A New Curriculum for an Uncertain Future

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Uncertainty is a keyword whenever the future is described. As educators, we must contribute to promote a feeling of ease among our youth in an uncertain world. Our students must be able to discover problems and face those that are ill-defined, to build innovative solutions, to analyze situations using non-traditional viewpoints and to happily and effectively respond to changing constraints. This work presents the curricular redesign process of Mexico's national university virtual high school. The program is aimed at building the fundamental cultural basis that is expected from this educational level. We expect its contents, structure and learning activities to constitute a two-year training for students to feel comfortable and be productive while facing uncertain environments. The redesign process involved a diagnosis, the definition of its design constraints and general structure, and the development of an educational social network to socialize and improve the syllabi, as well as an intelligent tutoring system that will support teachers' work.

Contemporary society faces a range of complex and urgent challenges characterized by a high degree of uncertainty.
Hauge & Barwell

1. Introduction

Designing and updating a curriculum are projects that comprise, at present, a special challenge [1]. The unfolding technological, societal and economic changes mean that uncertainty rules when deciding what we should prepare students for (there is also the question if we should *prepare* students at all, or only provide the means for them to evolve using a wide variety of resources) [2]. In a context where formal education levels are in question and informal learning and its credentialization is gaining momentum, we know *more of the same* is not working. Adding a couple of courses or changing the scope of others is not a solution: we must reimagine education, restructure our academic programs and focus in the immediate and long-term future in order to better serve our students. Also, the type of offerings is changing, due to the emphasis on life-long learning [3], as opposed to graduating from a specific program in order to make a living.

We put forward the curriculum design methodology we followed while updating the virtual high school program at Mexico's national university: B@UNAM, knowing that we must prepare our learners for uncertain contexts. It begins with a diagnosis of the former program through a 360° research process that involved students, dropouts and graduates, online tutors and counselors, program administrators, disciplinary experts and a review of the literature. This diagnosis provided the frame for the second stage that enabled us to perform seven processes that are described in the results section and six that we included in order to foster skills that enable our graduates to be able to face uncertainty.

2. Theoretical background

One of the basic problems we face when building a new curriculum is identifying the roots of our foundational thinking. For example, most educators prioritize social justice when preparing an educational program, but probably designers are not aware of the beliefs that underlie their work. As Andreotti and her colleagues [4] highlight, the great challenges we face as a society seem to require more knowledge and social consensus which is solved by more data and more effective communication. However, they state: "These assumptions are forged within a modern/colonial imaginary that presumes a single story of seamless progress, development and human evolution that divides humanity between those heading history, and those lagging behind" (p.10). Therefore, being conscientious about the modulating premises that model our decisions while designing a new program has been a must.

Another important issue when facing an uncertain context is the inclusion of post-normal science, a term proposed by Funtowicz & Ravetz in 2005 [5], that walks away

from Kuhn's concept of "normal" science as an "unexciting, indeed anti-intellectual routine puzzle solving by which advances steadily between its conceptual revolutions" (p. 740). Post-science is especially important in order to address problems with a high degree of complexity, uncertainty, and risk, such as climate change or global epidemics. These problems require alternative means of working through problems, such as the use of extended peer communities, which involves the participation of a wide range of stakeholders in the process of analyzing phenomena [6].

In order to foster these new educational settings, Beguetto [7] proposes the creation of contexts of "structured uncertainty" and "beautiful risks" in semi-structured activities, because according to him:

> It's not about thinking outside the box, it's about thinking creatively inside the box. Which works well in educational settings because we're really good at defining and specifying the task constraints down to an almost ridiculous level of detail. But we're not that great about creating spaces for originally meeting those task constraints in different and unexpected ways. (p. 543)

Following the same idea, Bilton [8] suggests that a new balance is necessary in order to favor not just the creative process because of its novel outcomes, but search for a counterbalance involving "uncreativity", when looking for closure or resolution of ideas. He asserts that: "uncreative thinking introduces doubt and reflection on questions of value to challenge the initial excitement of novelty and change." (2015, p. 164).

Specific strategies to prepare students for uncertain contexts have been put forward. One example is Beguetto's [9] recommendation to remove from a previous lesson one of four components: problem, process, product, criteria. This action will create a sense of uncertainty in learners. Another strategy he suggests is a *legacy project* designed by students in order to address a problem they identify. They have to come up with a contribution that goes beyond the life of the project.

