Case Report

Self-Directed and Self-Designed Learning: Integrating Imperative Topics with Case - COVID-19

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Abstract: The research proposes a self-directed paradigm with self-design using the existing technology with LMS modules, discussions, and self-tests. The research establishes its criteria for assurance of teaching and learning known as 7x2C for the compliance of content, and appearance along with other criteria for the analysis. The above technology of web and LMS is tested for a business course that is technology-oriented in creating an experiential learning system for Covid-19 awareness. Similarly, among other ideas, an environment for educating learners about diabetes and obesity has been designed. The project is known as Sunchoke with its theme of Grow, Eat, and Heal. The educators can use their technology and apply self-directed pedagogy to transform this approach to their customized ways by using their content and rubrics.

Keywords: self-directed learning; pedagogy; visualization plan; web analysis; big data; pattern matching; COVID-19

Introduction

Self-Directed Learning and Self Design became unwantedly popular and common during the Covid-19 era.   Learners are directed to do their learning and, in many instances, to do their design as what they must do. This research illustrates the use of technology in teaching and learning technology with a central theme of promoting self-directed learning with its self-design engaging both educators and learners. The technology in use is from already existing tools such as web page design, Learning Management Systems (LMS), Project Management tools, and basic Programming Foundations and concepts of big data and databases. In addition, the tool can be created by simple coding by end users and developers of their own choice.   The planning techniques such as Visual Plan Construct Language with its own embedded AI used in this research will integrate the course material and rubrics with time management. An educator may use a project management tool instead.

The research proposes a self-directed paradigm with self-design using the existing technology with LMS modules, discussions, and self-tests. The research establishes its criteria for assurance of teaching and learning known as 7x2C for the compliance of content, and appearance along with other criteria for the analysis.   The above technology of web and LMS is tested for a business course that is technology-oriented in creating an experiential learning system for Covid-19 awareness. Similarly, among other ideas, an environment for educating learners about diabetes and obesity has been designed. The project is known as Sunchoke with its theme of Grow, Eat, and Heal. The educators can use their technology and apply self-directed pedagogy to transform this approach to their customized ways by using their content and rubrics.

Self-Directed Learning with a Contemporary Topic: COVID-19

The research connects the covid-19 as a sample of the contemporary topic to a business course "Web Systems and E-commerce" curriculum by making the learning applicable to real life and creating an engaging and exciting atmosphere. The moment of the spark and start of the project with

plan integration seems the hardest part but seeing the intermediate results deliver satisfaction among the learners. This research shows how the learners are directed to use Covid-19 in four phases: Informative, diagnostics, simulation, and pattern matching for trend and the solution. A set of frameworks and the initial setup are given for the design of the project using the materials from the course including creating a web page to keep track of the self-learning and self-design. The task of each learner is to customize the work and transform the learning in collaboration in each of the four phases and processes. The course consists of topics such as web technology, web design, website analysis, and creating an E-commerce from scratch with techniques in web hosting. The web design includes the basics of HTML coding and programming with JavaScript and C++. However, the learners are given the freedom to choose an existing template or work.   The recipe of homemade criteria for web analysis known as 7x2 C's is illustrated throughout the course. For example, the learners are directed to collect "Correct and Credible" information about COVID-19 such as WHO and CDC when creating the informative phase. The course requires learning and applying the basics of programming on the web page. The learners were directed to build a simple diagnostic program that finds the diseases that have co-symptom of covid-19. Similarly, to find a game or simulation program mimicking Covid-19 interaction with the body's cells. The learner is given a language translator program from English to Spanish written in JavaScript. The task is to convert the translator program to a diagnostic program simply by changing the variable names and input/output display messages (Ebrahimi, 2002). The web color code (RED, GREEN, BLUE) Hexadecimal or binary is used for the presentation of the data for the COVID-19 cases, to pattern-match and find the possible trend by applying a certain mask on data.   In the early stage, learners are directed to acquire web hosting accounts and publish their COVID-19 web page in sharing their experiences and challenges. This research has been an ongoing effort since the Spring of 2020, each time to improve ways to direct self-learning with self-design by adding new values.

The COVID-19 pandemic has disturbed the normalcy of society by enforcing people to distance themselves from each other "social distancing" and limit contact as a crucial strategy to curb the spread of the virus. The limit of physical contact and isolation was a key remedy to combat the infected from non-infected people. People lived in isolation (quarantine) and encourage to stay home until it is safe to be around others.   People relied on themselves to do their own day-to-day business rather than wait for what was to be done by others. On many occasions, people designed their tools and environments, and self-directed their learning. Technology became a tool for reaching out and being part of solutions for individuals experiencing social isolation and loneliness. Many institutions adopted learning management systems for teaching and learning and many businesses have gone to virtual including health care.

