



THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

# Abstract Book

20<sup>th</sup> Annual International Conference on  
Information Technology & Computer  
Science

20-23 May 2024, Athens, Greece

Edited by  
Adrian Ionescu & Olga Gkounta

2024



Abstracts  
20<sup>th</sup> Annual International  
Conference on Information  
Technology & Computer Science  
20-23 May 2024, Athens, Greece

Edited by  
Adrian Ionescu & Olga Gkounta

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## Preface

This book includes the abstracts of all the papers presented at the 20<sup>th</sup> Annual International Conference on Information Technology & Computer Science (20-23 May 2024), organized by the Athens Institute for Education and Research (ATINER).

A full conference program can be found before the relevant abstracts. In accordance with ATINER's Publication Policy, the papers presented during this conference will be considered for inclusion in one of ATINER's many publications only after a blind peer review process.

The purpose of this abstract book is to provide members of ATINER and other academics around the world with a resource through which they can discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. ATINER was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world can meet to exchange ideas on their research and consider the future developments of their fields of study.

To facilitate the communication, a new references section includes all the abstract books published as part of this conference (Table 1). I invite the readers to access these abstract books –these are available for free– and compare how the themes of the conference have evolved over the years. According to ATINER's mission, the presenters in these conferences are coming from many different countries, presenting various topics.

**Table 1.** *Publication of Books of Abstracts of Proceedings, 2011-2024*

Year	Papers	Countries	References
2024	35	17	Ionescu and Gkounta (2024)
2023	58	19	<a href="#">Ionescu and Gkounta (2023)</a>
2022	68	23	<a href="#">Petratos and Gkounta (2022)</a>
2021	36	19	<a href="#">Papanikos (2021)</a>
2020	33	17	<a href="#">Papanikos (2020)</a>
2019	34	13	<a href="#">Papanikos (2019)</a>
2018	24	10	<a href="#">Papanikos (2018)</a>
2017	47	21	<a href="#">Papanikos (2017)</a>
2016	34	12	<a href="#">Papanikos (2016)</a>
2015	33	18	<a href="#">Papanikos (2015)</a>
2014	30	21	<a href="#">Papanikos (2014)</a>
2013	22	16	<a href="#">Papanikos (2013)</a>
2012	26	15	<a href="#">Papanikos (2012)</a>
2011	25	14	<a href="#">Papanikos (2011)</a>

It is our hope that through ATINER's conferences and publications, Athens will become a place where academics and researchers from all over the world can regularly meet to discuss the developments of their disciplines and present their work. Since 1995, ATINER has organized more than 400 international conferences and has published over 200 books. Academically, the institute is organized into 6 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of ATINER for putting this conference and its subsequent publications together.

**Gregory T. Papanikos**  
**President**

## **Editors' Note**

These abstracts provide a vital means to the dissemination of scholarly inquiry in the field of Information Technology & Computer Science. The breadth and depth of research approaches and topics represented in this book underscores the diversity of the conference.

ATINER's mission is to bring together academics from all corners of the world in order to engage with each other, brainstorm, exchange ideas, be inspired by one another, and once they are back in their institutions and countries to implement what they have acquired. The *20<sup>th</sup> Annual International Conference on Information Technology & Computer Science*, accomplished this goal by bringing together academics and scholars from 17 different countries (Canada, Colombia, Croatia, Estonia, Germany, Hungary, India, Israel, Italy, Mexico, Poland, Slovakia, South Africa, Switzerland, The Netherlands, UK, USA), which brought in the conference the perspectives of many different country approaches and realities in the field.

Publishing this book can help that spirit of engaged scholarship continue into the future. With our joint efforts, the next editions of this conference will be even better. We hope that this abstract book as a whole will be both of interest and of value to the reading audience.

**Adrian Ionescu & Olga Gkounta**  
**Editors**

**20th Annual International Conference on Information  
Technology & Computer Science, 20-23 May 2024, Athens,  
Greece**

**Organizing & Scientific Committee**

All ATINER's conferences are organized by the Academic Council. This conference has been organized with the assistance of the following academic members of ATINER, who contributed by reviewing the submitted abstracts and papers.

1. Gregory T. Papanikos, President, ATINER & Honorary Professor, University of Stirling, U.K.
2. Adrian Ionescu, Head, Computer Science Unit, ATINER & Professor, Wagner College, USA.
3. Thomas Fehlmann, Senior Researcher, Euro Project Office, Switzerland.

