Chapter

Personalizing Course Design, Build and Delivery Using PLErify

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Abstract

The Course-Building technique called PLErify was developed by the author in response to the emerging roles of university faculty in the technology-driven teaching with the rising popularity of AI and deep learning. Topics that support personalized teaching and learning using technology to make it more efficient, more effective and more pragmatic. Early attempts at pedagogy and trends that pushed the personalization movement are explained. The progress of the project in a Web App format is detailed focusing on a faculty building a sample hybrid course planned for a course offering of a framework of digital resources within the app in a technology-rich smart classroom. The PLErify course-building Template is explained with methodologies to add content to it in various ways with suggestions to insert multimodal techniques, e.g., Augmented Reality, Virtual Reality and Simulation, however applicable, alongside numerical data-science-supported technologies that will comprise the most part of course presentation technique. A portion of a full course will be demonstrated using PLErify with an accompanying Course Evaluation for Professors to mull to prepare for course redesign current to improve next year's offering of same course.

Keywords: web application, digital resources, personal learning environment, PLErify, course development, MOOC, didactic, AI

1. Introduction

In a digital society, every aspect of our daily lives is interconnected and each person has an identity that is solely one's own that is encrypted and authenticable by a system. That identity allows you to interactively access multiple parts of any platform to perform actions and obtain something as a result. In an ideal version of a digital society, we humans are interconnected as citizens (*e-government*) and members of various groups (private) and afforded rights and privileges accordingly. We see micro versions of the workings of a digital society in Big Tech such as Facebook, LinkedIn, Twitter, Instagram, and Google with each connectivity model functioning according to predetermined business model.

Our ever-evolving digital society intertwines the roles of humans and robots in institutions and industries. These roles keep changing as technology advances to near capability of humans through artificial intelligence and deep learning permeating the deepest trenches of every industry, not excluding higher education. In higher education, it is hardly noticeable that the roles of main players (*faculty and instructors*) as primary owners, designers, and deliverers of their own courses for live instruction need to step up and adapt more aggressively more so than any other group. Not to be confused with purely online learning, tech-driven courses go beyond use of learning management system, LMS. PLErify use of private server, resource, and tool-based application is one such solution and discussed below.

2. Emerging faculty role in an AI-driven scenario.

> *"If we teach today's students as we taught yesterday's, we rob them of tomorrow".*
>
> *John Dewey*

An American philosopher and educator, John Dewey (1859–1952) gave a very powerful quote with a whole new meaning that is truer now than in his time. Truer now because the educational methods we now deal with goes beyond the chalkboard, goes beyond talking in front of students, and goes beyond doing projects in isolation using pen and paper. Not completely discounting the power and value of note-taking using pen and paper and would not advise against the method, it is important to recognize the presence of computational tools being used as part of current teaching methods he would have never imagined would exist today.

Undeniably, educational technology tools ushered the transition from passive (*sit, listen, take notes*) to active (*interactive "constructivist" learning*) with students defining their knowledge accumulation, construction, and learning pathways. Deep learning, Machine Learning, Big Data and Internet of Things (*IoT*), and artificial intelligence disrupting education in more pervasive ways have no specific timeframe. While innovation and adaptation slowly chip away traditional education system, the idea of faculty being put aside with little to no role in designing, offering, syndicating, and delivering courses (*aptly described as course massification*) is in fact a repelling thought. In universities however, few scenarios must play out to avoid a scenario where the machine decides and controls. The professor must play the central role but in an enhanced strategic [1] and impactful way. They (*professors*) must assume leadership roles to formulate actionable changes but be cognizant and fully prepared to face added responsibilities from programming robot consciousness to designing robotized courses through aggregating and updating content, that is, build virtual (*academic versions of Alexa-like*) robot assistants [2], automated pulling of content from a variety of resources. These new robot-driven challenges in higher education are succinctly described as follows.

2.1 Robots and professors for efficient teaching

Widely practiced in Japan, Korea, Taiwan, Singapore, and China, are robots (built in the likeness of a professor/researcher), robot applications, and robots programmed to co-teach/co-research juggling the myriad roles of the human instructor. Other foreseen creative uses of these robots involve individualizing attention to each student, thereby ensuring progress, remediation, and success (knowledgebase-driven virtual assistants). Missing in those possible roles are robots that build online courses for professors based on didactic teaching styles and student learning styles all utilizing high integrity knowledge bases with optimum performance. Past attempts at course development using course sequencing [3], adaptive learning paths [4], computational teaching, and participatory teaching [5] can inspire new innovations in this area. One deep-learn course building technique is an AI-based course aggregator (*software-based*) which pulls different curriculum (using Big Data) of the same course from many places/universities and then gets stored to a central location where students get to pick and choose a course program of study. These new courses would be up-to-date with new data that include recent developments in the discipline. Since my focus on PLErify is to assist the instructor, the adaptive learning concept for learners based on any learner model (*cognitive, behaviorist, and mental models*) has been intentionally skipped.

2.2 The MOOC-as-course augmentation for faculty and as resource for PLErify teaching learning

In AI age, faculty must face their new roles as programmer and owner/builder of learning environments of their courses that they must update per semester. Professors who remain indifferent in the new reality of a virtualized higher education vis-a-vis their expanded roles and new responsibilities will face major challenges as industry-driven automation-driven AI persistently seek dormant or stagnant unchanging areas to automate and simplify. A faculty [6] from Scotland recalls his very productive sabbatical spent at Google (*Big Tech and AI-driven*) in Silicon Valley. In that sabbatical, this academically trained faculty learned and eventually re-adapted his purely academic mindset (coding) to meld with that of a practitioner's mindset and started building coding projects that work in real life. Faculty (*particularly those in the sciences and engineering*) can follow Barker's example and come out technologically empowered fusing the academic with the practical real world and impart the same mentality to its students, that is, college to career.

