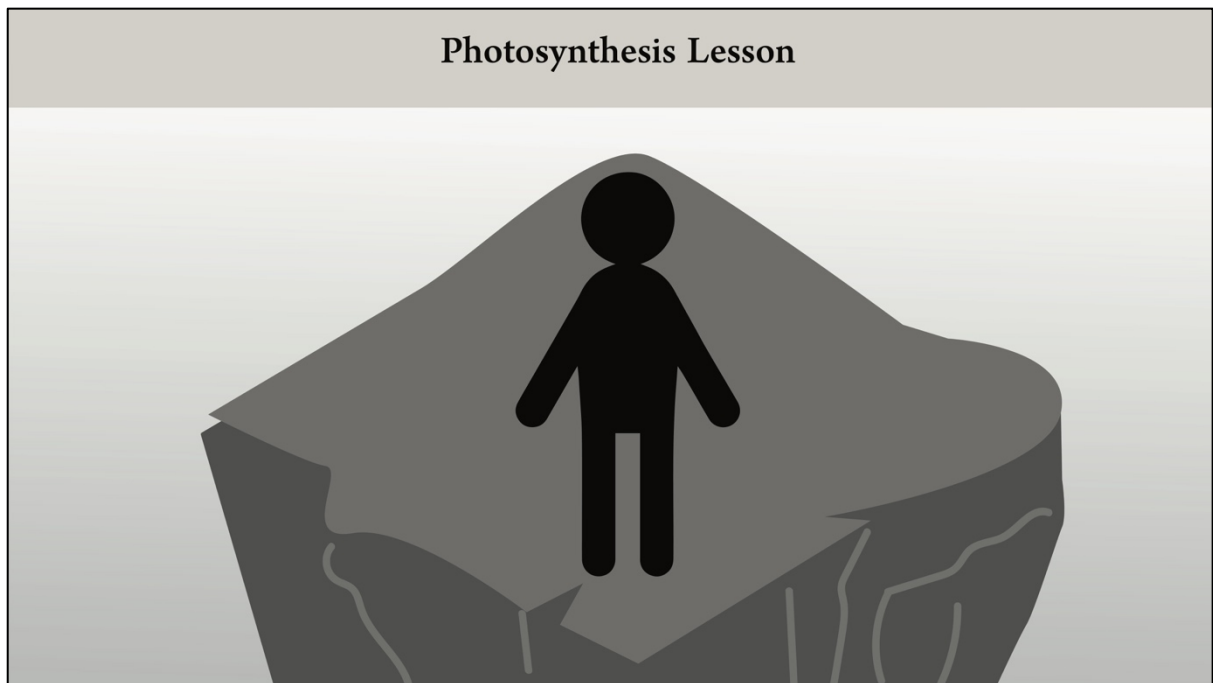


Figure 10. Screen (1) layout

The following two figures represent the idea of sending a notification from the educator, including the lesson's location. In the case of the sample lesson, the teacher sends the farm location as it is an appropriate location for teaching kids about photosynthesis.

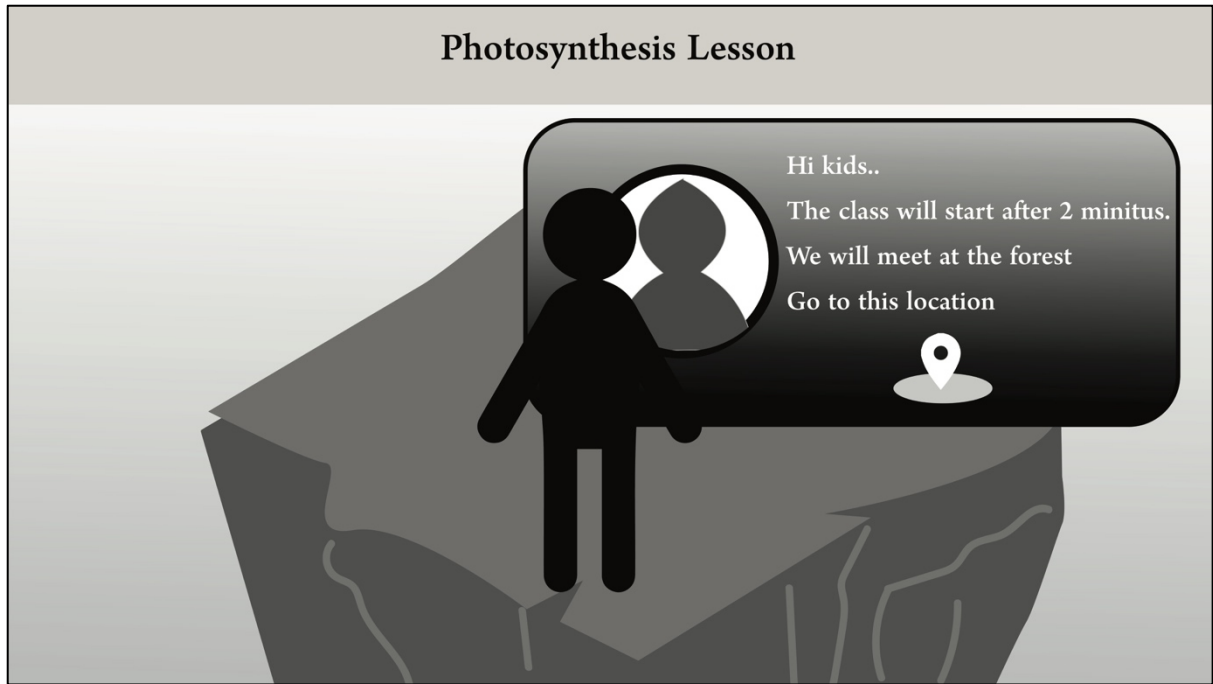


Figure 11. Screen (2) layout

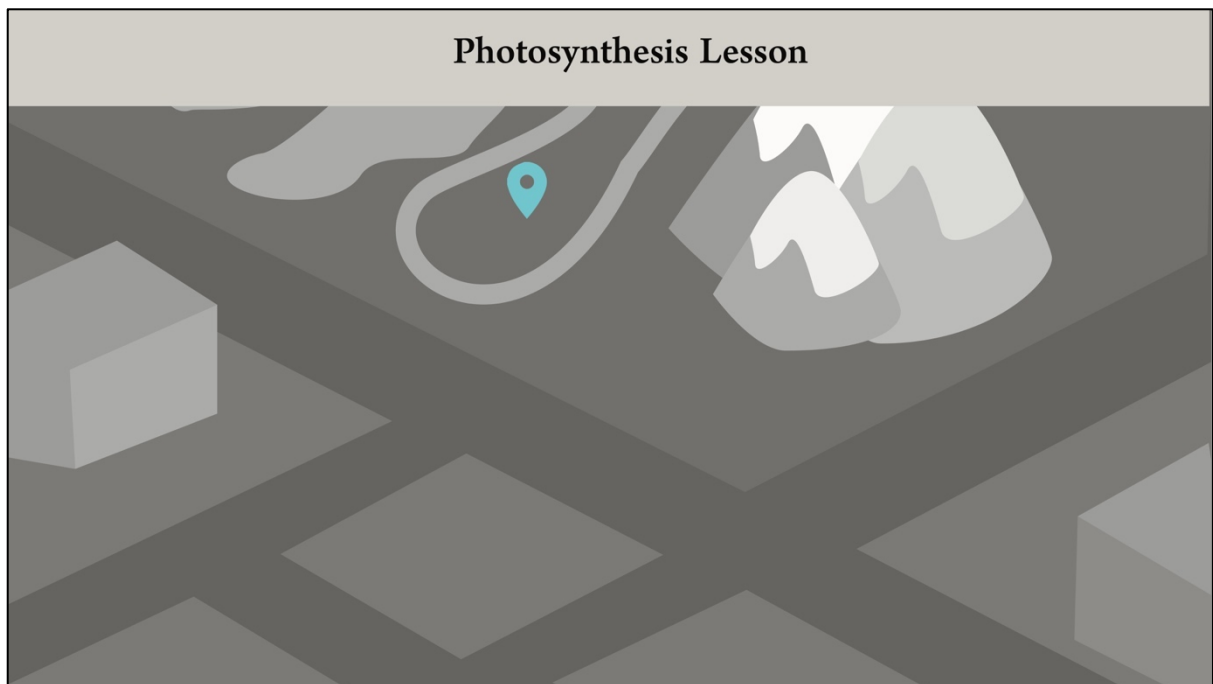


Figure 12. Screen (3) layout

The first task given to learners is to classify different creations based on where they take energy. Animals should be classified into producers of their food or consumers. The task also includes discovering how plants can survive. To discover this, learners are provided the virtual tools to subtract objects from the scene and speed up time to see results. After accomplishing the task, learners can arrange animals on a food chain.