# FINAL CONFERENCE PROGRAM

## 20th Annual International Conference on Information Technology & Computer Science, 20-23 May 2024, Athens, Greece

### PROGRAM

Monday 20 May 2024

08.30-09.15

Registration

09:15-10:00

Opening and Welcoming Remarks:

- Gregory T. Papanikos, President, ATINER.

10:00-11:30 Session 1

Moderator: Till Haenisch, Professor, DHBW Heidenheim, Germany.

1. **Francesca Di Virgilio**, Full Professor, University of Molise, Italy.  
*Title: Innovative Work Behaviour and Empowering in Italian SMEs – University Eco-system.*
2. **Christoph Karg**, Professor, Aalen University of Applied Sciences, Germany.  
**Ralf-Christian Härting**, Professor, Aalen University of Applied Sciences, Germany.  
**Demian Deffner**, Scientific Employee, Aalen University of Applied Sciences, Germany.  
**Miriam Kappe**, Scientific Employee, Aalen University of Applied Sciences, Germany.  
*Title: CyberWuP – A Low-Threshold Cyber-Security Awareness Program for Small and Medium Enterprises.*
3. **Kiridaran Kanagaretnam**, Professor, York University, Canada.  
*Title: Machine Lending and Discrimination: Evidence from Peer-to-peer FinTech Lending.*
4. **Massimo Maresca**, Professor, University of Genoa, CIPI, Italy.  
**Luca Andreoli**, Graduate Student, University of Genoa, CIPI, Italy.  
**Carlo Andreotti**, Software Engineer, DocSpace S.r.l., Italy.  
**Pierpaolo Baglietto**, Professor, University of Genoa, CIPI, Italy.  
*Title: Internet Service in the Maritime Domain.*

11:30-13:00 Session 2

Moderator: Francesca Di Virgilio, Full Professor, University of Molise, Italy.

1. **Till Haenisch**, Professor, DHBW Heidenheim, Germany.  
**Christoph Karg**, Professor, Aalen University of Applied Sciences, Germany.  
*Title: Virtual Labs for Contemporary Teaching of IT-Security.*
2. **Djuradj Budimir**, Reader in Wireless Communications, University of Westminster, UK.  
*Title: IoT Based Monitoring of University Classrooms.*
3. **Franziska Schuetz**, Senior Researcher, DHBW Heidenheim, Germany.  
**Till Haenisch**, Professor, DHBW Heidenheim, Germany.  
*Title: Transforming CS Curricula into EU-standardized Micro-Credentials – The Hard Parts.*

13:00-14:30 Session 3

Moderator: Christoph Karg, Professor, Aalen University of Applied Sciences, Germany.

1. **Hans Dulimarta**, Professor, Grand Valley State University, USA.  
**William Dickinson**, Professor, Grand Valley State University, USA.  
*Title: Composite Command Pattern in Spherical Geometry.*
2. **Sikha Bagui**, Distinguished Professor, University of West Florida, USA.  
**Dustin Mink**, Research Faculty, University of West Florida, USA.  
**Subhash Bagui**, Distinguished Professor, University of West Florida, USA.  
*Title: Creating a Comprehensive Network Intrusion Dataset Based on the MITRE ATT&CK Framework in the Big Data Environment: UWF-ZeekData22.*
3. **Thomas Fehlmann**, Senior Researcher, Euro Project Office AG, Switzerland.

*Title: Measuring Knowledge – An Attempt to Define a Measurement Principle.*

**14:30-15:30 Lunch**

**15:30-17:00 Session 4**

**Moderator: Susan Miller**, Chair, Department of Family Medicine, Houston Methodist Academic Institute, USA.

1. **Trinettia Respress**, Interim Dean of Graduate School/Professor, Tennessee State University, USA.  
**Owen Johnson**, Professor, Tennessee State University, USA.  
**Sosiak Makonnen**, Director of Special Projects and Grants, Tennessee State University, USA.  
*Title: Early Exposure/Long Term Gains: Encouraging High School Students to Pursue STEM Degrees and Careers.*
2. **Jennifer Cuddapah**, Professor, Hood College, USA.  
**Jessica Keeney**, Classroom Teacher, Frederick County Public Schools / Hood College, USA.  
**Riley Smith**, Mathematics Teacher, Frederick County Public Schools, USA.  
*Title: Preparing STEM Teachers for Today's Post-COVID Classrooms.*
3. **Elsa Tovar**, Educational Consultant, Trail Tree Consulting, USA.  
*Title: Learning from Experience: Development of Culturally Responsive STEM Curriculum.*
4. **Pius Tanga**, Professor, University of Fort Hare, South Africa.  
**Magdaline Tanga**, Lecturer, Professor, University of Fort Hare, South Africa.  
*Title: Contestations of Remote Teaching and Learning of English Language During Covid-19 Pandemic: A Case of a South African University.*

