

A Virtual Tour of the Algiers STEM Center – The UDL Lens

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Abstract

*This presentation will give a 360 view of the Algiers STEM Center activities, with intensive insights into the **UDL in STEM** teacher training modules. The Algiers STEM Center, located in Algiers, Algeria, has become a magnet for inquiring youth, with over 2,000 participants benefiting from interactive makers' inspired activities such as coding, robotics, engineering, chemistry and artificial intelligence. The Center has graduated 82 teacher candidates from the UDL in STEM Teacher training program. Graduates continue to work directly with youth both in the STEM Center and in public and private schools across Algeria. This session uses virtual reality technology to explore a sample spectrum of STEM workshops and teacher training activities. Activities are all rooted in the application of UDL principles to provide accessible learning experiences for STEM educators in Algeria's unique context.*

Keywords

STEM education, Algerian education, teacher training, lesson planning, inclusion, learner variability, multilingual classrooms.

INTRODUCTION

Algeria is emerging from decades of rote learning institutionalized as the norm across classrooms. In this former French colony, with borders on both the Mediterranean Sea and the Sahara Desert, exceptional students of all abilities are systematically required to seek private support if they require any sort of personalized teaching. Schools do not, as the norm, have hands-on learning opportunities where students can experiment, tinker, test and collaborate to explore new concepts.

World Learning Algeria has been working since 2005 to improve teaching quality across Algeria, and in 2016 launched the Algiers STEM Center to bring best practices in teaching to STEM education. Funding from private sector partners - Dow Chemicals, Boeing Company, and Anadarko Petroleum allowed for the creation of a collaborative learning space where participants work with high- and low-tech equipment to explore and build enthusiasm for learning. To achieve the overarching project goal of making STEM education accessible and exciting for students of all abilities, World Learning created a set of teacher-training modules which train candidates to apply a UDL lens to creation and implementation of lessons in the STEM fields and beyond.



Figure 1. Students at the Free Practice stage busy developing their Curiosity Machine projects in various formats with educators monitoring to offer support.

BACKGROUND

Inquisitive teachers in Algeria are starting to question the traditional ways in which they themselves have been taught, seeking professional development opportunities that add flexibility to a rigid system of learning and teaching. World Learning Algeria (WLA) has been working to create teacher training opportunities that match this growing demand and deliver sustainable impact in classrooms. Taking both a top-down approach (via training for National Ministry of Education leadership) as well as direct training of teachers in learner-centered methodology, WLA worked to identify an approach to teacher training that maximized impact with students in Algerian classrooms. The latter model has taken solid shape towards gradual implementation of Universal Design for Learning (UDL) practices along the 5 phases of systematic change (CAST, 2015).

The Algiers STEM Center serves as a magnet for inquisitive youth and teachers wanting to expand the impact of education in Algeria. The UDL in STEM Teacher training in the Center has been able to capitalize on the energy of the community drawn to the Center to implement a high-impact, scalable support for teachers who are ready to create accessible and innovative classrooms.

360 VIEW OF THE ALGIERS STEM CENTER

Every week, a diverse group of STEM volunteers drawn from science faculties at local universities guide youth to ignite their passion for STEM through hands-on innovation

and fun science activities. These activities range from basic computer programming to science discovery workshops to advanced artificial intelligence and robotics. Students may create water filters to solve sustainability issues one day and assemble programmable Lego robots the next. Activities are independent of the national science curriculum and take place outside of school hours during the school year, with longer intensive sessions organized during summer and other academic breaks.

At the heart of these activities is the Algiers STEM Center: a dynamic science and technology space that is emerging as a national hub for interactive science education. The center hosts numerous STEM workshops for local students to help build enthusiasm for scientific and technical learning. It offers teacher training courses preparing educators to adopt new hands-on teaching techniques for inclusive classrooms.

To complement these technical activities, the center offers civic engagement and pre-career training for STEM fields and presentations from STEM practitioners.

Aiming to extend its spark beyond the city, STEM instructors share their expertise and ignite the passion for inclusive approaches to STEM nationwide through STEM Camps, STEM Corners and STEM Fairs.



Figure 2. Lego Robotics Educator Abderraouf Chammkh adapting his lesson plan with anticipated challenges and how to overcome them for students outside Algiers.