Regardless, MOOC courses will continue to be made available online to anybody for free, or at a minimal cost. Boosting acceleration of acceptance by universities globally, MOOC continues an upward evolution toward a better practical higher education option for both career (*skills training or mastery certifications system*) and advanced degrees (*bachelors, masters, and doctorate*). Also, with student advancement (*and their interest in mind*) and ease of teaching for instructors as prime motivators for MOOC development, there is truly so much about the MOOC system to be appreciated that will make higher education leaner, more efficient, very current, and very affordable.

Another very encouragingly useful aspect of MOOC that is only now being realized is, they add to the personalization of learning both as a teaching resource for instructors and as an inexpensive way for students to obtain advanced degrees and lastly but more importantly to upgrade skills of work professionals. MOOC business model is being revamped and, evolving toward a more profitable version, thereby offering fee-based enrollments where certification of completion is a student's objective. The free aspect of the MOOC model however can be used by all faculty as another teaching tool. For example, professors can require students to take the MOOC version of their course offered by other universities (*now estimated at 900*) shown in **Figure 1**, before students take the real course. In a PLErify state, courses already in MOOC database can be treated as a required mastery before registering and enrolling in the equivalent actual university traditional course or program unloading faculty of heavy teaching. Some tedious portions of the course can be bypassed having mastered it beforehand through MOOC.

While debates and experimentation continue to grow in artificial intelligence, PLErify App (2007) remains a precursor to the above scenarios. Even though the core of educational technology research centers on academic applications, academe, ironically remains the most resistant and the slowest to adapt to a scenario of AI, Big Data and IoT which when taken as a group suddenly changes the course delivery game. Groups in the tech industry persistently hint at a future without a human teacher and professor, as computer scientists now and then flirt with the idea of adding consciousness to a computer. At this time though, a robot cannot actually augment human cognitive and emotional capabilities through what they claim as smarter machines currently experimented in other industries (automobile industry). I would simply and safely assume that use of virtual robot assistant is an easy spillover for use in higher education [2].

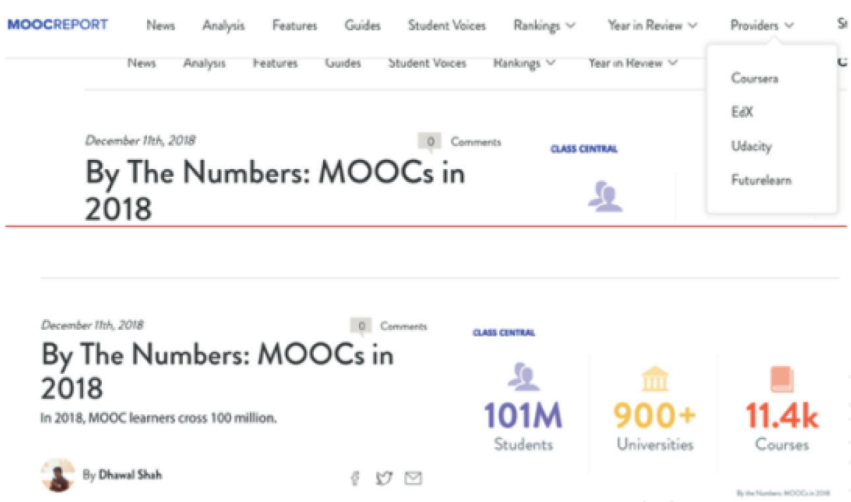

Figure 1.
The hard-to-ignore breadth and reach of MOOC globally.

It is best to speculate that whatever happens in the corporate industry will, in some form happen in the education industry. The digital society interconnects everything, from machines and app to the software/hardware; from knowledgebase to users; from different variety and degrees of transactional computing; from the teachers to the students; from the businesses to the consumers; from the students to the universities; from the faculty to the students to the universities; and finally, from the ordinary users to everything which can occur via our desktops and our handhelds. Apocalyptic ideas have been flouted at global corporate e-learning events that hint at the idea of massification to replace traditional creative teaching without a human teacher, which may appeal to select academicians who fall into the trappings of "easy teaching," that is, less classroom presence and letting the students watch video lectures and digitized .pdf files of the syllabus. Given that these handheld tools are now a normal part of everyday life blending the here, the now, and the future, a DIY culture for course building becomes inevitable. Embodied by the PLErify application (2007), the DIY mindset provides a solid training ground for ubiquitous computing vis-a-vis course building as it involves an interplay of a variety of cognitive skills combined with digital conversion of ideas into a viewable medium.

Today, 24/7 we carry our smartphones, iPad, and other handhelds also known as mini/microcomputers, more powerful than any computers built in the 1980s and the 1990s, with us and with these technologies we socialize, network, listen to music, share photos, financially transact, chat on live video, and much more, thereby doing tasks never before possible at the very same period of time educators were theorizing on learner styles, cognitive styles, etc. My own observation over this past decade is that while educators spent so much time researching learner styles and cognitive styles, they believed impacted learning, Big Tech simply went ahead and produced a plethora of handhelds and smartphones that rapidly jump-started user acquiring tech skills in turn accelerating mastery that are, fortunately, usable in both daily life and university learning but unfortunately left out those who could not keep up with the constant roll-out of new versions and models. What that phase did to each of us was it made us tech-savvy and I would argue, smarter. Now, certain tech user interactions have become ingrained for majority of us smartphone and multiple device owner and users. Majority of learner tasks to: make choices, complete learner tasks, solve problems, think about thinking (metacognition), compute, analyze have become second nature.