**17:00-18:30 Session 5**

**Moderator: Brett Elizabeth Blake**, Professor and Senior Research Fellow, St. John's University, USA.

1. **John Spiridakis**, Professor and Chair, Department of Education Specialties, St. John's University, USA.  
*Title: Book Bans and Culture Wars in America: Upheavals in Schooling and Society.*
2. **Kausalai Wijekumar**, Professor, Texas A&M University, USA.  
**Javier Garza**, Program Director, Texas A&M University, USA.  
**Maria Sierra**, Research Specialist II, Texas A&M University, USA.  
*Title: Children are Smart, the Systems are Preventing them from Achieving Success in Literacy.*
3. **Mohammad Toyon**, PhD Candidate, Estonian Business School, Estonia.  
*Title: Understanding Variability: A Closer Look at the Career Assistance Requirements and Contentment of Employed and Unemployed University Students in Estonia.*
4. **Paramita DasGupta**, Assistant Professor, National University of Juridical Sciences, Kolkata, India.  
*Title: Epistemological Interdisciplinarity in Legal Education: The Default Pedagogical Methodology for the New Global Reset? An Investigation.*

**20:30-22:30**

**Athenian Early Evening Symposium (includes in order of appearance: continuous academic discussions, dinner, wine/water, music)**

**Tuesday 21 May 2024**

**09:00-10:30 Session 6**

**Moderator: Emese Boksay-Pap**, Lecturer, Pázmány Péter Catholic University, Hungary.

1. **Volodymyr Voytenko**, Professor, Sheridan College, Canada.  
**Title:** An Iot-Based Smart Home System Prototype. with Sensors Management.
2. **Opher Etzion**, Professor and Chair, Information Systems Department, Zefat Academic College, Israel.  
**Title:** Event Processing within the Human Body.
3. **Wladimir Mitiuszew**, Professor, Cracow University of Technology, Poland.  
**Natalia Rylko**, Associate Professor, Cracow University of Technology, Poland.  
**Title:** Computer Simulations of the Effective Properties of Dispersed Composites.
4. **Stanislav Selitskiy**, PhD Student, University of Bedfordshire, UK.  
**Title:** Batch Transformer Architecture: Case of Synthetic Image Generation for Makeup and Occlusion Face Recognition.

**10:30-12:00 Session 7**

**Moderator: Hilda Patino**, Dean, Department of Education, Universidad Iberoamericana, Mexico.

1. **Elizabeth Diaz**, Associate Professor, The University of Texas at Arlington, USA.  
**Title:** *Literacy and Assisted Technology.*
2. **Marisel N. Torres Crespo**, Associate Professor, Hood College, USA.  
**Jennifer Cuddapah**, Professor, Hood College, USA.  
**Title:** *Building Teacher Confidence and Capacity for Incorporating Computer Science and Computational Thinking into Practice.*
3. **Martina Holenko Dlab**, Associate Professor, Head of Chair of Multimedia Systems and e-Learning, University of Rijeka, Croatia.  
**Nataša Hoić-Božić**, Full Professor, Head of Laboratory for Application of Information Technologies in Education (EDULAB), University of Rijeka, Croatia.  
**Title:** *Enhancing Remote Work Competencies in Croatia: Findings from VirtualEdu Project.*
4. **Samar Amer Zubidat**, Lecturer, The College of Sakhnin for Teacher Education, Israel.  
**Title:** *Could Robotics Help Arab Teachers to Conduct STEM Based Lessons?*