Self-directed learning application has been an effective strategy in education for decades and it has been a core concept in adult education. There are professional fields in which learners are more involved in SDL, such as medicine, accounting, teacher education, and software development. SDL allows both learners and educators to apply the skills by embedding the interest (Loeng, 2020).

In the Covid era, self-directed learning (SDL) became a popular choice ranging in cooking, self-study, work, communication, and most importantly learning ways to improve the quality of health and life and combat the pandemic.

Self-learning during this time got another dimension and necessity for self-design of tools and environments. A tremendous amount of search was done on the internet to look for the design of what was needed such as tackling the shortage of Personal Protective Equipment (PPE) and such design of workplace (mini office), computer interface, web page, and there was more reliance on social media and 3D printers.

The network and web systems played an important role to provide the means for exchanging information both in self-directed learning and self-design in using and creating tools and environments for health and other life necessities.

This study involved students at SUNY Old Westbury (Long Island) in a business course known as "Web Systems and E-Commerce" during the Spring of 2020 at the height of the Covid-19 pandemic and has been repeated in the Summer of 2020 and the Fall of 2021 semesters and continued until the

present time. In addition, materials from this work are from a collection of four of my conference presentations since 2020.

The students were self-directed to learn the materials given to design their web page first by providing the existing code and viewing the impact. The ultimate plan is to build an awareness system for Covid-19 by collaborating with other classmates. Students in collaboration with other classmates. Students are in college to share the challenges and new learning and tasks experience to the next level of learning and design.

The content of the page provided to each user in the course is used as a basic framework for self-learning direction. The information on COVID-19 is accessed from credible sources, such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC).

Learning Criteria Framework: Web Error Analysis

To design and evaluate a web page criteria established in the course are known as "7X2 C" (Ebrahimi, et al., 2007). The criteria are provided by the instructor to the user for ongoing design and evaluation in their mind. In the design and evaluation of a web page, there are 7 layers of the website. The seven pairs of C's are shown below

- (Content, Context)
- (Correctness, Credibility)
- (Currency, Continuity)
- (Completeness, Coverage)
- (Consistency, Conciseness)
- (Community, Customization)
- (Compelling, Creativity)

The 7 X 2 C criteria definition and examples

Content and Context

Each page on the website requires content that would be relevant to the context of the topic of the page, given the meaning. This volume of information should be helpful and informative, for example, in the case of COVID should provide basic facts about the virus and the pandemic.   For any other topic, the necessary content with the related context should be gathered and provided.

Correctness and Credibility

The content and the context of each page should be correct and creditable to be able to build trust and have the correct information. In the case of COVID, the content of each page should have used a correct and credible source such as CDC and WHO. Web users need to obtain the information correctly. For any other topic, the correctness and credibility of the content and posted material should be in the mindset of the learner. Credible sources from journal articles are encouraged.

Currency and Continuity

Each page should be up-to-date and have a history and a vision for the future with currency and continuity. In the case of COVID, there should be a history of the virus and the process that is happening at the current time and establish some predictions and events such as updates on progress. Time management with social presence has been enforced.

Completeness and Coverage

A website should cover all the necessary areas under consideration with complete information and coverage. Regarding COVID all-important subject matters should be presented with a visible link. In another topic the entire area under study has been identified, each with its coverage to be completed.

Consistency and Conciseness

Each page should be consistent in format, images, and style. In addition, the page should be concise to the point to avoid overwhelming. Regarding COVID-19, the page should use appropriate format images and styles across the site and provide only important information. For another topic, the learner is trained to apply consistency to the workspace and to practice the art of conciseness and abstraction.

Community and Customization

A page at the time of design should consider the users and be tailored to their needs. Regarding COVID-19, the audience of the page should be considered.

Compelling and Creativity

A page should be compelling and creative by incorporating arts and innovations. As for COVID-19 the use of colors, and backgrounds with special features and effects such as video, and sounds, in graphic design should be considered.

Layers of Website Evaluation and Design

A page can be seen in the following layers:

- Application and Development

    Identifies the use and the purpose of the page by applying (who, what, when, where, why, and how)

- Appearance

    Impress the overall look, animation, features, and clarity.

- Search Engine

    Locates the right information and the right amount promptly.

- HTML

    Covers important HTML commands (tags) properly.

- Client-Side Programming

    Incorporates JavaScript programming, for the interface, and validation.

- Server Side and Database

    Incorporates Server-Side programming and Database-user login and responses.

- Security, Privacy, and Ethics

    Considers protective measures and policies for security, privacy, and ethical issues.