Indeed, technology has a very democratizing effect on its dedicated users from acquiring uniformity of skills to performing actions to obtain something back as a result; skills, which by the way, are also transferable to other domains from personal, to business, to higher education with specific attention to learners. All users get it. We can turn on the device, charge the device, download and use apps, transact, collaborate, blog, share documents, and so many other things that it is now second nature to have (*as opposed to not have*) our smart devices even while we sleep. Technology has intercepted our lives in unimaginable and remarkable ways psychologically but best of all, educationally. I must conclude that though technology tools are not advisable for use by children, technology for mature adults is an additive rather than a subtractive experience.

3. Didactic models for creative computational teaching

The timely re-entry of computational [7] tools to teach creatively befits this era of our technology-driven education. Less intervention on how students create their learning paths as they meld new learning with what they already know in working memory gives students a better grasp at how to manage their interactions and the accumulation of those interactions in a self-directed way exemplified by the constructivist didactic model used in the Virtual Mentor Project notably learning by asking LBA Project [8].

The actors on stage in the world of tech-based teaching and learning and their functions in the teaching learning equation are summarized with one infrastructure in common: connection to the Internet (**Figure 2**).

Software applications accessible on the web allow both instructors (*course makers*) and students (*users*) to manipulate course content to create, present, and store. *Learning Management Systems* (*LMS*) are prepackaged applications that act as an administrative tool to manage the online course, the students who enroll, and the professor who offers the courses. *Artificial intelligence* (AI) is the byproduct of deep learning, huge swathes of databases within a database that when meshed together gives it intelligence though within a limit, that is, you can program a robot to do certain things that will be limited to the amount of intelligence you put in it. A human is still in command and an ill-programmed robot like a biased robot gives

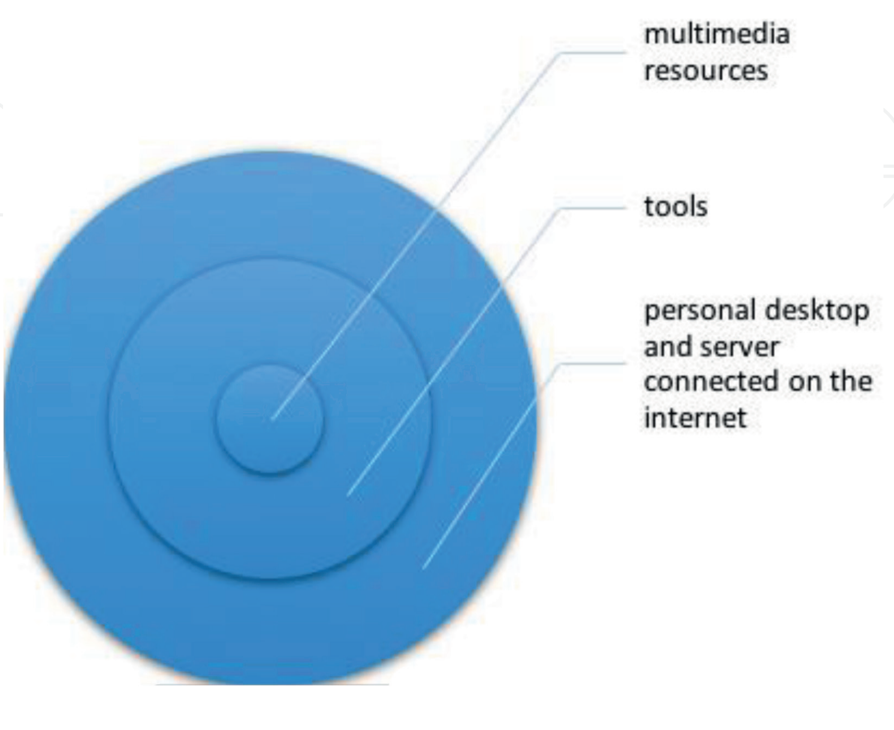

Figure 2.
Technology infrastructure to teach.

disastrous results. *Data science* is the highest application of computational ability that can detect patterns of naturally occurring events in nature, analyze it, and provide very accurate predictions and analysis in context. *Interactive rooms/walls* that began in the mid to late 1990s, but was not very successful such as the project at Stanford University and though unsuccessful at its early attempts to merge it in the teaching and learning game, has re-emerged (*Germany Applications*) with more sophisticated screens that cover the entire walls making possible the projection of visualized data comprehensible to all learners.

Augmented reality when applied has the capability to freeze, slow down or speed up, and look for patterns among piles and piles of data and of events that are intended to be analyzed and deduce from. It is very useful in the science and engineering course making in particular, though also usable in other fields when observation of actions is sought. *Virtual reality or virtual environments* are computing environments otherwise called *virtual immersions* where "users are immersed in low latency high-quality visual stimuli and spatial audio amplified by motion platforms, dispersed systems, and active/passive haptic device that allow users to fill objects with more sophisticated systems equipped with gesture recognition and voice input. Success of VE systems depend on system performance matching user expectations" [9]. *Ubiquitous computing* is computing at its finest you hardly notice it. *The Clouds* are on demand delivery model that enables the synchronized delivery of computing resources such as applications, storage, servers, networks, and services (liberating software providers of low-level IT on premise infrastructure) that allows instant scale up of various types of web services [10]. *Web services* are on-demand applications, storage, and servers and sometimes called SaaS, PaaS, and IaaS enabled mostly through the cloud. *DevOps and Containerization* [11] is a systems management technique for on-demand services performed in a bundled way as a completely packaged infrastructure (*operating system and software applications*) updateable on the fly with the least hassle.