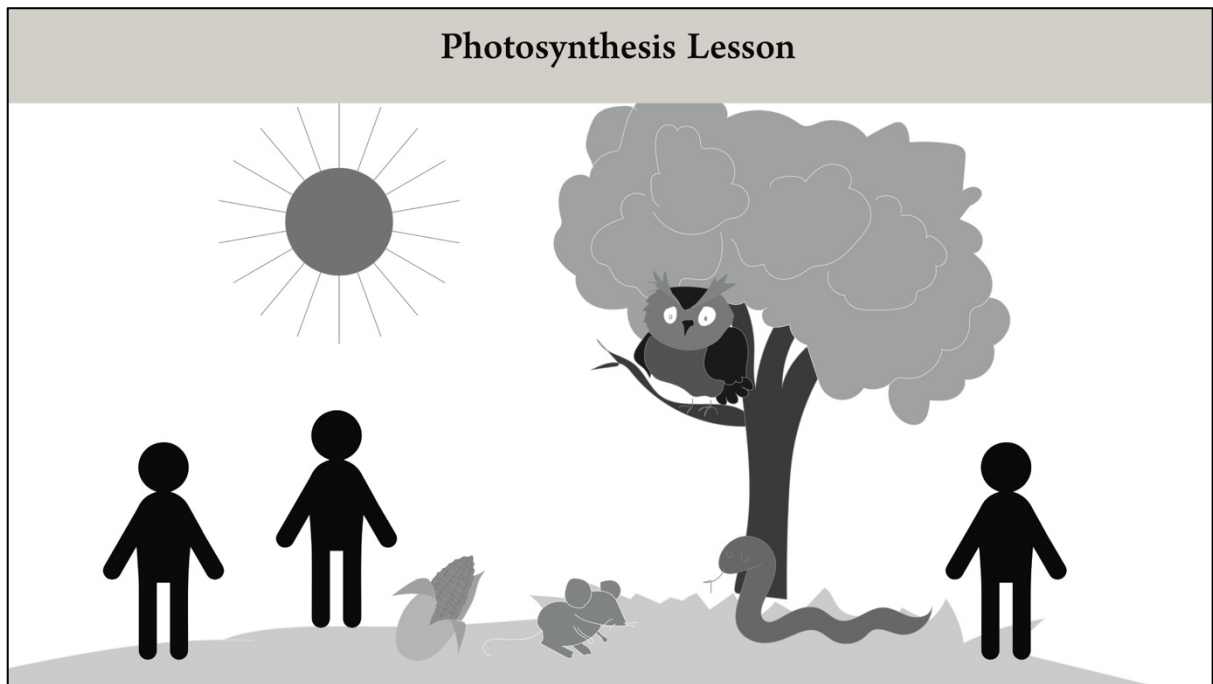


Figure 13. Screen (4) layout

The learner can choose an alternative task with the same purpose but another sensory experience and another virtual location. In our case, learners can choose to do the task under the sea and make a food chain for the sea creatures.

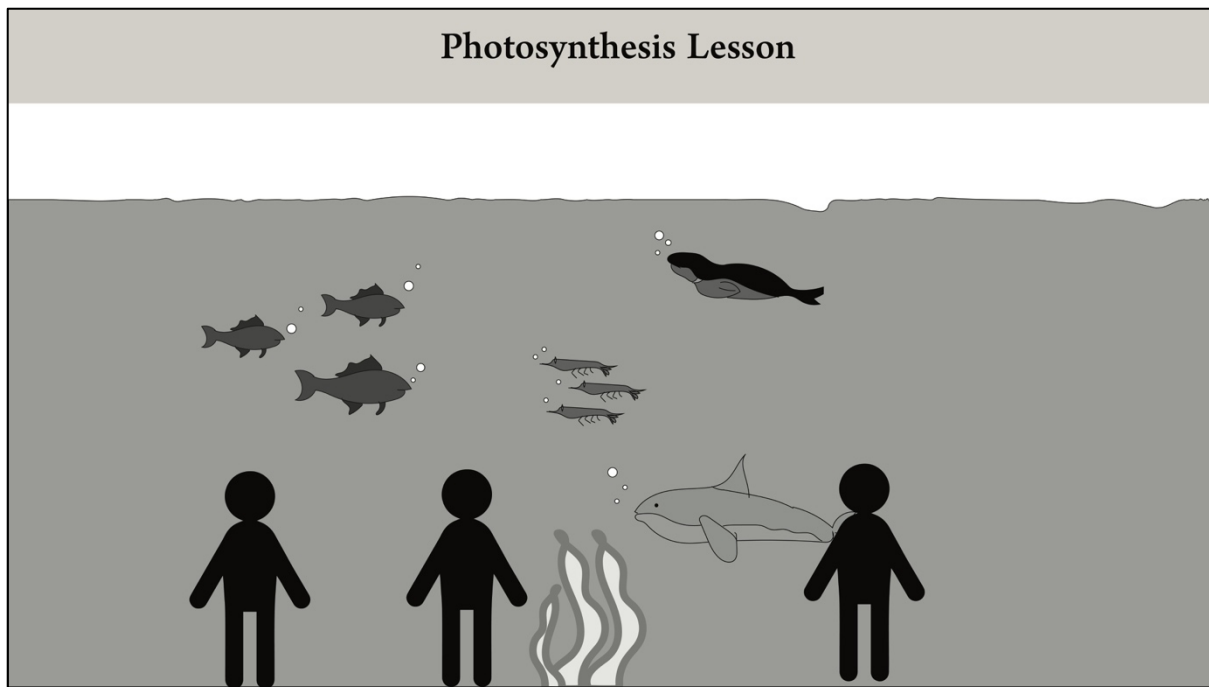


Figure 14. Screen (5) layout

The second task is about the elements of the leaf. Another opportunity for noticing, experimenting, and discovering the different elements of the leaf. Three-dimensional simulation of the elements and their job is included. It is an immersive experience for learners to examine the elements through a sensory experiment.

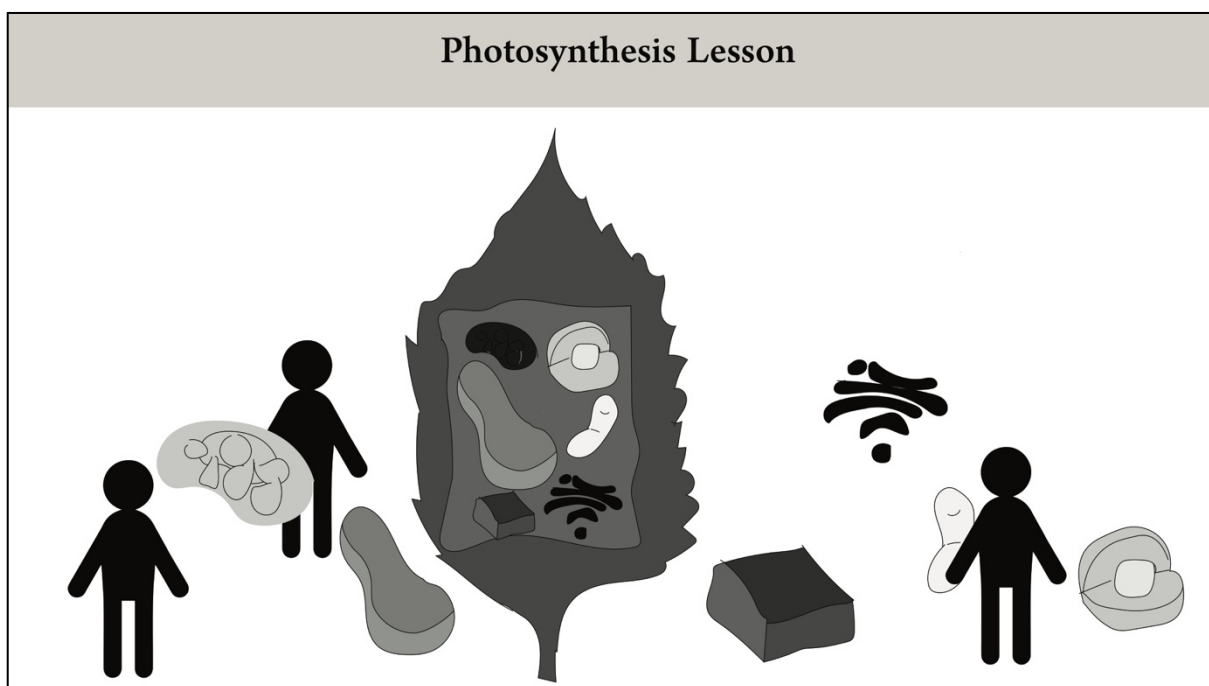


Figure 15. Screen (6) layout

An alternative experience or task with other kinds of plants is available.

