Centre d'Etudes Doctorales : Sciences et Techniques et Sciences Médicales

Avis de Soutenance

THESE DE DOCTORAT

Présentée par

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Discipline : Sciences de l'Ingénieur
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Sujet de la thèse

Change in Engineering Education by Design;A participatory approach and a Context Canvas to Transform Education

Formation Doctorale " Sciences de l'Ingénieur, Sciences Physique, Mathématiques et Informatique"

Thèse présentée et soutenue **le mercredi 13 décembre 2023 à 15h** à la Salle de Réunion de la Scolarité à la Faculté des Sciences et Techniques de Fès, devant le jury composé de :

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Résumé de la thèse

We exist in a world that is constantly changing, new challenges are arising every day calling humans to search for knowledge and meanings, and design and develop the infrastructure and technologies that make our lives better. Look around you. Almost everything that humans created was engineered. From the most basic objects and solutions we utilize to complex ones such as airplanes and AI, artifacts are crafted, refined, and constructed with profound inspiration, employing the wisdom of science, mathematics, and technology. In order to transfer the knowledge and skills needed to sustain survival and perpetuate comfort and well-being, education was created. A system that is supposed to consider the time and space where we exist and support humans in the acquisition and dissemination of essential knowledge, and necessary skills for the purpose of ensuring continued survival, perpetuating comfort, and enhancing the overall well-being of societies and their environment. However, education has undergone a process of "medicalization", transforming students into conforming entities tailored to fit within the educational system, rather than embracing and accepting them for who they truly are; individuals living in specific environments, building their own identities, having unique backgrounds, values, beliefs, and aspirations. Our goal is to inspire a reevaluation of the design of education, emphasizing the importance of considering the student as an active partner in the developmental process of education.

This novel design-based dissertation is addressing the challenge of engaging faculty to innovate in Engineering Education and, rather, making education a fit for its students and their environments. Utilizing a design-based approach to research, we developed a process and tool that prioritize humans and their contexts in learning experience development.

This work describes our design journey from opportunity identification to solution development and iteration. We start by presenting the scope of our work in Chapter 1 to describe the context of the challenge we are addressing. We evoke the need for change in engineering education and the necessity to empower educators as actors of change.

Chapter 2 provides the first solution to initiate faculty to change using a design-based transformation framework in Engineering Education. We suggest a design process and an activity to introduce educators to change in a way that captures their interest and stimulates their motivation. Realizing that contextual elements of the environment of learning need to be considered in the process, we then put emphasis on including the contextual factors in the design approach and, thereby, present in Chapter 3 a design approach that introduces the consideration of elements of the system early on in the design process. In developing an effective solution tailored to the specific context of use, we acknowledge that gathering and organizing a significant amount of information at the initial stage of design is

crucial but could be overwhelming and subject to bias. In the following chapters 4 and 5, we introduce the Context Canvas; a solution that facilitates the collection and analysis of contextual elements. Chapter 4 describes the Context Canvas and its origine, whereas Chapter 5 discusses the testing of the Context Canvas in a collaborative setting between faculty and students using Community Based participatory Design as an approach for co-design. The data derived from the study will serve as a foundation for refining the concept and will be shared to contribute to future research endeavors.

Our efforts in this work are meant to make faculty become aware of factors related to them as individuals, articulate what they know about the context of their work, and help them explore factors related to the institution and the student in order to create a change that benefits students as customers and society as a whole. Our vision is to initiate and implement a people-centric organizational change in higher and K-12 STEM education. Our short-term goal is to create ways to onboard engineering education faculty in change initiatives using our expertise in design, and background in engineering, and our motivation is to drive the process of value creation in education. Our objective in this work will be then to inspire change agents in STEM higher education to align their efforts with the design-based models for change that we will be suggesting and to adapt the model to their needs and underlying assumptions about change.

We are intended to bring small-scale changes and incremental improvements to STEM higher education by empowering faculty with design tools and models to create a student-centered education that considers the overall context where learning exists.

Overall, our conceptual and empirical work is meant to support a design-oriented approach to education by offering a design tool for educators to co-create learning experiences with students.