Bonk [12] aptly describes a changed e-learning ecosystem in the past two decades and summarizes it based on three themes namely *Learner Engagement*, *Pervasiveness*, and *Customizability* using the same computing technologies for document-sharing, collaborating, software, hardware, communicating, and digital resource use. Based on learner engagement, he cites, 1—mobility, 2—visual, 3—touch sensory, 4—game-based, 5—immersive, 6—collaborative, 7—social, 8—digital and resource rich, 9—adventurous, 10—hands-on and in its pervasiveness, 11—mostly online, 12—video-based, 13—global, 14—immediate, 15—access to experts, and 16—synchronous in being customizable, e-Learning is more 17—open, 18—more blended, 19—more competency-based, and 20—ubiquitous. With its customizable quality, e-learning is 21—more blended, 22—more self-directed, 23—more competency-based, 24—more on demand, 25—more massive, 26—more modular, 27—more communal, 28—more modifiable, 29—more flipped, and 30—more personal. The "more personal" thus sets the stage for personalization (PLErify) in both teaching and learning, which lends itself appropriately to the different didactic models [13] of teaching for different types of courses whether it is intended for knowledge-building, theorizing, knowledge or skills acquisition, model-building, simulation, and argumentation.

4. General instructional design with less focus on user learning style

Instructional design for high-performance computing [5, 7, 14, 15] focuses on the principles governing working memory vis-a-vis cognitive load [16] extracting memories associated with completion of task (primary and secondary memories). Primary memory are those cognitive schemas a person acquires as a result of interacting with the environment stored in long-term memory which the secondary memory (*the cognitive schemas stored in short-term memory*) uses to solve problems though not without limits. Knowledge creation for working memory follows the principles of (a) "narrow limit of change," that is, within a small span of time, new information should be very limited in order for it to be stored in long-term memory. "Unlimited": it may be in the amount of information it can process, working memory follows the principle of being capable of spewing (b) "unlimited amount of information" for information retrieval. When that knowledge creation does not occur, the mind adjusts by following the principle of (c) "randomness as genesis" methods (the borrowing and reorganizing principle, that is, imitation, listening, reading, and social interaction) to compensate in the knowledge creation. Finally, when cognitive overload must be overcome to commit new knowledge in long-term working memory, the mind does what is called the principle of environmental organizing and linking, retrieving, and cycles through information already stored in long-term memory.

In non-scientific, non-engineering subject matter, focus on cognitive load combined with learning theories has not been exhaustively studied. Learning styles has been linked to the effective design of course materials as it affects comprehension and overall performance [17]. A person's style of learning is determined by environmental factors manifested through behavioral patterns. In my 2001 Doctoral Dissertation [15] experimental study based on learning style effect on user performance, I found out that in a matched condition, i.e., matching concrete icons with concrete learners and matching abstract icons with abstract learners resulted in better performance on recall and memory and task completion. Concrete learners performed better overall in a matched condition. There are other learning theories besides that was used (Kolb's) in my experiment and most are in the style of thinking and therefore behaving, extent of proficiency or lack of and style of responding to environmental triggers. Knowing fully well that style of learning in the AI-driven teaching will override the learning style consideration, platforms will be built mainly based on learner independence during the learning process. That is, they will determine the route, path, and speed at accumulation of knowledge and skills as they see fit. In the past, there was "adaptive learning" where the computer adjusts to the learner based on the speed of knowledge acquisition of the user and then readjusts the next set of materials based on that performance. If the previous task proved hard, the computer generates an easier task to complete and vice versa.

Though the idea that learner pathways must still be considered in designing personal learning environments, it is safe not to overly worry about learners and skip the time-consuming practice of hand-holding knowing that users have full control of their digital strategies and techniques to learn. It is both consoling and problematic at the same time: consoling because instructors would not need to look over learner's shoulders during the process of mastery, yet problematic because it now forces the instructors to be on the top of every technology used by the learner. Instructors need to possess tech skills better than students. Casual everyday users (*including the dark forces of the web*) of tech will possess mastery of technology for every intended purpose.

5. State of purely online learning

MOOCs, such as EdX, Coursera, Open CourseWare (OCW), and hybrid designs, are designed to offer free courses for poor countries (MOOC), to corporations (*Coursera* and *Udacity*), EdX (*universities*), however of late modified it to a paid model adding some validation features to address legitimacy of courses, such as granting of certificates, shortening of Master's program as the case in Georgia Tech. Student attrition remains a problem compared to regular traditional classroom model proving that regardless of convenience, students still prefer a human teacher in the classroom indicative of what history has revealed, that is, the most valuable teacher is a human. Another acute finding is that MOOC courses are not suitable for advanced courses that can only be handled by a human.