**12:00-13:30 Session 8**

**Moderator: Elizabeth Diaz**, Associate Professor, The University of Texas at Arlington, USA.

1. **Valeria Svecova**, Assistant Professor, Constantine the Philosopher University in Nitra, Slovakia.  
**Marta Balgova**, Coordinator, National Institute of Education and Youth (NIVAM), Slovakia.  
**Veronika Uhrlikova**, Teacher, Elementary School with Kindergarten Na Hôrke, Nitra, Slovakia.  
**Title:** *Development of Critical Thinking through the Creation of Mathematical Problems.*
2. **Hilda Patino**, Dean, Department of Education, Universidad Iberoamericana, Mexico.  
**Luis Medina Gual**, Coordinator, Universidad Iberoamericana, Mexico.  
**Arcelia Martínez**, Tenure Professor, Universidad Iberoamericana, Mexico.  
**Title:** *Academic Achievement in Language and Mathematics in Primary and Secondary Education in Mexico: A Comparative Analysis before and After the COVID-19 Pandemic.*
3. **Jose Efrain Guataquira Ramirez**, Research Associate, Francisco José de Caldas District University, Grupo Enseñanza y Aprendizaje de la Física, Colombia.  
**Olga Lucia Castiblanco Abril**, Researcher, Francisco José de Caldas District University, Grupo Enseñanza y Aprendizaje de la Física, Colombia.  
**Title:** *The Diary of Sky: A Methodology for Teaching Astronomy Aimed at Teachers.*

4. **Stefania Zoi Ntregka**, Lecturer & Research Fellow, Hotelschool The Hague, The Netherlands.  
**Michelle Schefman**, Lecturer, Hotelschool The Hague, The Netherlands.  
*Title: Agile Teaching in Applied Science Universities: Integrating an Evidence-based Approach.*

**13:30-14:30 Lunch**

**14:30-16:30 Session 9**

**Moderator: Olga Gkounta**, Researcher, ATINER.

1. **Smita Guha**, Professor, St. John's University, USA.  
*Title: Nutrition Education for the Underprivileged Mothers and Children in India: An Ethnic Study.*
2. **Emilie Sitzia**, Associate Professor, Maastricht University, The Netherlands.  
*Title: Senses-Based Learning in Tertiary Education.*
3. **Li-Qiong Wang**, Distinguished Senior Lecturer, Brown University, USA.  
*Title: Collaborative, Interdisciplinary and Case Study Approaches in Undergraduate Research, Teaching and Learning.*
4. **Emese Boksay-Pap**, Lecturer, Pázmány Péter Catholic University, Hungary.  
*Title: Wearing the Instructional Designer's Hat. Teachers and Transformative Learning.*
5. **Busisiwe Ndawonde**, Teaching and Learning Consultant, University of Fort Hare, South Africa.  
*Title: Effects of the Teaching Philosophies in Life Sciences.*

**17:00-20:00 Session 10**

**Old and New-An Educational Urban Walk**

The urban walk ticket is not included as part of your registration fee. It includes transportation costs and the cost to enter the Parthenon and the other monuments on the Acropolis Hill. The urban walk tour includes the broader area of Athens. Among other sites, it includes: Zappion, Syntagma Square, Temple of Olympian Zeus, Ancient Roman Agora and on Acropolis Hill: the Propylaea, the Temple of Athena Nike, the Erechtheion, and the Parthenon. The program of the tour may be adjusted, if there is a need beyond our control. This is a private event organized by ATINER exclusively for the conference participants.

**20:30-22:00**

**Dinner**

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**Wednesday 22 May 2024**  
**An Educational Visit to Selected Islands**  
**or Mycenae Visit**

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**Thursday 23 May 2024**  
**Visiting the Oracle of Delphi**

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**Friday 24 May 2024**  
**Visiting the Ancient Corinth and Cape Sounion**

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**Samar Amer Zubidat**

Lecturer, The College of Sakhnin for Teacher Education, Israel

## **Could Robotics Help Arab Teachers to Conduct STEM based Lessons?**

The educational system's outcomes can be influenced by various factors, including cultural, socioeconomic, and political issues. In Israel, a country known for its investment in science and technology, there is a focus on preparing qualified teachers in integrative STEM (Science, Technology, Engineering, Mathematics), but this approach differs for Jewish and Arab teachers. Jewish teachers have more self-efficacy in integrating technology and promoting STEM education, leading to higher achievements among Jewish students compared to Arab students. To bridge this gap, it is crucial to empower Arab teachers and students in STEM education.

Robotics is widely recognized as a platform that advances integrative STEM and student-centered learning of scientific and technological concepts. In this study, 88 in-service teachers from two Arab teacher colleges participated in a STEM course that introduced educational robotics and its use in teaching mathematical and physical principles. Subsequently, seven teachers applied robotics activities in mathematics, physics, and programming lessons with their students.