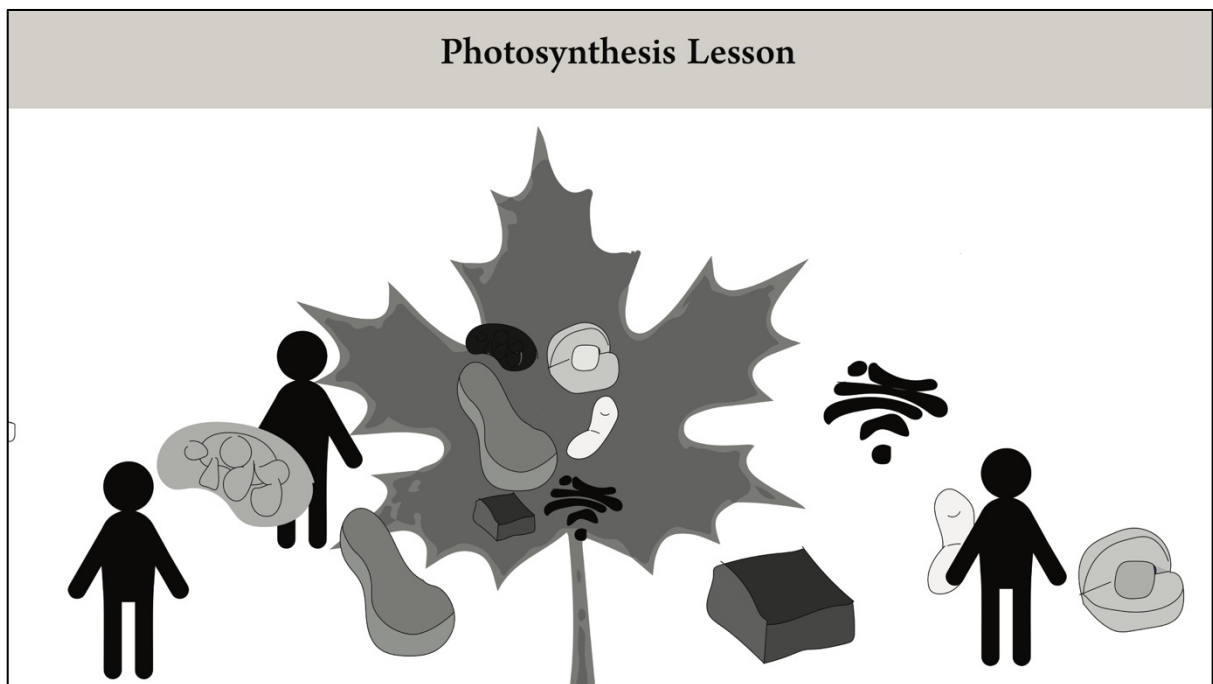


Figure 16. Screen (8) layout

The last task is about the process of photosynthesis. It is the most immersive experience of the three tasks. Learners can pretend they are O_2 , CO_2 , sun rays, or water. They can go in and out of the plant to see what happened inside and live the whole experience.

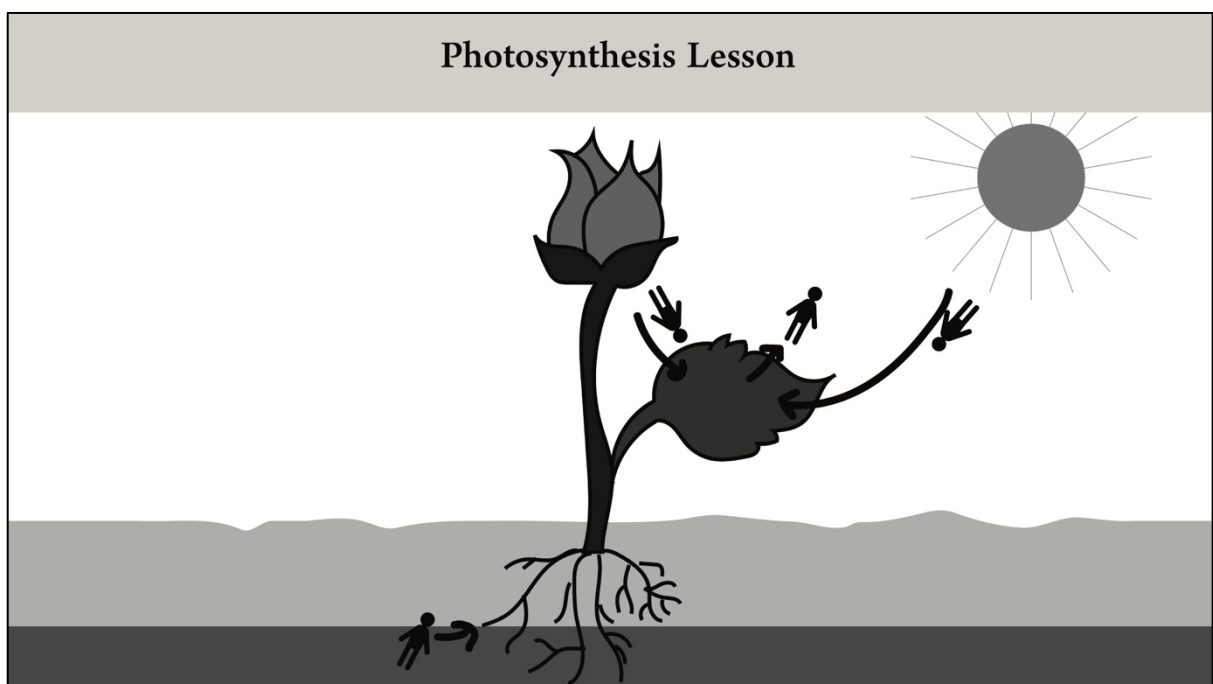


Figure 17. Screen (9) layout

After accomplishing the tasks, a symbol of the lesson will appear in a shiny and colorful way that represents the lesson learned. The symbol contains empty spaces for three kinds of badges.