Alternatively, MOOC courses, based on a very interesting observation of Cooper and Mehran [18], have the potential utility in personalized learning in the same manner as YouTube online video courses do, that is, a place to find highly reputable learning resources for students to pre-familiarize themselves of courses they will take before they turn up at actual class lectures. This utility when applied as a "before-you-attend-a-class" feature skirts the nagging issues attached in MOOC such as validation, plagiarism, certification, and lack of richer evaluation. MOOC, in that capacity, is indeed a welcome addition to personalized learning. One monetization [19] possibility explored by MOOC concerns that of providing added validation about the student for employment which, to my mind is very interesting and closes the loop of education to career. In an interview [13] with John Hennessey by his longtime colleague Davis Patterson, John was very enthusiastic about MOOC and thought of it is a compelling solution for continuing education (skills upgrading for working professionals) with his continuing belief that Masters and PhD program will be part of MOOC and non-MOOC.

In that vein, professors in higher education institutions need to skill themselves sufficiently to be able to create a digital course only once but updated for every semester's offering. Faculty load of work is, in truth, lightened while students carry most of the load of a course, that is, reading materials, accessing mixed modal multimedia, collaborating, project work, homework, assignments, critiquing, mid-term exams, and final exams. In the PLErify platform, AI tools, in the research (*Research Resources and Libraries Semantic Knowledgebase*), analytics (*Quantifying/Analytical engines*), authoring (*Multimedia and Multimodal*), and learning management systems (*Course Delivery Student Access Point*) are placed in a private server for the instructor where he is given the freedom to extract all sorts of information for his course and capture and store those information in an organized cataloged file directory (*on both desktop and the Private server*) purely for his own access **Figure 6**.

6. PLErify course design and future AI prospects

PLErify components that are visually depicted in **Figure 3** are as follows.

Research is a set of live databases to extract content through digital libraries for download of scholarly materials, quantitative and qualitative data. *Analytics* is a set of measurement tools to analyze datasets and extract visualization files for inclusion in the instructor's course curriculum. *Authoring tools* are a set of applications to convert text to viewable mixed media and mix it up for immediate playback as one full course. *Learning management system* (*LMS*) is described in my paper [1] "Virtualized Higher Education" as the course's administrative tool performing the tedious tasks as the container that holds a course or courses. An LMS is an application that typically contains the following: administrative features for managing content: content uploading/downloading; calendar and scheduling instructor timings; student administration; faculty/student communication tool; conferencing; and homework/project submission and grading. These processes and activities as shown in **Figure 4** are time-consuming and repetitive some of which can be made efficient through automation. Decisions to automate parts of the PLErify platform depends on the instructor who (*after updating his skills in AI, deep learning, virtual assistants, and robots*) can select which activities to augment as shown in **Figure 7**.

Figure 3.
The PLErify application toolset desktop version (http://elearnovate.com/plerify).