After running workshops, teacher trainees express a high level of satisfaction in their efficacy as teachers. "The students felt proud presenting the robots they had built, and everybody could see how engaged they were and how much they loved it from the excitement during their presentations," said trainee Abderraouf Chammkh. "It was an indescribable feeling to see the happiness on students' faces while they were learning and enjoying it."

Educators at the STEM Center come from science and technology backgrounds but also from language and literary streams. They all share one common passion for learning through teaching, exercised through STEM discovery workshops. 2 paid staff members and over 100 volunteer

mentors manage an expanding array of STEM activities. 57% of the STEM volunteer mentors have participated in the UDL-based teacher training. These volunteer mentors put the UDL guidelines (CAST 2018) into play as they develop and lead STEM workshops of their own design at the Algiers STEM Center and back at their educational institutions in their home regions across the country. Teacher trainees develop a UDL lens for lesson planning and delivery via experiential learning activities. They then integrate UDL principles into lesson planning for STEM workshops such as coding, engineering design and robotics. Candidates test lessons first amongst themselves in a microteaching, peer-learning format, then pilot their lessons with live student participants of the Algiers STEM Center. Each teaching session is followed by a detailed feedback session reflecting on what worked well and setting action points for future teaching sessions using the UDL guidelines.

Planning - "Explore and Prepare" Phases

When candidates join the UDL in STEM Teacher Training course, they first reflect on their own learning experience as part of a constructive approach to the art of lesson planning. In this experiential learning model, learning is seen as a *process whereby knowledge is created through the transformation of experience* (Kolb: 1984). This experience paves the way to build growth on addressing student variability, setting SMART objectives, and the application UDL spin methodology. Participants refer to the UDL guidelines first in pairs then individually, with peer and trainer support, articulating the variability perspective and student-centered learning objectives. Over time, as participants hone their UDL lenses, they observe increased engagement and productivity when putting their UDL-infused lesson plans in practice with STEM Center participants. The aim of the course structure is for teachers to gain independence in planning as they continuously build skills through reflective feedback loops.

Teaching - "Integrate" Phase

The overarching goal of the Algiers STEM Center is to increase awareness and enthusiasm for STEM fields in students from diverse backgrounds. Most activities provided for students at the STEM Center are new to the K-12 Algerian student population. Motivated either by overcoming their fear of the unknown, or exploring their excitement for the new, students quickly engage in the varied range of STEM activities at the Center. The teacher volunteers focus on the student engagement guidelines first, seeking to create a comfortable and safe environment where learning is fun and mistakes are between absolute value bars.

Providing Multiple Means of STEM Presentation

This presentation will use 360 Virtual Presentation technology to show examples of engaging workshops simplifying the previously "only-for-college level brains" STEM specialties. Educators activate students' learning by providing everyday examples on how the subject matter is relevant. For example, students may brainstorm about the variety of household chore they endure as a staging activity

to visualize a robot that could relieve them from these chores with “special powers.” Students then sketch their visions using different tools provided to represent their ideas: ‘scratch’ software on the computer, colorful markers on a glass board, Lego pieces, crayon on poster paper or a hand-written story on 2*2 inch sticky notes. These activities form the design phase for students first contact with robotics. Participant engagement has grown at an exponential rate such that the Center produced a robotics team to participate in the 2017 and 2018 FIRST Global Robotics Challenges, taking 2nd place in the 2018 gathering in Mexico City.

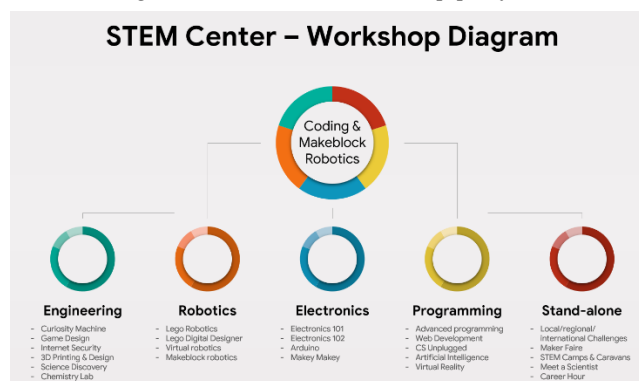
As class profiles vary, the approach and planning to engage the students varies throughout the various STEM workshops offered at the STEM Center.