Self-directed Learning and COVID-19

The first step in self-directed learning is for the users to understand what they need to do and what they need to design to prove the necessary materials. The next step is to utilize the learned material and build the way of their creativity and innovation. In the case of COVID-19, self-learning helps individuals to manage and seek the remedy for the virus. The information may include that COVID-19 affects people differently in many ways, from asymptomatic, mild, and severe to fatality. Some of the reasons people react differently to the virus are known as certain underlying health conditions, dietary intake, environmental controls, genetic predisposition, and immune system function. Other reasons will be known to us in the future.

The Aim of the System

Self-learning aims to develop a gradual system, which would incorporate the learning material to raise awareness about the pandemic. This can be accomplished by engaging and assisting self-

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learners where each can collaborate and share their new knowledge with the database. The system is divided into 4 categories for COVID-19 known as to

- Comprehend
- Combat
- Coexist/cope
- Trace/pattern matching

The ultimate goal, of the system collectively, would be to find a pattern that provides hints for the cure for COVID-19. This makes self-directed learning with self-design a successful technique that contributes to the quality of education in our life.

Self-Design Framework -COVID-19: Plan Oriented Approach

There are two considerations in the design of the system for COVID awareness. One is for the learner to understand the technology/code that creates the system and the second is the health and medical information that is needed for the awareness of the system. Additionally, learner participation, sharing information, and creativity are something to be aware of when the system is created bottom-up from scratch. Special steps are taken to make the awareness system as simple and friendly as possible. In the design of the awareness system, a Plan Oriented approach has been introduced.

Plan Oriented Approach-Integration

In the plan-oriented system, any task performing an action or providing the information is considered a plan. A plan can be combined with another plan to form a larger plan and this trend continues to form the entire system as a plan (Ebrahimi, 1993).

For Plan Integration, there are four ways to combine two plans known as:

- Append Plans, the plans are next to each other, and action after a plan goes to another plan, therefore Plan B is after or on the top of plan A.
- Interleave Plans, the plans are in and out of each other. After a quick start to A, plan B starts, and then back to plan A and so forth.
- Embed Plans, one plan is entirely in another plan, therefore plan B is entirely in plan A.
- Branch Plans, a plan is an alternative to another plan, therefore selecting either plan A or plan B.

The plan integration can illustrate visuality for the sake of a better understanding.

Self-Design System Phases

For teaching and learning self-design, the entire system has been divided into three phases in respect of plan orientation

- Rehearsal (observation) Plans

In this phase, the learner can visually observe how the entire system is created via plans including the name, description of the plans, and how the plans are integrated and detailed

- Integration (composition) Plans

In this phase, the learner can visually observe how two plans are integrated and provide the content and the name of the newly formed plan. with provided content and a new plan has been formed. For a known system plan integration as a smart agent helps the learner choose the right decision.   The trend of integration can be repeated until the entire system has been created.

- Creation (innovation) Plans

Lastly in this phase, the learner can visually build their plans by borrowing a plan from the system, modifying an existing plan, or creating an entirely new innovative plan that can be added to the system for future use.

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The required knowledge for self-design would include a basic understanding of Information systems, programming, web design, project management, and E-commerce. Self-learning can be incorporated in parallel with other topics.

Integrating Contemporary and Imperative: COVID-19

COVID-19 has been chosen as a contemporary and Imperative topic to be incorporated into the business course of web systems and E-commerce. However, the learner can choose their interest and match it with the COVID-19 system. Before COVID-19, the Sunchoke project was used to Grow, Eat and Heal with its web page and product and service. This project has been known throughout the colleges for more than a decade. Some of the contemporary topics that have been tested include programming torturing, mindfulness, art and poetry, marketing and business plans, and the stock market.

The COVID-19 system self-designed skeleton is built on four plans prevention, detection, simulation, and solution. The content for each of the four plans to the learner from the credit source and the learners to expand their knowledge and engage with other participants in obtaining new learning that can be added to their plan. Learners are encouraged to think abstractly and convert the details as much as possible to avoid being overwhelmed by the system. Therefore, the system can be expanded or shrunk depending on the provided knowledge or acquiring more. The layout, format for the web and the links for the plans are shown and can be modified to the learner's preferences. The Basic programming code amounted to twenty lines for a diagnostic portion of the plan and was written in JavaScript for the moment. A sample game is provided to show the interaction of the virus with human cells. A database and a program written in C/C++ are provided to be hosted in the web server for interaction with the system. COVID-19 as a Contemporary and Imperative has been incorporated using self-learning and self-design into web systems and E-commerce into the following four categories of the plans that are shown below.