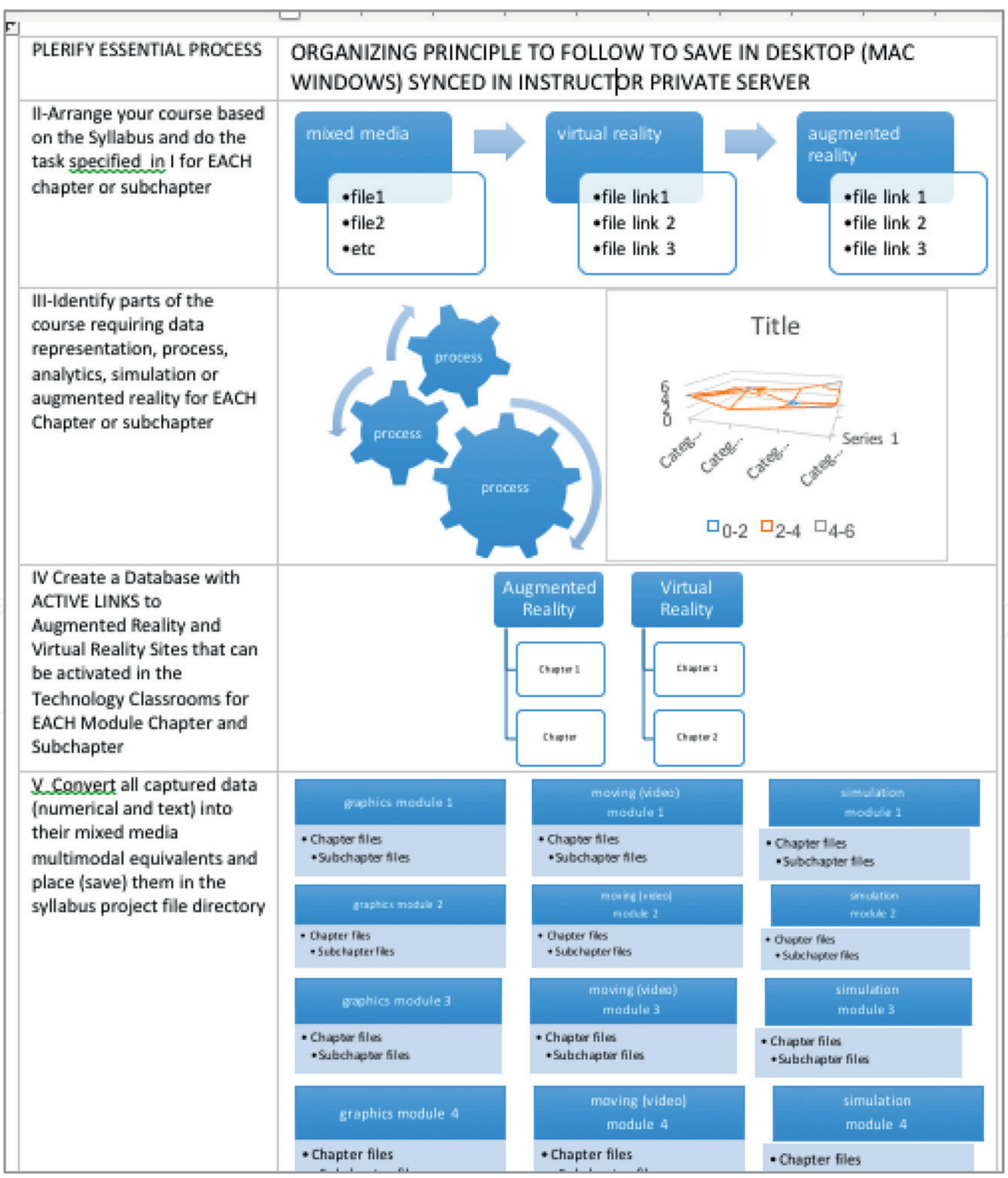

Figure 4.
PLErify processes and organizing storage principles for the Mac and Windows.

6.1 Sample course curriculum on learning styles

- Module I: Timeline Origins and Theorists
    - Step 1 Research: gather literature on early theorists (background, philosophies, and teachings)
    - Step 2 Analytics: quantitative data from research associated with background, philosophies, teachings, and applications of learning theory in higher education
    - Step 3: extract visuals and moving media equivalent of content derived from steps 1 and 2 and combine them to illustrate concepts and examples
    - Step 4: prepare the interactive module summary for Part 1.
- Module II: Belief Systems of LS (Cognition, Behaviorism, Environment)
    - Step 1: gather literature on LS relative to cognition, behaviorism, and environment
    - Step 2: extract quantitative/qualitative data on LS relative to cognition, behaviorism, and environment
    - Step 3: extract visuals and moving media equivalent of content derived from steps 1 and 2 and combine them to illustrate concepts and examples
    - Step 4: prepare interactive module summary for Part II.
- Module III: Higher Education Applications of Learning Styles
    - Step 1: gather research on higher education use of learning styles (projects successful or unsuccessful)
    - Step 2: extract quantitative or qualitative info based on above.
    - Step 3: visuals and moving media from steps 1 and 2.
    - Step 4: prepare interactive module summary for Part III.

Identify simulation videos or games to illustrate LS application.

Include the URL's of videos (simulation and VR) within the course before packaging it for export to the LMS. Package the three modules as one course and export it to the LMS enroll students taking the course.

Add a Course Evaluation (**Table 1**) showing a generic form freely available online at https://www.jotform.com/form-templates/course-evaluation-form-3.

6.2 Course and instructor evaluation form

Instructor's Name.
Course Description.
Course Number Date-Month-Day Year.
Please evaluate honestly.

	Excellent	Very Good	Good	Fair	Poor	Very Poor
The course as a whole was:						
The course content was:						
The instructor's contribution to the course was:						
The instructor's effectiveness in teaching the subject matter was:						
Course Organization was:						
Clarity of instructor's voice was:						
Explanations by instructor were:						
Instructor's use of examples and illustrations was:						
Quality of questions or problems raised by the instructor was:						
Student's confidence in instructor's knowledge was:						
Instructor's enthusiasm was:						
Encouragement giving students to express themselves was:						
Answers to student questions were:						
Availability of extra help when needed was:						
Use of class time was:						
Instructor's interest in student's progress was:						
Amount you learned was:						
Relevance of course content was:						
Grading techniques were:						
Reasonableness of assigned work was:						
Clarity of student requirements was:						
Intellectual challenge was:						

Table 1.
Generic course evaluation form that can be modified.

6.3 Student participation

The amount of effort you put into this course was:

Excellent Very Good Good Fair Poor Very Poor.

On average, how many hours a week did you spend on this course (in and out of class)?

0–2 2–5 6–10 11–14 15 Up.

What grade do you expect in this course?

A (4.5–5.0) B (3.5–4.4) C (2.5–3.4) D (1.7–2.4).

This course is best described as:

Major Minor A distribution requirement A program requirement Prerequisite Other.

Every e-learning course is organized into modules shown in **Figure 5**. To populate content, the method is quite straightforward starting with Module 1 but not necessarily following a linear process, that is an instructor can jump from Module 1 to other modules in no particular order depending on how they interconnect topics and ideas.

Click Module 1. Module 1 will load chapters. In the edit mode, you can replace the content with your content. Chapter 1's format is repeated for Chapters 2–4. You can replace the content as your syllabus progresses. In each chapter, you can include datasets (from the research toolset analyzed with results presented).

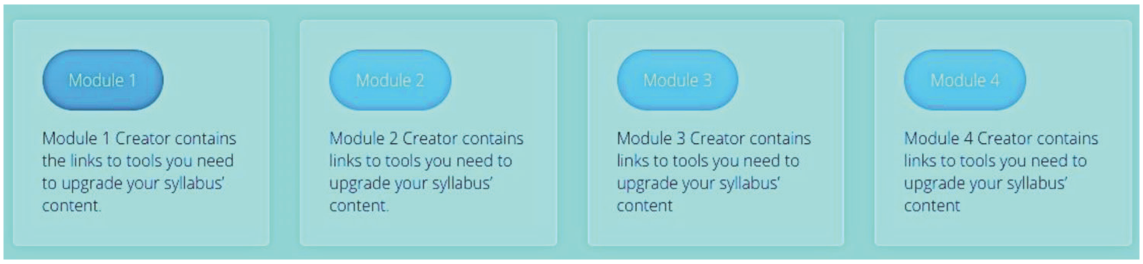

Figure 5.
PLErify course creation in modules.