Data collection involved a questionnaire to assess participants' motivation, interest in learning, problem-solving skills, and conceptual knowledge. Semi-structured interviews were also conducted with the ten teachers.

The survey results indicated that participants perceived robotics as an effective tool for engaging students in problem-solving activities and facilitating a deeper understanding of scientific and technological concepts. The teachers expressed a notable level of motivation and interest in integrating robotics-enabled STEM lessons into their future teaching practices. Additionally, the teachers highlighted that robotics brought enjoyment to their classrooms, aided in visualizing abstract concepts, and fostered spontaneous collaborative learning, regardless of gender. However, concerns were raised about the time-consuming nature of integrating robotics and its potential impact on curriculum progress.

In summary, Arab teachers in Israel considered robotics a valuable platform that can enhance STEM learning and support the emotional and intellectual development of students. It is recommended to implement further training and research initiatives to support the

professional development of teachers in STEM education, particularly among underrepresented populations. Evaluating the effectiveness of this approach in reducing disparities in academic achievements is also recommended.

**Sikha Bagui**

Distinguished Professor, University of West Florida, USA

**Dustin Mink**

Research Faculty, University of West Florida, USA

&

**Subhash Bagui**

Distinguished Professor, University of West Florida, USA

## **Creating a Comprehensive Network Intrusion Dataset Based on the MITRE ATT&CK Framework in the Big Data Environment: UWF-ZeekData22**

With the rapid rate at which networking technologies are changing, there is a need to regularly update network activity datasets to accurately reflect the current state of network infrastructure/traffic. However, there is very little literature, if any, on creating such network datasets in the Big Data environment. This paper outlines how both the cyber range and big data platform are used to create labeled data. The cyber range labs from The University of West Florida's (UWF's) National Centers of Academic Excellence in Cybersecurity designated cybersecurity degree will be presented.

The UWF-ZeekData22 is publicly available at [datasets.uwf.edu](https://datasets.uwf.edu) in three formats: CSV, Parquet, and PCAP. The UWF-ZeekData22 is collected using Security Onion in two formats: Zeek logs and PCAPs. The collected data is labeled using the MITRE ATT&CK Framework, crowdsourced from the cyber range labs from UWF's National Centers of Academic Excellence in a Cybersecurity designated Cybersecurity degree.

**Emese Boksay-Pap**

Lecturer, Pázmány Péter Catholic University, Hungary

## **Wearing the Instructional Designer's Hat: Teachers and Transformative Learning**

The need to reposition teacher training to meet the needs of the evolving environments of 21<sup>st</sup>-century education and job markets has led to several innovative teacher capacity development programs. The present longitudinal research study examined the learning and development processes of in-service secondary school teachers enrolled on a teaching skills course centered on designing gamified learning experiences. Three groups of in-service teachers took part in the study (N=27). The study spanned a period of three years, and it followed the steps of the grounded theory method. The main aims of the study were: identifying the research participants' understandings of *transformative learning*, identifying the landmarks that shaped the participants' acquisition trajectory of designer knowledge, and the issues that they interpreted as *hindrance to development*. Data collection took place by way of one-to-one interviews, focus group interviews and self-reports of progress/stagnation. Collected data was interpreted in the sequences of open-coding, in-vivo coding, and focused coding. The formulated middle-range theory suggests that teachers' learning that results in adopting new (teaching) attitudes and behavior is hindered by (1) skepticism in own abilities (imposter syndrome), (2) the lack of institutional support and (3) lack of opportunities to practice new (teaching) habits. The trajectory that characterized the construction of new knowledge was marked by the phases of (1) enthusiasm, (2) ambiguity/confusion, (3) crystallization, and (4) completion. The outcomes of the study may have some implications for teacher education and teacher training programs.