3. Research methods

The first stage of the redesign process involved a diagnosis of the original program. All of the main stakeholders contributed to the appraisal through different instruments and activities. Figure 1 illustrates the process.

Three learner and alumni surveys were conducted through online questionnaires: 971 graduates, 1,032 dropouts and 528 students. Statistical analysis was conducted in each case and strengths and weaknesses were identified. Also, an online survey was conducted so tutors and counselors could suggest contents or resources they considered the program and online materials were lacking.

Content analysis of seven types of documents was conducted. This includes the monthly self-assessment reports on behalf of tutors; both the tutor and counselor performance evaluation forms; program coordinators reports; reports about courses' accreditation indexes, drop-outs, and flaws in the online materials; and the

questionnaires to disciplinary experts. The first five types of documents contributed to the identification of flaws of online materials as well as knowledge gaps of the programs. Reports on accreditation, drop-outs, and flaws allowed the identification of critical incidents and weaknesses. Experts helped us identify educational trends and new information they considered high school graduates should possess. Finally, the interviews with academic experts signaled priorities in terms of contents and focus of courses we had to consider.
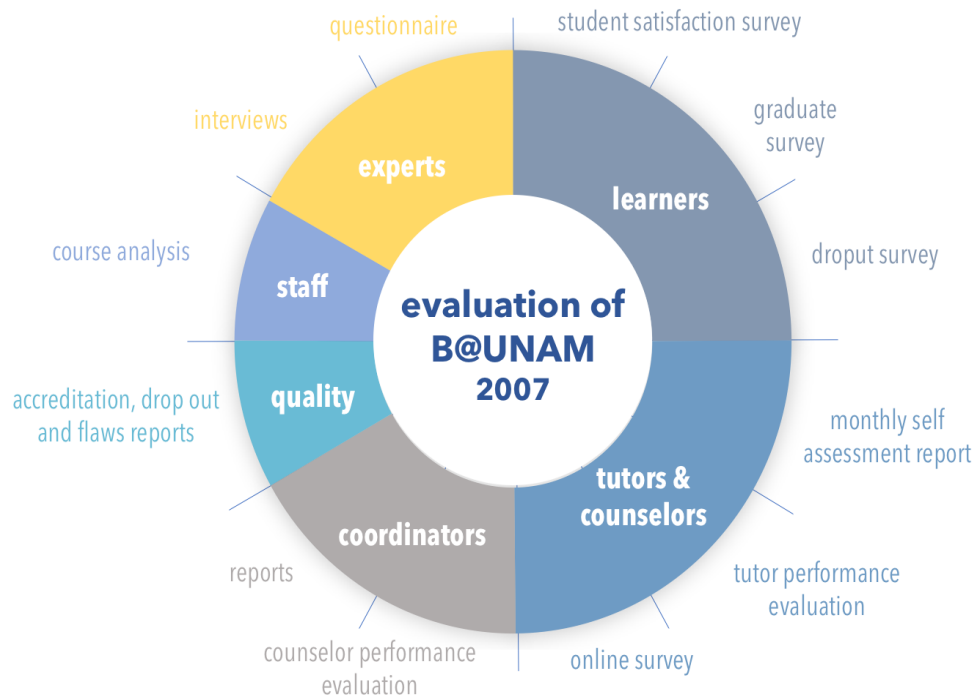

Figure 1. Element of the 360º diagnosis

4. Results

The main results of this 360º diagnoses were:

a. In general, a positive perception of the program is portrayed by all stakeholders. However, they pinpoint specific areas of concern: plagiarism, a high drop-out rate, lack of commitment on behalf of some teachers, flaws that appear in the online materials (functionalities, broken links, typos, and even several content errors in exam questions).

b. Teachers appreciate the professional development opportunities and wish there were more.

c. Students desire an even more rapid response from their online teachers and counselors.

d. Accessibility is an area of opportunity for all our courses.