These analyses of presented data, or sample data can be saved in database readable format backed up in instructor's private server and desktop for inclusion in the digital course. The content of the modules is managed as shown in **Figure 6**. For example, in a digital course on Learning Theories, an instructor will find the timeline data to present the history of the early to modern learning theorists. This timeline tool in the PLErify App can be dramatized through an augmented reality historical film on the significance of each era and how it influenced education at different times in the history of the modern world.

Personal learning environments or expert systems as it is sometimes called is disruptive enough to education due to its "lean to use automation." Any AI application is still limited in capability where human skills of negotiation, detection, mobilization, and understanding of power and trust (*much like the gut instinct humans have to sense danger and change*) is required. In other words, regardless of whether it is continually built to be smarter and smarter and contradicted by Krakovsky [20] who has a more optimistic view, AI as predicted may not develop a true "sense of self." Her research to a certain extent can be useful for building the intelligent robot as instructor assistants that will be tasked to meet students, answer course-related concerns, substitute the human instructor who is on research travel, and track student progress as described in Section 2.

Assigning automation features shown in **Figure 7** in PLErify in the next 5–10 years will center on course preparation, in converting a simple text to something more graphic or visual, combining the visuals into a more powerful single visual based on context, capturing real live data from a source known only to the instructor, citing the link of that source in the course materials, mastery in the use of sophisticated tech-enhanced classroom, synching course presentation of materials with the tools in the smart tech-enhanced classroom, and automating tasks in use of the LMS.

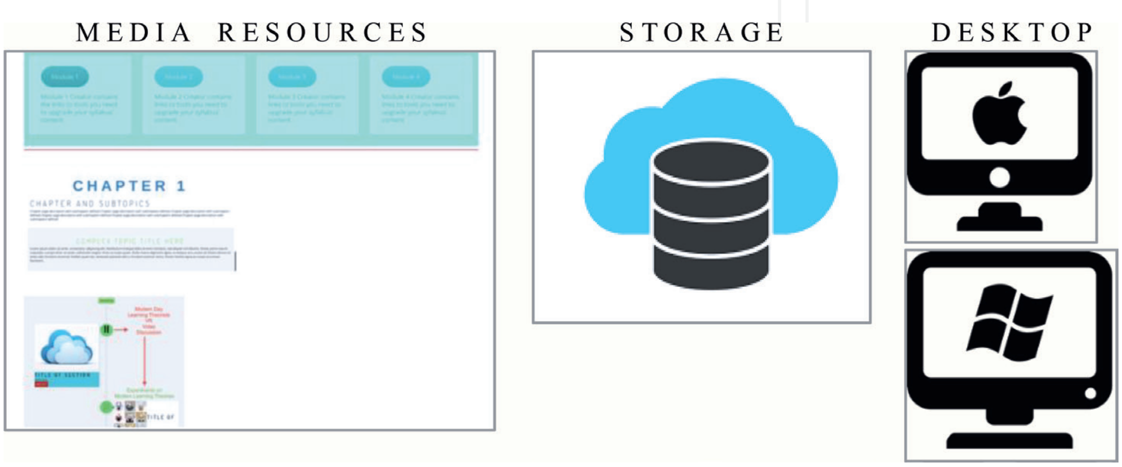

Figure 6.
Course module management.