**Djuradj Budimir**

Reader in Wireless Communications, University of Westminster, UK

## **IoT Based Monitoring of University Classrooms**

This paper presents the design of the wireless communication architecture, the implementation of IoT technology in educational institutions and the system hardware based on customised micro-controller and wireless communication processors. The study involves the security threats involved in current practices and proposing a solution using IoT. The conventional method of recording attendance using RFID cards has proven to be insecure and prone to proxies. This paper provides a smart attendance system using IoT based sensors, and Raspberry Pi to collect data. The IoT devices are embedded into the existing education environment for data to be collected, transmitted through WiFi using MQTT protocol and store data in local server. The collected data is then accessible to the management with real time insights and attendance pattern. There are many advantages for educational institutions and their stakeholders in using IoT-based attendance tracking systems. Firstly, it promotes accuracy and reliability by eliminating the possibilities of proxy attendance. Secondly, it promotes a sense of accountability among students and promotes consistent attendance, which is directly related to better academic performance. The proposed solution was tested in several different courses in real time over a period of time and the results were compared to the actual attendance data collected through traditional methods. The Raspberry Pi and sensors are used together to collect, process, share, and store data. The need for students to carry an RFID tag and automated the attendance system is eliminated. The IoT system is equipped with BME280 sensors integrated into a Raspberry Pi Zero W on a single-piece breadboard. The sensors are used to capture measurements such as pressure, temperature, and humidity. The Raspberry Pi Zero has an implemented Micropython script that uses the Micropython-bme280 library driver to read continuous sensor values. The proposed monitoring was tested in several different courses in real time over a period of time and the results were compared to the actual attendance data collected through traditional methods.

**Jennifer Cuddapah**

Professor, Hood College, USA

**Jessica Keeney**

Classroom Teacher, Frederick County Public Schools / Hood College,  
USA

&

**Riley Smith**

Mathematics Teacher, Frederick County Public Schools, USA

**Preparing STEM Teachers for Today's Post-COVID  
Classrooms**

In the US, there continues to be a need for recruiting and retaining STEM teachers. The US Department of Education (n.d.) states, “few American students pursue expertise in STEM fields—and we have an inadequate pipeline of teachers skilled in those subjects” (para 2). Complicating the picture is the need to have a multifaceted approach to preparing secondary teachers to teach in post-Covid schools. To respond to this need, our college runs a grant-funded teacher education partnership in collaboration between a four-year school, a two-year school, and a local public school district. The goal of the program is to train high-quality secondary education STEM teachers and equip them to teach in what the US calls “high-needs” schools. These are schools with high teacher turnover, high student poverty, and staffing with those not certified to teach in the areas in which they are teaching. This grant program provides scholarships for students’ last two years of study toward a bachelor’s degree in one of three STEM disciplines (biology, chemistry, or mathematics) along with coursework to qualify as a fully credentialed secondary education teacher. In addition to scholarships, the program provides a variety of activities and support mechanisms to prepare secondary STEM teachers specifically to work in culturally relevant ways in high-needs schools. Hallmark professional development opportunities have included field trips, workshops, Young Scholars summer STEM program support, and STEM 101 immersion learning experience.

This presentation, written and prepared by college faculty and a student graduate of the program, will focus on the process and outcomes of the Young Scholars and STEM 101 experiences. STEM 101, designed for students who have completed their first year of college, is a multi-day experience comprised of workshops, informational sessions, and field trips, which brings together faculty in the STEM majors, the Education Department, and the local school system. It

introduces potential STEM teachers to the STEM major options and Secondary Education. Young Scholars is a 2-week summer program for identified at-risk youth who demonstrate potential for achieving in the STEM areas. This program has been sponsored at Elementary, Middle, and High School sites over the past decade. Hood's student teachers have served as assistants during this summer program, and college STEM faculty have assisted with content teaching support each year. Graduates of the college's program have gone on to become the lead educators in the Young Scholars Program. Presenters will share an overview of the STEM 101 and Young Scholars curricula as well as the outcomes from data collected about these two teacher preparation experiences designed to support new entrants for today's schools. Participants will reflect on the information provided as well as engage in discussion around post-COVID school and student needs and how teacher preparation programs can adapt to meet these needs.

**Paramita DasGupta**

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## **Epistemological Interdisciplinarity in Legal Education: The Default Pedagogical Methodology for the New Global Reset? An Investigation**

That education is a core human right and a crucial force for attaining sustainable development and peace, has been emphatically underscored by all international instruments, institutions and communities. Every goal in the United Nations Sustainable Development Agenda requires education to empower people with the knowledge, skills and values to live in dignity, build their lives and contribute to their societies. Ambitions for education are essentially captured in Sustainable Development Goal 4 (SDG 4) of the 2030 Agenda, which, per the UNESCO's Leading SDG4 - Education 2030 Report, aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" by 2030. The roadmap to achieve the education goal, adopted in November 2015, provides guidance to governments and partners on how to turn commitments into action.