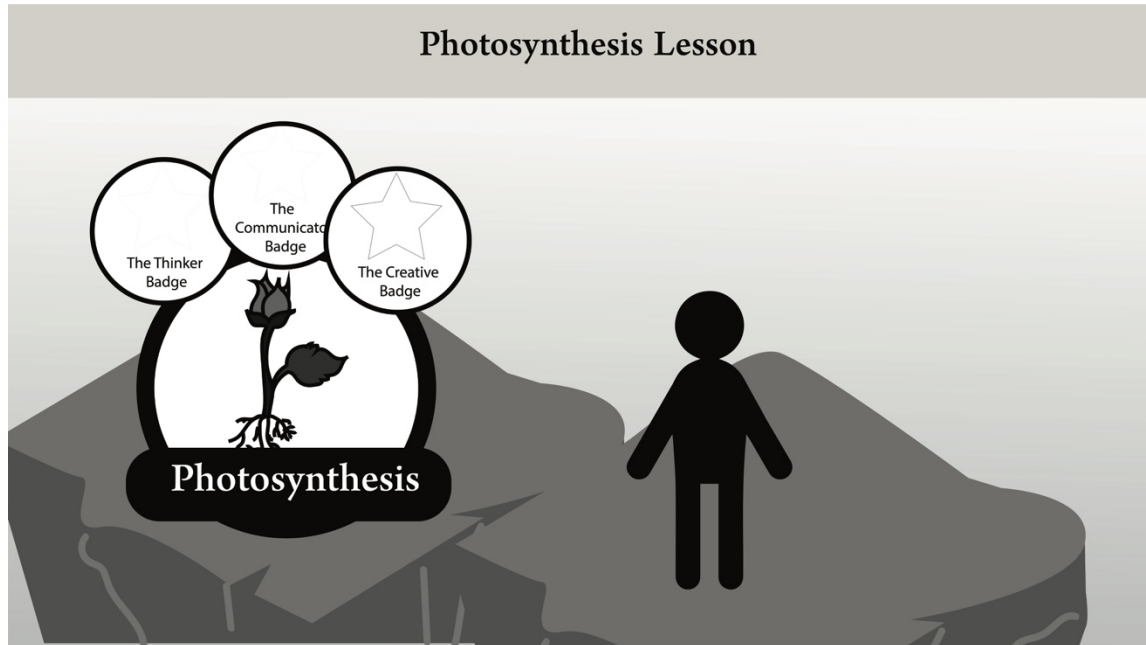
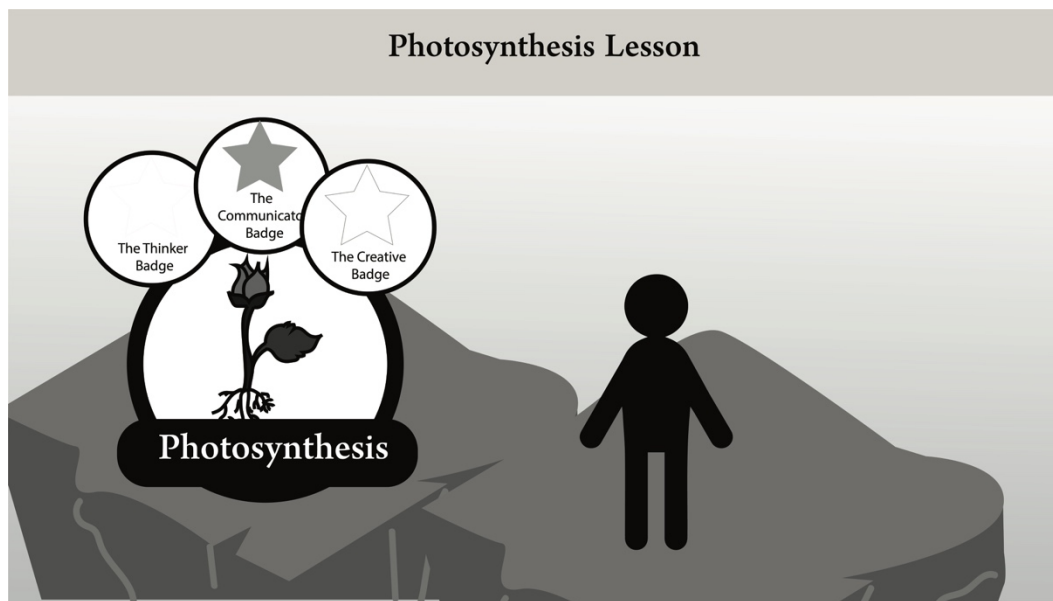
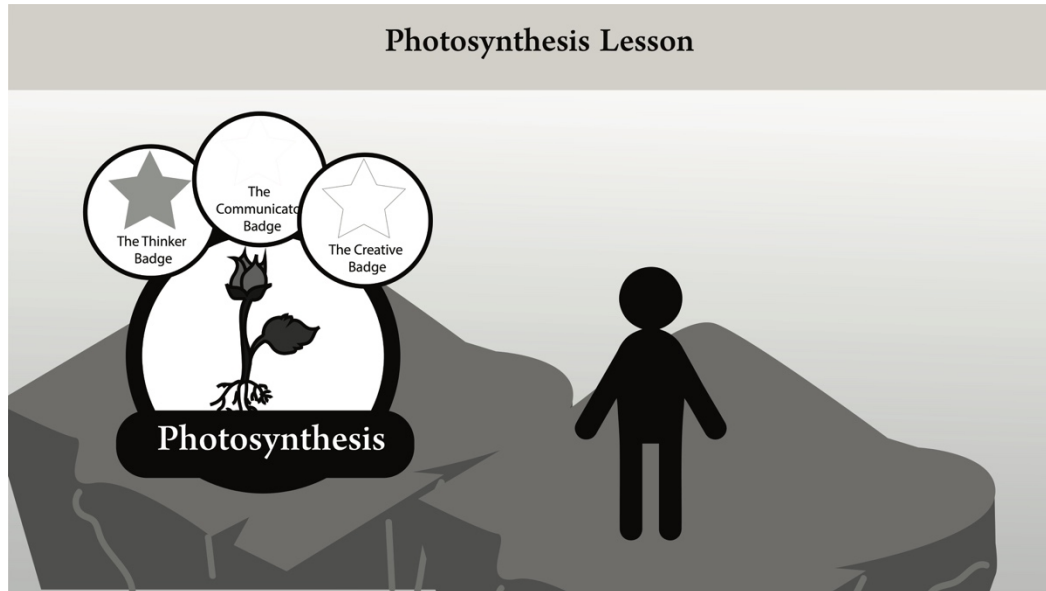


Figure 18. a screen shows the learner's land after accomplishing the lesson's tasks, before getting badges

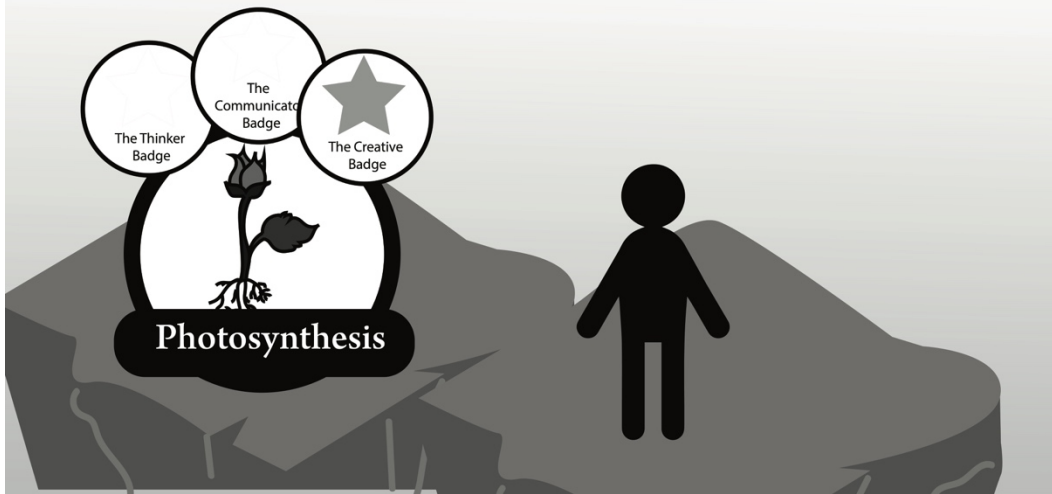
Learners get suggestions from the suggestion system to connect with other nodes for two reasons:

1. To help another learner figure some topics they know well. The other suggestion is to connect with another node with a common interest to write a report or do a project about the topic or connect to it.
2. Learners can write a report or do projects about special plants or alive creations. They may write about energy sources. They may need to write about a topic that requires knowledge from another field. Therefore, the system suggests connections based on his needs and interest.

After that, learners will be rewarded by symbolizing the topic in their land. If they achieve extra goals such as reports, projects, or helping another learner(s), they will get badges accordingly.

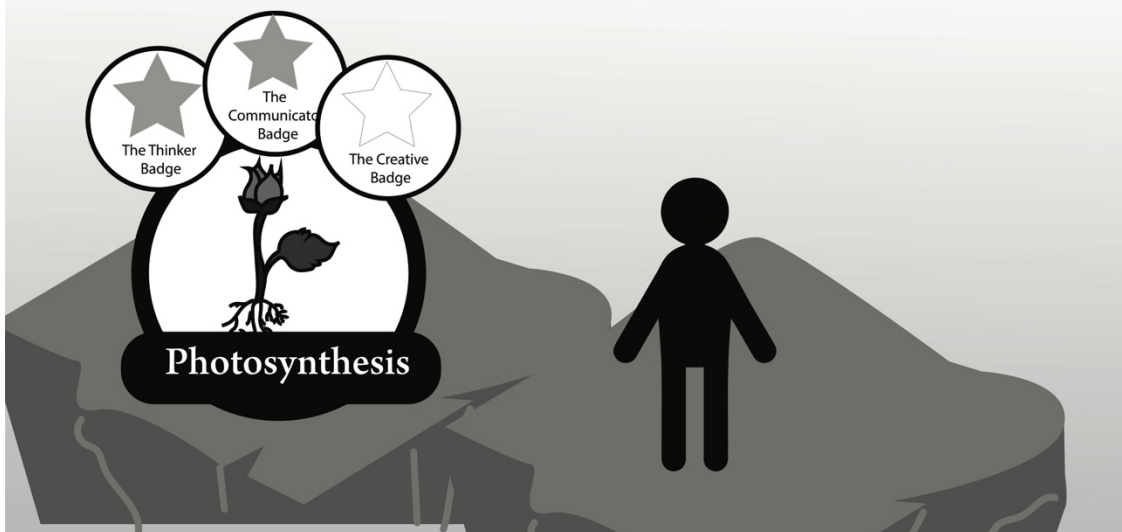


Photosynthesis Lesson



The learner may earn more than one badge, or all of them, in the same lesson.

Photosynthesis Lesson



After finishing the lesson, he will wait for the next level to live another immersive discovery experience.