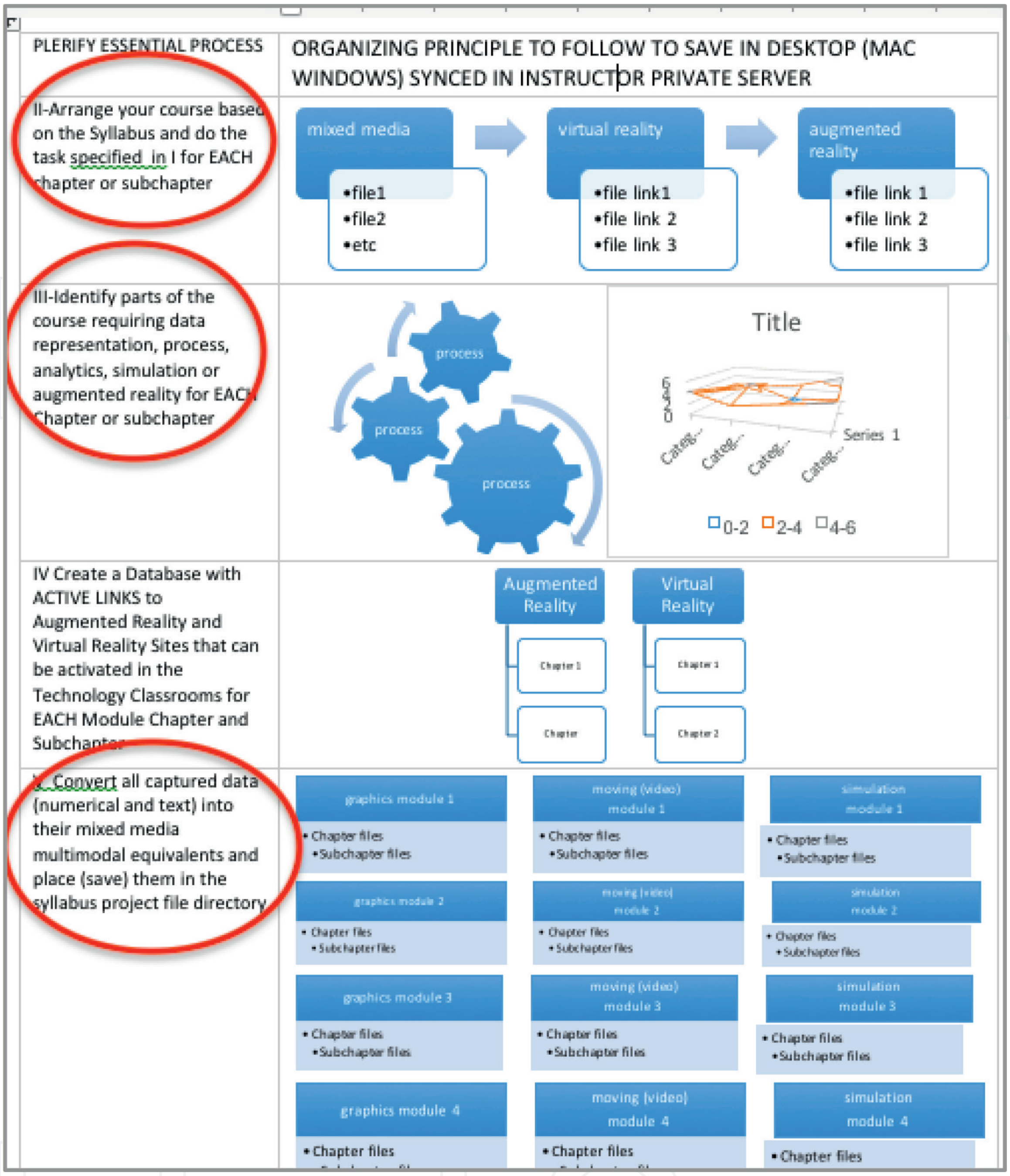

Figure 7.
Areas in PLErify that may be automated highlighted in red circle.

7. Reflections on the profession vis-a-vis digital society

We can entrust the ability to recognize learner styles, learner abilities, comprehension and understanding in Artificial Intelligence (AI) as it continues its ascent towards enhanced intelligence in almost all facets of our digital life in this case Higher Education and Course building. In that token, Instructor (*as Designers*) and Technologists can look into Chris Stary's [13] research on the Scholion Project as one guide looking into the design and implementation of his constructivist-based project that aids learners taking into account learners' mental models, cognition and metacognition.

In this second half of this decade, AI's recognition capability has gone far beyond its early beginnings that it is now termed the Age of the Machine. Much similar to Elon Musk's Tesla, the machine can now build other machines. Thinking about this new reality in education also means the teaching and learning can now rid of a lot of the mundane tasks in: course creation (*by instructors*), course management (*by LMS's*), course participation (students), grading and course evaluation methodology, and issuing valid certification. The machine age that will make our transition to a fully digital society brings with it a whole slew of new realities as well for the professional. The expectations from each of us has become compounded to an extent that a degree certificate attached to an individual that requires skills are also updated be it technical, socialization, community, or connectivity [21].

Professional degree certificates (*undergraduate and graduate*) now also comes with it the responsibilities of skills upgrading on a continuing basis; of being in communities attached to that profession; of being in the know in those communities; of being socialized in the platforms of Facebook, Twitter, Instagram, and LinkedIn to not just being there but being a part of the larger whole comprised of billions of people in the world. To think about it in terms of how AI responds to that changed perspective is to assume that all these interactions are captured by the AI machine and adds it in terms of quantifiable data, making new assumptions about the added data in effect, understanding ourselves more from that newly captured information producing an updated profile of a person's learners style based on captured cognitive functions and user action decisions as opposed to self-reported learner style [22].

Schneider [21] points out that through data analytics, these learner characteristics can be extracted automatically from user's ongoing interaction to perform a variety of transactions (*from finding a route using GPS* (*geographical positioning system) or learning online to online banking transaction*) in day-to-day lives. When these patterns of user interaction are validated, a method called "user nudging" could be used much like adaptive computing that "adjusts to serving user tasks based on prior action," that is, nudging would guide user actions by giving choices through prompts.

Denning [23] summarizes it brilliantly that to truly survive in the age of machines where the knowledge worker conducts work on highly intelligent machines, new expectations come to the fore that requires pragmatism in belongingness, ever adapting skillsets that changes as the system changes, community building based on chosen areas of belongingness (professional, leisure, or recreational), and last but not least, willingness to mentor, to display your skills to the person that needs it so that the next learner improves the knowledge to the next and so on and so forth.

8. Conclusion

8.1 Security concerns with respect to PLErify, MOOC, and tech tools

Security breaches from China, North/South Korea, and Russia are a threat to our tech-enabled life. These countries' very advanced cyber-surveillance and intrusion system have penetrated US cyber defense system potentially undoing major education technology advancements. The industry needs to come up with a very strong authentication system as well as cyber-blocking mechanisms beyond the obvious firewalls.

Without a strong cyber security strategy attached to all these tech innovations, any attempts at technologizing higher education would face enormous challenges. China's breaches covered the entire hardware/software and telecommunication ecosystem (home routers included) baffling Europe, the US, and Australia. A solution that has been proposed is virtualization and containerization. If virtualization and containerization provides a guarantee for the safety and security of cumulative progress and strides made in the education sector and if we are willing to adapt to rapid changes demanded of us as educators, faculty, and students, then the future will certainly be bright.

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