Informative Plan

This plan concentrates on information regarding the COVID-19 virus including its history, prevention, spread, and general knowledge. The information provided is to be from credible sources such as CDC, and WHO. To ensure the quality of the criteria of 7 X2 C's is applied. The learners are encouraged to share the content and to build team trust in their collaborations.

Diagnostics Plan

A multidisciplinary study integrates artificial intelligence, simulation, and monitoring observation to combat the disease, and its spread and predict the trajectory (Allam, et al., 2020). A learning AI-based system is used to assist as diagnostic support for the assessment of imaging findings of the disease (Harman, et al., 2020). This plan concentrates on diagnosing the virus using the co-symptoms and based on inference rules. Initially, the diagnostics plan starts with a few systems and diseases that have similar symptoms. This can be expanded to ten or more symptoms as the learning progresses. The learners are provided with approximately a small search program using associative arrays to hold symptoms and the corresponding disease with interaction to find a possibility for COVID-19, after having more than several symptoms, the number of symptoms can be adjusted. The search program is given in JavaScript due to the nature of JavaScript client programming embedded in the web. A learner can add their weight to rank a disease for better probability and accuracy, the items into an array can be increased on the discovery of new symptoms.

Simulation Plan

An agent-based simulation based on a network of susceptible, exposed, infected, and recovered known as SEIR investigates two network strategies for mitigating the spread of disease and maintaining economic activities (Barak, et al., 2021). This plan concentrates on how COVID-19

interacts with the body cells and enters the body. A simulation game is used to mimic the interaction with four scenarios:

- Virus defeats the body's cell

The virus would be replicated with an assigned degree by the learner and generate itself in recursive behavior.

- Body cell defeats the virus

The body cells win and prevent the survival of invading viruses.

- Virus and body cells remain neutral

The virus sustains a chain of transmission to coexist.

- The covid-19 virus turns into a positive virus.

The virus becomes part of the body and stays neutral or the virus becomes a useful virus.

Trace Pattern Matching Database-Solution Plan

A pattern-matching system process intelligent algorithms to identify the significant associations and patterns within the data. The outcomes will aid the understanding of the spread of disease and its progression (Wasiq, K., et al., 2020). This plan concentrates on finding patterns for COVID-19 by collecting information on the individual and trend that has been discovered. A trend could be by the blood type., age group, or vaccination among other factors such as underlying conditions and even existing disparity on race and ethnicity. One way to present individual or cases is to use an id that is breakable into sections and each section present a situation. Computer bits/bytes/words have been historically used to present different tasks and operations with more than Gigabytes or Terabytes presentation and having different variations in that population of humans on earth.

The web color code which is built on three colors red, green, and blue (RGB) is used to identify the subject id and in a unique way to trace COVID-19. Each color has 8 bits (byte) which range from 0 to 255 with a total of 256 different colors and creating 256x256x256= 16,777,216 assorted colors that can be used for the subject id different situations of COVID-19 in the study representing 24-bit color representing by binary, decimal or hexadecimal from 000000 to FFFFF ranging from black to white. A case of COVID-19 can be presented with 16 shades of redness stating the degree of severity. Having data in a binary form enables the system to mask teach part of data for an assigned purpose. To organize the data, there would be four separate databases will be attached to the system incorporating asymptomatic, mild, severe, and fatal cases or issues creating a data mart for the analysis. The study will shed light on what has happened, what to predict, and what to prescribe by applying an algorithm to solve the problem.

Conclusion

The study promotes the use of technology in self-learning with self-design as a pedagogical technique and tool in teaching and learning, in an attempt to meet the best of the curriculum and learners' interests. The Covid-19 case is used as a contemporary and imperative topic for this project. However, learners can select their topic of interest and transform the learning from the Covid-19 case. Creating a network of learning systems with learners' collaboration incorporating the sample case of Covid-19 is the aim, to achieve a health awareness system throughout the Web System and E-Commerce course. The self-learning framework is based on the concept of 7x2C criteria as an assurance of compliance to assess the effectiveness and efficiency of the system. The self-design framework is plan oriented and based on the concept of the plan and plans integrations and their spatial relationships. The learners are directed to design the system to comprehend, combat, coexist, cope, and trace COVID-19 with four layers of diagnostics, simulation, and pattern-matching database with the collaboration of learners together. There are three teaching and learning phases in which learners can observe the entire creation, engage in partial integration and create entirely their plans. Based on collecting facts and data, a mini data mart is established in search of patterns and trends for

an algorithm to tackle a solution to COVID-19.   Sunchoke projects as a product and service system have been used at the institution for some time and students have participated in the project in the business contest.   The other topics under consideration are programming tutorials and innovation systems, learning, and teaching via art and poetry. This study and the idea of self-learning with self-design needs further investigation with its implication possibly with Covid-19 or any other imperative topic.

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