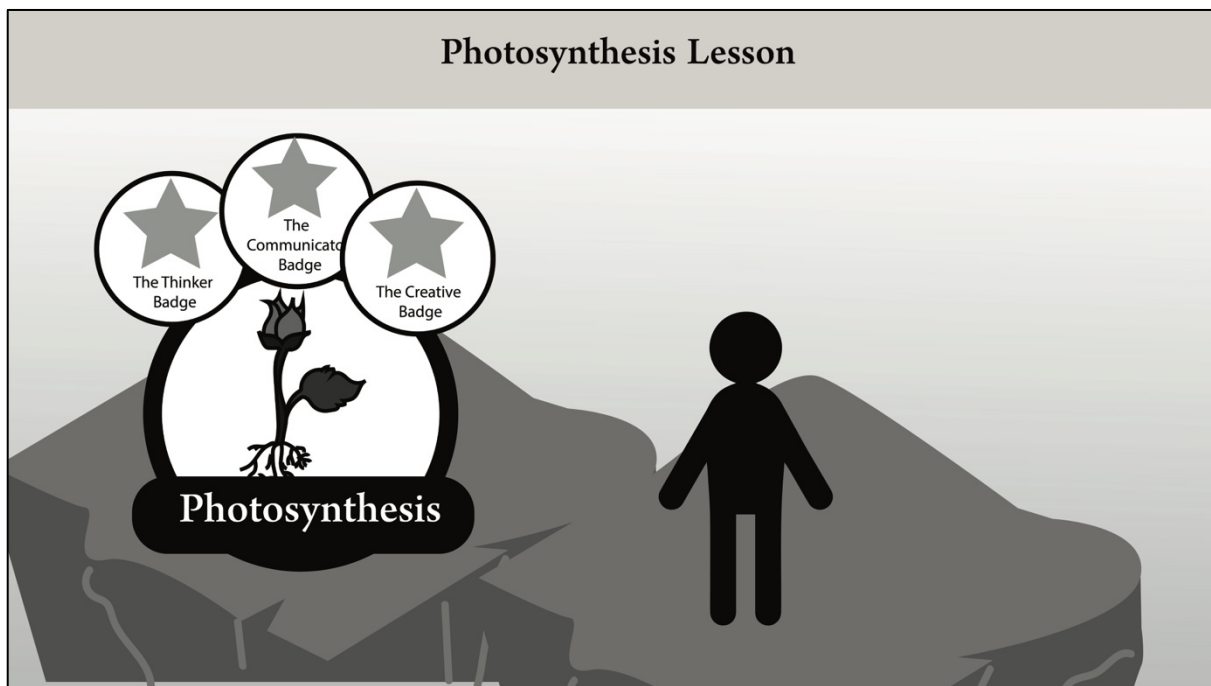


Figure 19. Screen (10) layout

The proposed model has a navigational metaphor: a GPS map to find other nodes' locations. The bellow figure shows how the search bar works. It enables searching by a specific name, and then the GPS map shows the location, and the learner can go there and communicate with the node.

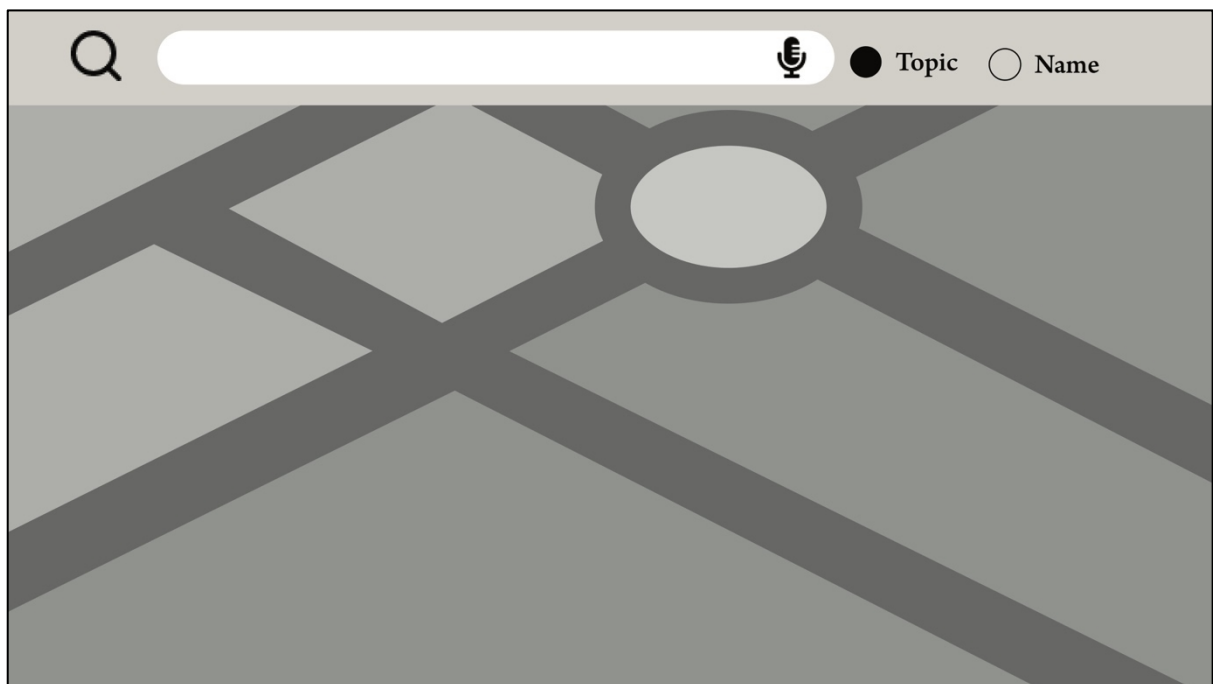


Figure 20. Screen (12) layout

Searching by topic is allowed. In our case, if the learner search for (food chain), results will be classified into learner, educator, and material tabs. As explained before, a checklist is provided in each tab to narrow down the results.

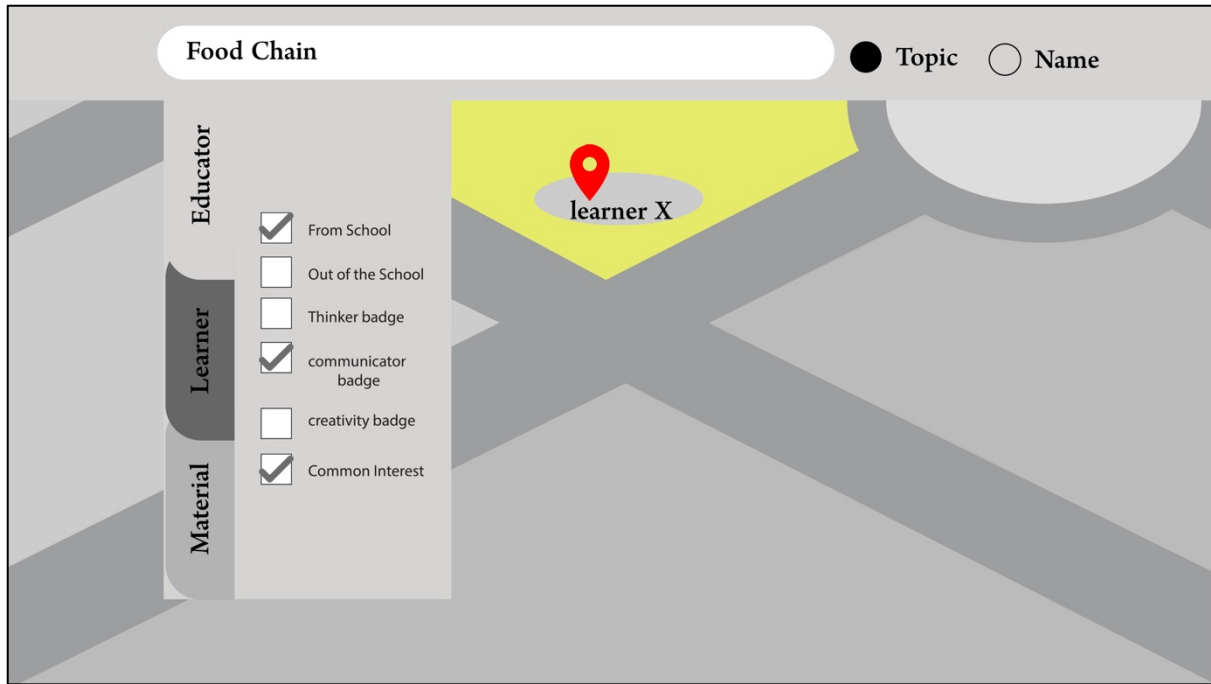


Figure 21. Screen (13) layout

If the user wants to, the bellow figure shows the result of searching for a learner from his school with communicative skills and common interests.