These results led to the redesign of seven specific elements:

a) *Redesigning the mission and underlying principles of the program* The new mission stresses the role of all B@UNAM' members: "Here, each learner builds a fundamental culture in order to think and transform the world". Learners are not only students but also faculty and administrative staff. They are expected to become multiple-solution designers, through an open vision of the world, and a digital, connectivist and innovative perspective, with a strong social and ethical focus. Also, foundational values are highlighted so course developers, designers, teachers and learners are aware of them, following this need presented by Androtti et al. [4].

b) *Establishing the design constraints.* Five constraints were identified:

- The program should have a transdisciplinary perspective.
- AI should be used to foster better and deeper learning as well as to prevent drop-out.
- Learners should have a personalized trajectory so their motivation and understanding leap.
- Learning should be constantly spilled into the students' communities through authentic projects that relate them even more with their community, and that improve the environment and provide solutions to real problems. Each project has a social approach or is related to the improvement of the community.
- Learning English happens throughout the whole program and three levels of the Common European Framework of Reference for Languages should be achieved.

c) *Identifying the curricular design steps to follow.* A creative and complex thoughts map was created as a guideline for the design of each program and each learning activity.
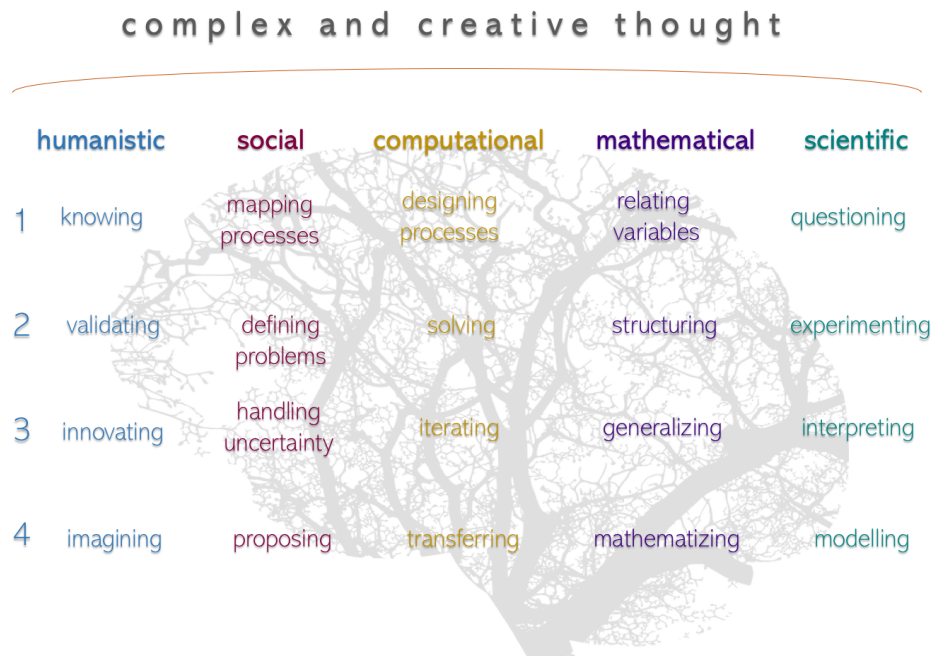
Figure 2. Complex and creative thought map

d) *Selecting an educational model that represents the underlying principles.* A connectivist view of the world with a phenomenon-based learning perspective was chosen. It includes design-based learning and place-based learning. Gender, diversity, sustainability, complexity, and innovation are transversal axes, as well as disciplinary content related to art, Greek and Latin etymologies, technology and English as a second language. Each program presents all these topics in a variety of forms: through activities, texts, projects, quotes and multimedia content.

e) *Using the future as a design axis.* "Change is the only constant": content, as well as feel and touch of each course, are presented in different formats, so learners must seek adaptation to changing scenarios. After all, graduates must be able to cope with uncertainty in every situation when visiting the web.

f) *Working with agile and lean methodologies for rapid feedback and partial redesigns, and then, experimenting.* During the redesign process of the framework, the syllabi, and the online materials constant evaluation and testing have taken place. We assume nothing is forever and improvement is always possible. Focus groups, user experience tests, and staff discussions were central elements. Once the program is launched, we will research the impact of learning based on the new curricular elements: constant research-based testing will be implemented as an ongoing process to improve the program continuously.