Basic-level STEM Workshops

These STEM workshops are introductory activities where students get a feel of STEM, build their mindset for innovation, and more importantly have the basic level of knowledge and comfort to be autonomous. By the end of these workshops, students will be able to use the basic components specific to the workshop to build mini-projects, guided and free, in collaborative activities. Educators usually have a strong presence at the first stages of the lesson then start fading away as students take over their own learning.

STEM Center participants are introduced to coding through an **Hour of Code**¹ workshop. Students get to choose to create a game from popular games such as Minecraft or Star Wars, facing growing challenges in which they learn the basics of coding, conditions, and loops. A full list of STEM Center workshops is as follows:

Table 1: Algiers STEM Center workshop portfolio



Note: reprinted from Algiers STEM Center Program Overview World Learning Algeria, 2018

Students can follow these activities by exploring three fields: **Arduino**² **Electronics, Robotics & Mechatronics**, and **Advanced Programming**. Throughout this journey, students have also the possibility to participate in engineering design workshops like **Curiosity Machine**³, and **Chemistry Lab**. In these workshops, students develop

cognitive skills related to the engineering process and ideation, with goal of achieving “expert learners” according to the UDL guidelines: purposeful and motivated, resourceful and knowledgeable, and strategic and goal-oriented (CAST 2018).

This presentation will feature a 360 Virtual reality tour of workshops and participants.. The STEM educators will explain their UDL experience from exploration, preparation, integration, and reflection phases.

Reflecting - “Scale & Optimize” Phases

As teacher candidates near graduation from the course, their trainer guides the STEM educators in reflecting on their classroom practice. Educators focus on whether or not the student-centered SWBATs (Students Will Be Able To...) have been achieved, and what aspects of UDL have either helped student learning, or could have been better applied to overcome obstacles in the lessons. Educators learn how to look objectively at their lesson to draw conclusions on their efficacy in guiding learning in a particular setting. Near the end of the course, STEM educators internalize the UDL guiding principles and use multiple elements as a concrete tool used to engage all students and support their learning from start to end.

Serving to “scale” the initiative, many teacher candidates join the UDL in STEM course as they complete university study at the national technical institutions located in Algeria’s capital of Algiers, As they prepare to graduate from both the teacher training course and their university courses of study, they start to reflect on how to bring STEM and UDL activities back to their home communities. Since opening the STEM Center in Algiers, a second Center has opened in Ouargla -- a town in the northern Sahara --as well as 7 other “STEM corners” across the mountain, desert and coastal communities across Algeria. All Corners have been created and maintained by STEM Center graduates.

CONCLUSION

Demand for high-quality learning in Science, Technology, Engineering, and Math (STEM) fields is higher than ever in Algeria. From robotics challenges to chemistry experiments, geology workshops to coding camps, the exciting mix of activities at the Algiers STEM Center is sparking interest in STEM education nationwide. The UDL in STEM Teacher Training modules are assuring that this dynamic Center produces a continuous supply of enthusiastic Algerian teachers equipped with UDL toolboxes able to open up learning for students of all abilities eager to explore the STEM fields. World Learning is eager to continue to scale and optimize this exciting initiative and open further engagement in learning across this vast country.

ACKNOWLEDGMENTS

World Learning would like to acknowledge the generous support and vision of the Algiers STEM Center sponsors: Anadarko Petroleum, The Boeing Company and Dow Chemicals. These companies' ongoing financial support and visits with live "experts from the STEM fields" has allowed the Algiers STEM Center to develop into a vibrant space for learning and innovation.

REFERENCES

CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from <http://udlguidelines.cast.org>

CAST (2015) CAST's UDL Implementation Phases. Grace Meo, Rachel Currie-Rubin Retrieved from http://castprofessionallearning.org/wp-content/uploads/2015/08/Overview_Implementation.pdf

Kolb, D (1984) Experiential Learning: Experience As The Source Of Learning And Development. New York, Prentice-hall

Notes:

- (1) Hour of Code, coding campaign started by Code.org[®]
Retrieved from <https://code.org/hourofcode/overview>
- (2) Arduino, open-source electronics platform licensed by GNU General Public License (GPL). Retrieved from <https://www.arduino.cc>
- (3) Curiosity Machine[®], a program of Iridescent, a nonprofit organization in the United States. Retrieved from <https://www.curiositymachine.org>

APPENDICES:

Appendix A: STEM Center Workshops