Immersive virtual reality setup

To implement the proposed model, a technical setup for the environment is an important step. This is out of the thesis scope, but to have a full image of the proposed model, some hardware and equipment are needed, such as wearable equipment, tracking systems for reporting positions, sound system, and devices for interacting and input (Handa, Aul, & Bajaj, 2012).

A head-Mounted Display (HMD) is a helmet combined with an LCD screen to render the virtual environment (Handa, Aul, & Bajaj, 2012). HMD is categorized into immersive or see-through. For the case of the proposed model, immersive HDM is required, as they block real worldview and instead show the design's view. While see-through let augmenting the design into the real world view (Rolland & Hua, 2005).

A 3D sound system is vital to increase the involvement in the immersive environment. This sound system guides learners to focus on and observe specific events in the virtual environment (Doer, Rademacher, Huesgen, & Kubbat, 2007).

Olfactory displays allow learners to get information from the smell. The use of olfactory is rare in educational technologies (Kovács, Rozinaj, Murray, Sulema, & Rybárová, 2015).

Haptic devices allow the interaction with objects in the virtual environment to accomplish sensory feedback and control the object (Kovács, Rozinaj, Murray, Sulema, & Rybárová, 2015) the device that is used for our proposed model is a wearable suit and gloves to get whole-body interaction in the immersive environment.

Chapter 5: Discussion and Conclusion

Müller & Goldenberg (2020) Education and Foundation reported that the quality of teaching is more important than the method and technology used to deliver information in the time of the pandemic crises. What matters most is the scaffolding, good explanation, and feedback, whether through remote teaching or face-to-face teaching. Teachers are therefore strongly encouraged to decide on the approach they will use. They consider that deciding on a technology for teaching or another is the teacher's professional decision.

Based on the theoretical and conceptual framework, this thesis proposes a new model that aims to create a rich, communicative and immersive environment for education.

As mentioned in the methodology section, designing the new model (KnowledgeLand) consists of three phases. In the first phase, the problems of current online education technologies were listed by reference to the literature review section.

The second phase involved analyzing the new model's objective and characteristics and defining the target environment.

The third phase entailed proposing a design for the proposed model based on Garret's framework (The elements of user experience).

As McLuhan argues, the research based on understanding the power of media considers the textbook as a communicative medium was a milestone in shifting societies to literate societies. However, when using a panoramic view of media in education, we realized that every medium creates an environment or media sphere that aims to define the characteristics of the current

age and the most influential media. The current media sphere is not separated from previous ones. Instead, previous media gives the current media its uniqueness (Debray, 1996).

This is the case of the print book in the digital age. Books will never disappear (Gomez, 2008). However, digital technologies are the media of this age, and they have the power to change our perception and being (Vial,2019).

Digital media amazed us . Murray (2012) named them, immature media. We are familiar with mature medium such as print, nothing new can be exceptional, even remediating the book into a digital book. As Murray (2012) argues, it is much easier to innovate in a mature medium because it passed a long journey of trials and errors and established standards and form.

Therefore, we are forced to shift towards the new environment. The education system is fortified to change easily. Even using ICT's in education was blooming, but the philosophy of the system did not shift dramatically.

Suddenly, Covid-19 changed the scene, and this strong reinforced system was forced to accept educating online. Literature indicates that online education has problems, such as a lack of communication.

The proposed design used literature to find out the problems learners face through online education; most surprisingly, the lack of communication.

Problems of online education indicated that the education system is forced to open the door in front of digital media to shift toward a communicative immersive educational environment.

The proposed model will give the learner a new set of skills based on the 21centuryy learning skills the 4Cs (communication, collaboration, critical thinking, and creativity skills) by implementing the connectivism theory principles in designing.

Connectivism theory principles made a concrete ground for the proposed design. The main idea of connectivism is to know how to connect with others to learn and where to find the knowledge.

The (knowledge Land) model encourages connecting by building a reward system that forces learners to communicate with nodes on the network of the medium. For example, if the learner accomplishes all tasks, he is forced to do one of the following or all of them to get the rewards and end the level:

First: Connect with another learner. That have difficulty in figuring out a topic he is good at. These nodes are suggested from the suggestion system based on algorithms and big data analysis.

Second: Connect with human nodes (educators or learners) with common interests, even in another field of study or another school. Writing a report or doing a project that includes a personal interpretation of information is a requirement.

Third: Suggest extra material from non-human nodes to expand knowledge and connect with nodes out of the learner's field to create creative projects or have creative opinions and interpretations. Moreover, this point also meets the connectivism principles to know things outside the prior knowledge area.

Another feature of the model that encourages communication is that basic tasks on each level are done with a group of learners and their educators. Teamwork skills, communication, and collaboration skills are encouraged.

Knowing how to connect and where to find the needed knowledge as a connectivism principle indicates is implemented in the search option of the system. The search system helps the educator find knowledge based on his digital traces and analysis of big data and algorithms. As social media platforms analyze the user behavior for commercial purposes, the the proposed

model also analyzes the educator's behavior for educational purposes and gives him suggestions to find the needed information.

The metaphor of the interface as a city gives the learner a mental model that helps find areas of knowledge.

School experience is considered a semiotical engagement (Stables, Learoyd-Smith, Daniels, & Ming Tse, 2014). The use of digital technologies in education shifts the traditional dialogical semiosis between student and teacher or textbook to a new one between the student and the information itself (Bockarova, 2014). Debray argues that the power of the sign is more important than the meaning, The fact that. The system that encourages bridging between different disciplines is an example of intertextuality when the text has a vertical perspective that connects it with other texts.

The metaphor used as a conceptual reference of the new model is the City/Land metaphor. The new relationship between the learner and the model in this thesis aims for an interactive relation; knowledge will be visualized in owning land and expanding it. The learner is not alone in this land; he can communicate and collaborate with others in other lands.

As desktop is a well-known example of spatial metaphor, building or city metaphors have many advantages, such as having different structures and levels of security. Also, they encourage social interaction between different users (Dieberger & Frank, 1998).

Kay (2003) argues that learning the world and science is not happening directly; it is all about our representational; system, just like an incomplete map, which allows criticizing and improving. Our new model uses the city metaphor because cities are always incomplete, constantly expanding and improving.

Kay's most important idea was not about having a new device but having a new relationship between the user and the technology. His perspective for seeing the relation through a metaphor for the medium, not for a tool (Roschelle, Courey, Patton, & Murray, 2013). The vision of Dynabook is about to have a democratic medium (Roschelle, Courey, Patton, & Murray, 2013); our proposed model is democratic and decentralized.

The thesis proposed a conceptual model and a skeleton design that enrich the educational environment with Immersive virtual experience. This model aims to shift online education to be more humanistic and engaging. It aims to solve the problems of the current online learning technologies. It give spaces to learners to connect and expands his knowledge. It supplement learners with the needed skills to learn in this changing and complex world. The researcher recommends implementing the design and testing it.

The researcher proposes a two-phase evaluation after prototyping the system—evaluation with educators' perspective to precisely assess the learners' academic achievement after using the prototype. SOLO Taxonomy is recommended; SOLO is an abbreviation for 'Structure of the Observed Learning Outcome,' which aims to describe students' understanding growth and make sure that assessment tasks are aligned with the learning objectives. It is a descriptive tool of the learner's complexity of performance, from early engagement to expertise (Biggs & Collis, 1989).

The second phase is the users' evaluation; we suggest testing their satisfaction through the Technology Acceptance Model (TAM). According to its founder Davis (1980), TAM is a model used to describe the motivational variables that mediate between the computer-based information system and the user behavior. TAM has two variables that can affect the attitude of a person toward using the technology, which is Perceived Usefulness (PU) and Perceived Ease of use (PE) (Davis, 1980; Wilson, 2016; Hsiao & Yang, 2011).

Bibliography

- Kang, M., & Duong, A. (2021). Student Perceptions of First-Time Online Learning during the COVID-19 Pandemic in Vietnam. *i.e.: inquiry in education*, 13(1), 1-17.
- Khlaif, Z., Salha, S., Affouneh, S., Rashed, H., & ElKimishy, L. (2021). The Covid-19 epidemic: teachers' responses to school closure in developing countries. *Technology, Pedagogy and Education*, 30(1), 95-109.
- Veale, T., Shutova, E., & Klebanov, B. (2016). *Metaphor A Computational Perspective*. Toronto: Morgan & Claypool.
- Adams, C. (2012). Technology as Teacher: Digital Media And The Re-Schooling of Everyday Life. *Society for Existential Analysis Annual Conference*. Canada.
- Affouneh, S., Salha, S., & Khlaif, Z. (2021). The Bright and Dark Sides of Online Learning in Palestine During the Pandemic. In B. Khan, S. Affouneh, S. Salha, & Z. Khlaif, *Challenges and Opportunities for the Global Implementation of E-Learning Frameworks* (pp. 24-35). IGI Global.
- Allcoat, D., & Mühlenen, A. (2018). Learning in virtual reality: Effects on performance, emotion and engagement. *Research in Learning Technology*,.
- Alodwan, T. (2021). Online learning during the COVID-19 pandemic from the perspectives of English as foreign language students. *Educational Research and Reviews*, 279-288.
- Arnheim, R. (1969). *Visual Thinking*. Berkeley: University of California.
- Atasay, E. (2013). Ivan Illich and the Study of Everyday Life. *The International Journal of Illich Studies*, 3(1), 56-77.