The six main challenges we found in the diagnoses of the academic program that are linked to training for an uncertain world, the identified solutions and the way they impact learners' training for an uncertain future are presented in the following table:

challenges	solutions	preparation for uncertainty
Activities do not truly prepare learners to face complex realities	Transdisciplinary focus	Training to observe reality through a transdisciplinary lens allows learners to better cope with uncertain scenarios
Dropouts say contents are difficult and the platform is not easy to navigate	Adaptive learning, just in time learning, different formats for each course	Students will be familiar with the need to adapt to changing course formats and will have to develop self-regulatory skills in order to cope with uncertain contexts and requirements
Many evaluations are fact-based	Authentic evaluation related to the learner's context	Students must adapt to the environments they research and provide solutions to unique circumstances in each course
Most course contents focus on past events or present challenges	Future studies	Training in developing futuribles and future studies methods provides a valuable tool to face new developments
Most learning activities don't reflect changing conditions of real life	Unexpected change of restrictions and requirements	Learners must be able to rapidly react to change and to be successful under different circumstances
Most learning activities and contents analyze the obvious	Data viz in all courses	Skills to read different visualizations (including those of big data) prepare students to look for ways to interpret new visual info

Table 1. Six elements to prepare students for uncertainty along the online high school program.

An example to showcase these elements in our courses is *Mexico and its challenges*. This 100-hour course is one of the last required subjects in our program. It involves history, geography, political science, sociology, economy and art history. The legacy project we introduced is the development of a futurible through the method of Causal layered analysis, developed in 1996 by Inayatullah [10]. Learners must work with four levels (litany or conventional wisdoms and traditions; social, economic, cultural and environmental drivers; worldview; and myths, meta-narratives and metaphors). They create the "narrative foresight" in order to develop a preferred future from several possible futures. They must select one pressing issue in their communities and analyze using this methodology. The purpose is to critically analyze that issue, identify causation and develop a futurible that is desirable for their community. During the weeks they engage in this activity each student must:

- Analyze the problem he selected that must include at least three of the disciplines embedded in the course (in this way they use a transdisciplinary approach) with the help of methodologies from those disciplines to understand the phenomenon in a holistic way.
- While studying the contents of the course, learners will navigate to a unique course format, and they will have to explore functionalities and layout in order to access resources and interact with peers and experts.
- The fact that they will have to explore a specific problem of their community and provide an evidence-based portfolio to conduct their analysis and create future scenarios constitutes an authentic learning activity. It also has a combination of creative and uncreative phases, as Bilton [8] suggests, for students must present an analysis based on present evidence but leaving room for future developments that encompass more subjective elements such as myth and metaphor.
- The legacy project is the application of a specific future studies method, which provides a tool to explore possible developments.
- A way to promote short reaction times and low frustration levels is the inclusion of last-minute changes when delivering their project. Modification in quantity (your project will have to be a 5-minute presentation, instead of the original seven minutes), mode (you will have to deliver a video, not a slide presentation) or content (you must include at least two more references) will provide a training for real life conditions where we face changing constraints.
- Since learners must use at least one new way of data visualization per course, they will have to develop skills to create and interpret different kinds of visuals. In this case, the analysis of present conditions will have to include a new type of dataviz.

5. Discussion

In this work we presented the main findings of the diagnoses we conducted on the first version of the online high school program (B@UNAM) of Mexico's National University. Seven elements were redesigned, and six elements were included in order for our students to have a better chance at facing uncertain contexts in their futures. We exemplified the integration of those elements in the last semester course that analyses Mexico`s challenges from historical, political, economic and societal perspectives.

We included in each course at least an instance of the "structured uncertainty" that Beguetto [7] suggests through the integrating project, the main learning activity in each course. These "beautiful risks", as he calls them, foster learners' knowledge about their communities and the development and implementation of solutions to some of their problems. They constitute legacy projects, as Beguetto calls them [10], for they exist in the community even after the completion of the educational requirement.

The introduction of the six elements to prepare our learners for uncertainty run along Yuval Harari's [11] statement: "Most important of all will be the ability to deal with change, learn new things, and preserve your mental balance in unfamiliar situations. In order to keep up with the world of 2050, you will need not merely to invent new ideas and products but above all to reinvent yourself again and again".

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