- Biggs, J., & Collis, K. (1989). Towards a Model of School-based Curriculum Development and Assessment Using the SOLO Taxonomy. *Australian Journal of Education*, 33(2), 151-163.
- Bilyalova, A., Salimova, D., & Zelenina, T. (2019). Digital Transformation in Education. *International Conference on Integrated Science* (pp. 265-276). Cham: Springer.
- Bockarova, M. (2014). On The Implementation Of Technology In Education. In I. Semetsky, & A. Stables, *Pedagogy and Edusemiotics: Theoretical Challenges/ Practical Opportunities* (pp. 69-90). The Netherlands: Sense Publishers.
- Brâncoveanu, R. (2020). Towards virtualization: Impact of technologies on educational ecosystems. In *Humanistic futures of learning Perspectives from UNESCO Chairs and UNITWIN Networks* (pp. 132-135). France: UNESCO Education Sector.
- Carroll, J., Mack, R., & Kellogg, W. (1988). Interface Metaphors and User Interface Design. In M. Helande, *Handbook of Human-Computer Interaction*. North-Holnd: Elsevie.
- Chandler, D. (2017). *SEMIOTICS THE BASICS* (Third edition ed.). New York: Routledge.
- Cocton, G. (2008). Human–Computer Interaction. In J. D. Pooley, & E. W. Rothenbuhler, *The International Encyclopedia of Communication*. UK: John Wiley & Sons.
- Creswell, J., & Creswell, J. (2018). *Research Design Qualitative, Quantitative, and Mixed Methods*. California: SAGE.
- Danes, M. (2002). *Understanding Media Semiotics*. London: Arnold.
- Davis, F. (1980). A TECHNOLOGY ACCEPTANCE MODEL FOR EMPIRICALLY TESTING NEW END-USER INFORMATION SYSTEMS: THEORY AND RESULTS. *Doctoral dissertation*.
- Debray, R. (1996). *Media Manifestos on the Technological Transmission of Cultural Forms*. London: Vers .

- Dieberger, A., & Frank, A. (1998). A City Metaphor to Support Navigation in Complex Information Spaces. *Journal of Visual Languages and Computing* , 597—622.
- Doer, K.-u., Rademacher, H., Huesgen, S., & Kubbat, W. (2007). Evaluation of a Low-Cost 3D Sound System for Immersive Virtual Reality Training Systems. *IEEE Transactions on Visualization and Computer Graphics*, 204-212.
- Downes, S. (2019). RECENT WORK IN CONNECTIVISM. *European Journal of Open, Distance and e-Learning*.
- Duke, B., Harper, G., & Johnston, M. (2013). Connectivism as a Digital Age Learning Theory. *The International HETL Review* (pp. 4-13). New York: The International HETL Association.
- Dunn, P., Brunton, E., & Farrar, M. (2021). Your online textbook is ready: a shareable, interactive online textbook in response to COVID-19 lockdowns. *International Journal of Mathematical Education in Science and Technology* .
- Eco, U. (1976). *A THEORY .: OF SEMIOTICS*. Bloomington: INDIANA UNIVERSITY PRESS.
- Eco, U. (1996). Afterword. *The Future of the Book* (pp. 295-306). California: University of California Press.
- Ertmer, P., & Newby, T. (1993). Behaviorism, Cognitivism, Constructivism: Comparing Critical Features from an Instructional Design Perspective. *Performance improvement quarterly*, 6(4), 50-72.
- Farrah, M., & Jabari, S. (2020). Interaction in Online Learning Environment during Covid -19: Factors behind Lack of Interaction and Ideas for Promoting it. *Bulletin of Advanced English Studies (BAES)*, 5(2), 47-56.
- Fisher, J. (1996). Plato on Writing and Doing Philosophy. *Journal of the History of Ideas*, 27(2), 163-172.

- Foster, A., Shah, M., Barany, A., Petrovich, M., Cellitti, J., Duka, M., . . . Shaffer, D. (2018). Virtual Learning Environments for Promoting Self Transformation: Iterative Design and Implementation of Philadelphia Land Science. *International Conference on Immersive Learning* (pp. 3-22). Cham: Springer.
- Garret, J. (2011). *The Elements of User Experience: User-Centered Design for the Web and Beyond*. Pearson Education.
- Goethe, O. (2019). *Gamification Mindset*. Oslo: Springer.
- Gomez, J. (2008). *Print is Dead Books in Our Digital Age*. New York: PALGRAVE MACMILLAN.
- Gordon, W. T. (2012). *Mcluhan for beginners*. Danbury: A For Beginners® Documentary Comic Book.
- Hamad, F. (2021). Palestinian Mothers' Perceptions about Online Learning at Public and Private Elementary Schools during COVID-19: Challenges and Recommendations. *Pedagogical Research*, 6(3).
- Handa, M., Aul, G., & Bajaj, S. (2012). Immersive Technology- Uses, challenges and opportunities. *International Journal of Computing & Business Research*, 1-11.
- Harasim, L. (2001). Shift happens Online education as a new paradigm in learning. *Internet and Higher Education*, 41-61.
- Hikmah, A., Wuryandani, W., Zubaidah, E., Herwin, H., & john, W. (2021). Online Learning in Primary School during Covid-19 Pandemic: How Does It Look Like? *Journal of Educational Research and Evaluation*, 350-361.
- Homanova, Z., Prextova, T., & Klubal, L. (2018). Connectivism in Elementary School Instruction. *The 17th European Conference on e-Learning* (pp. 177-184). acpi.

- Hsiao, C., & Yang, C. (2011). The intellectual development of the technology acceptance model: A co-citation analysis. *International Journal of Information Management*, 128-136.
- Huang □ , R., Spector □ , J., & Yang, J.. (2019). *Educational Technology: A Primer for the 21st Century*. Singapore: Springer.
- Jandrić, P. (2014). Deschooling Virtuality . *Publication Cover Open Review of Educational Research*, Taylor and Francis .
- Johnson, J., & Henderson, A. (2012). *Conceptual Models: Core to Good Design*. Morgan & Claypool.
- Kay, A. (2003). *The Dynabook Revisited: A Conversation with Alan Kay*. Retrieved from The Book & The Computer: <http://www.honco.net/os/kay.html/>.
- Kay, A. (2013). *Afterword: What is a Dynabook?* Glendale: Viewpoints Research Institute.
- Kay, A. (2013). The Future of Reading Depends on the Future of Learning Difficult to Learn Things. In B. JungeZ, a. Berzina, W. Scheiffele, W. Westerveld, & C. Zwick, *The Digital Turn, Design in the Era of Interactive Technologies*. Chicago: University of Chicago Press.
- Kestenbaum, D. (2005). The challenges of IDC: what have we learned from our past? *Communications of the ACM*, 48(1), 35-38.
- Khan, M., Trujano, F., & Maes, P. (2018). Mathland: Constructionist Mathematical Learning in the Real World Using Immersive Mixed Reality. *International Conference on Immersive Learning* (pp. 133-147). Cham: Springer.
- Kop , R., & Hill, A. (2008). Connectivism: Learning theory of the future or vestige of the past? *International Review of Research in Open and Distributed Learning*, 1–13.
- Kostakis, V., & Pantazis, A. (2021). Is ‘Deschooling Society’ Possible? Notes from the Field. *Postdigital Science and Education*.

- Kovács, P., Rozinaj, G., Murray, N., Sulema, Y., & Rybárová, R. (2015). Application of Immersive Technologies for Education: State Of The Art. *International Conference on Interactive Mobile Communication Technologies and Learning (IMCL)* (pp. 283-288). Greece: IEEE.
- Lassoued, Z., Alhendawi, M., & Bashitialshaaer, R. (2020). An Exploratory Study of the Obstacles for Achieving Quality in Distance Learning during the COVID-19 Pandemic. *education sciences* , 1-13.
- Müller, L.-M., & Goldenberg , G. (2020). *Education in times of crisis: The potential implications of school closures for teachers and students*. London: Chartered College of Teaching.
- Maxwell, J. (1985). The Future of Textbooks— Can They Help Individualize Education? *NASSP Bulletin*, 68-74.
- McLuhan, M. (1951). *The Mechanical Bride: Folklore of Industrial Man*. Vanguard Press.
- McLuhan, M. (1962). *The Gutenberg Galaxy: The Making of Typographic Man* . Toronto: University of Toronto Press.
- Mcluhan, M. (1964). *Understanding Media: The Extensions of Man*. ARK.
- Mcluhan, M. (1967). *The medium is the message*. New York : Ginkgo Press.
- McLuhan, M. (1970). Education in the electronic age. *Interchange*, 1(4), 1-12.
- Meyrowitz, J. (2008). Medium Theory. In J. Pooley, & E. Rothenbuhler, *The International Encyclopedia of Communication*. John Wiley & Sons.
- Moore, J., Dickson-Deane, C., & Galyen, K. (2011). e-Learning, online learning, and distance learning environments: Are they the same? *Internet and Higher Education*, 129–135.
- Mouri , K., Uosakib, N., Hasnine , M., Shimada, A., Yin, C., Kaneko, K., & Ogata, H. (2019). An automatic quiz generation system utilizing digital textbook logs. *Interactive Learning Environments*, 1-14.

- Murphy, J., & Shelley, A. (2020). Textbook Affordability in the Time of COVID-19. *Serials Review*, 232-237.
- Murray, J. H. (2012). *Inventing the medium: Principles of Interaction Design as a Cultural Practice*. Massachusetts: The MIT Press.
- Nake, F., & Grabowski, S. (2001). Human–computer interaction viewed as pseudo-communication. *Knowledge-Based Systems*, 14(8), 441-447.
- Ng, W. (2015). *New Digital Technology in Education Conceptualizing Professional Learning for Educators*. New York: Springer.
- Palkova, Z., Fragkaki, M., bdelhafid, F., Al-Qubaj, S., Aburajab, N., Hawamdeh, M., . . . Valicek, J. (2019). VIRTUAL REALITY AS AN INNOVATIVE AND IMMERSIVE LEARNING TOOL FOR HEIS IN PALESTINE. *3th International Technology, Education and Development Conference*, (pp. 11-13). Spain.
- Pamment, J. (2015). Digital diplomacy as transmedia engagement: Aligning theories of participatory culture with international advocacy campaigns . *new media & society*, 1-17.
- Partnership for 21st century skills. (2015). *Frameworks & Resources*. Retrieved November 2021, from Battelle for Kids: <https://battelleforkids.org/networks/p21/frameworks-resources>
- Radwan, E., Radwan, A., Radwan, W., & Pandey, D. (2021). Perceived Stress among School Students in Distance Learning During the COVID-19 Pandemic in the Gaza Strip, Palestine. *Augmented Human Research*, 6(12), 1-13.
- Redlo, J. M. (2021). Barriers in Teaching the Four C's of 21st Century Competencies: Dismantling the Obstacles. In H. K. Dhir, *Handbook of Research on Barriers for Teaching 21st-Century Competencies and the Impact of Digitalization* (pp. 129-172). IGI Global.

- Rolland, J., & Hua, H. (2005). Head-Mounted Display Systems. In *Encyclopedia of optical engineering 2*.
- Roschelle, J., Courey, S., Patton, C., & Murray, E. (2013). Dynabooks: Supporting Teachers to Engage All Learners in Key Literacies. In C. Mouza, & N. Lavigne, *Emerging Technologies for the Classroom A Learning Sciences Perspective* (pp. 31-46). New York: Springer.
- Rosli, M. W., & Cabrera, A. (2015). Gestalt Principles in Multimodal Data Representation. *IEEE Computer Graphics and Applications*, 35(2), 80-87.
- Sahin, M. (2009). Instructional design principles for 21st century learning skills. *Procedia Social and Behavioral Sciences*, 1464–1468.
- Scolari, C. (2009). DIGITAL ECOLOGY, Umberto Eco and a semiotic approach to digital communication . *Information, Communication & Society*, 12(1), 129-148.
- Selwyn, N. (2015). The discursive construction of education in the digital age. In R. Jones, A. Chik, & C. Hafner, *Discourse and Digital Practices: Doing discourse analysis in the digital age* (pp. 226-240). London: Routledge.
- Senova, M. (2020). META-SKILLS ARE THE KEY TO HUMAN POTENTIAL. *JOURNAL OF BEHAVIOURAL ECONOMICS AND SOCIAL SYSTEMS*.
- Shahin, G. O. (2012). *DEVELOPMENT OF A MODEL FOR BLENDED LEARNING IN TRADITIONAL UNIVERSITIES IN PALESTINE*. KUALA LUMPUR: UNIVERSITY OF MALAYA.
- Sharp, H., Preece, J., & Rogers , Y. (2019). *Interaction Design Beyond Human-Computer Interaction, Fifth Edition*. Indiana: John Wiley & Sons.
- Shepard, M. (2012). Creating a Culture of Digital Collaborative in Online Learning. In L. Moller, & J. Huett, *The Next Generation of Distance Education Unconstrained Learning* (pp. 126-138). New York: Springer.

- Siemens, G. (2005). *Connectivism: A Learning Theory for the Digital Age*. Retrieved from International Journal of Instructional Technology and Distance Learning: http://www.itdl.org/Journal/Jan_05/article01.htm
- Silva, F. C. (2016). Following the Book: Towards a Pragmatic Sociology of the Book. *Sociology*, 50(6), 1185-1200.
- Sobaih, A., Salem, A., Hasanein, A., & Abu Elnasr , A. (2021). Responses to COVID-19 in Higher Education: Students' Learning Experience Using Microsoft Teams versus Social Network Sites. *sustainability*, 13(18), 1-12.
- Soukup, P. A. (2008). Medium. In J. D. Pooley, & E. W. Rothenbuhler, *The International Encyclopedia of Communication*. John Wiley & Sons.
- Stables, A., Learoyd-Smith, S., Daniels, H., & Ming Tse, H. (2014). Schools And Schooling As Semiotic Engagement. In I. Semetsky, & A. Stables, *Pedagogy and Edusemiotics: Theoretical Challenges/ Practical Opportunities* (pp. 35-50). The Netherlands: Sense Publishers.
- Suh, A., & Prophet, J. (2018). The State of Immersive Technology Research: A Literature Analysis. *Computers in Human Behavior*.
- Trestini, M. (2018). *Modeling of Next Generation Digital Learning Environments: Complex Systems Theory*. Hoboken: Wiley.
- Utecht, J., & Keller, D. (2019). ecoming Relevant Again: Applying Connectivism Learning Theory to Today's Classrooms. *Critical Questions in Education*, 107-119.
- Vandendorpe, C. (2009). *From Papyrus to Hypertext Toward the universal digital library* . Chicago: Univerzity of Illionis Press.
- Vial, S. (2015). Philosophy applied to design: A design research teaching method. *Design Studies*, 37, 59-66.

- Vial, S. (2019). *Being and the Screen: How the Digital Changes Perception. Published in one volume with A Short Treatise on Design*. Cambridge, Massachusetts: MIT Press.
- Volonté, P., Rampino, L., & Colombo, S. (2018). The Specificity of Design Research: How Practice-Based Design Knowledge Can Enter the Great Archive of Science. In P. E. Vermaas, & S. Vial, *Advancements in the Philosophy of Design* (pp. 319-345). Springer.
- Widikasih, P., Widiana, W., & Margunayasa, G. (2021). Online Learning Problems for Elementary School Students. *Journal of Educational Research and Evaluation* .
- Wilson, T. D. (2016). Theoretical approaches to e-book research . *journal for the research of writing, books, and cultural heritage institutions*, 9(1), 159-174.
- Witmer, B., & Singer, M. (1998). Measuring Presence in Virtual Environments: A Presence Questionnaire. *Presence: Teleoperators and Virtual Environments*, 225–240.
- Yin, C., Okubo, F., Shimada, A., OIa, M., & Hirokawa, S. (2015). Identifying and Analyzing the Learning Behaviors of Students using e-Books. *Proceedings of the 23rd International Conference on Computers in Education* (pp. 118-120). China: Asia-Pacific Society for Computers in Education.
- Yoh, M.-S. (2001). The Reality of Virtual Reality. *The Seventh International Conference on Virtual Systems and Multimedia* (pp. 666-674). Berkeley,: IEEE.

Arabic Bibliography

دوبريه, ر. (1997). *محاضرات في علم الإعلام العام: الميديولوجيا*. بيروت: دار الطليعة للطباعة والنشر.

النشوي, م. (2012). *الميديولوجيا، مدخل لمقاربة وسائط الإعلام*. مركز نماء للبحوث والدراسات.