It thus follows that, a quality education is the foundation of sustainable development, and therefore of the Sustainable Development Goals, in that education as a policy intervention, acts as a force multiplier which enables self-reliance, boosts economic growth by enhancing skills, and directly enhances lives by opening up opportunities for pursuing better livelihoods [Vaughan (2007); Walker & Unterhalter (2007); Terzi (2008)]. And while individual governments do indeed shoulder the primary responsibility for ensuring the right to quality education - the 2030 Agenda, it bears emphasis is, as formally re-affirmed by The Incheon Declaration, 2015 - a universal and collective commitment. It therefore requires not just political will, but global and regional collaboration as well as the engagement of all governments, civil society, the private sector, the United Nations, and other multilateral agencies to tackle often deeply ingrained systemic challenges so as to be able to shift into a fresh paradigm that is inclusive, equitable and relevant to all learners, equipping them holistically for the journeys ahead.

That said, the actual process of education policy formation, and thereby, knowledge creation, is but "an analysis of the dynamics of value formation" [Vaughan & Walker (2012)], in that, it demands an



honest reflection of the interwoven aspirations, contexts, histories [Rizvi & Lingard (2009)], and the embedded values that build the normative bedrock upon which, sound policy choices may be envisioned and made, and it is against this backdrop that this Paper will seek to critically analyse the scope for epistemological and pedagogical interdisciplinarity as afforded by the National Education Policy (India) 2020, when read against a strife-torn, post-pandemic global context, with the aim of constructively demonstrating the now exponentially pertinent merits of adopting fundamentally pluralistic perspective when seeking to impart higher education, in particular vis-à-vis the 'integrated' model of legal education, – so as to be better able to create a generation of advocates, jurists, statespersons and future policymakers who, personally, intellectually and professionally, will help lay the foundations of a sincerely inclusive, mutually respectful and a genuinely equitable society, going forward.

**Francesca Di Virgilio**

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## **Innovative Work Behaviour and Empowering in Italian SMEs - University Eco-system**

Skills and technology interact and the relationship represents a key reason for the large observed differences in productivity and competitiveness, which in turn determine the processes of internationalization and stimulate innovation.

The recognition of the importance of efficient policies to move the private sector to the technological together with the awareness of the relevance of the need to effectively increase the level of regional human capital, represent fundamental steps to successfully perform in terms of technology-driven increases in living standards.

SMEs' inventive activity strongly depends on technological opportunity and appropriability which act as principal industry-level determinants of the SMEs' inventive activity. A different channel of knowledge transfer is the cooperation agreement with other SMEs and university through the implementation and support of innovation hub such as "Contamination Labs" (Clab), enhancement of entrepreneurial skills and the implementation of a collaboration model with the entrepreneurial environment. The present study aims to significantly contribute to the existing literature by comprehensively analysing a case study and to pave the way for further research in related areas

**Elizabeth Diaz**

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## **Literacy and Assisted Technology**

The process of learning to read in the Spanish language has always been considered straightforward due to its phonetic alphabet. Spanish is considered a transparent language, according to its linguistic classification. However, teaching and learning modalities continue to evolve significantly in the modern age. For example, a conventional "bottom to top" approach is known to introduce first small fragments such as letters and progresses to words. The opposite approach begins with word memorization to understand the smaller fragments as a secondary effect.

This article introduces the transformative power of technology as a tool that enhances the teaching and learning of any Spanish literacy method. Particularly the way in which assistive technology can be used to offer more accessible and engaging tools for teaching children to read in Spanish.

Using a novel two-step approach to support teaching children how to read in Spanish, an interactive, clickable image can initiate the symbol-sound correspondence by increasing phonemic awareness through analysis of the sounds that the object represents.

Learners can click on the image to hear the corresponding sound of the word and interact with individual syllables to hear each one. They can assemble these written syllables into a complete word, receiving instant feedback from the system.

In this first step, students are able to listen to the entire word before dragging the corresponding syllables to form a word. It has always been said "Everything is about sound".

A second supporting step using artificial intelligence (AI) is employed to further facilitate learning. The AI model presents a text to the learner, who reads it aloud. Through speech-to-text (STT) technology, the model can verify whether the learner is reading correctly. Following this, the model administers a series of questions to assess the learner's comprehension of the text.

This groundbreaking approach not only leverages technology to enhance the reading experience for learners, but also offers a more efficient and engaging way to teach and assess reading skills in the Spanish language. It represents a significant advancement in the field of Spanish literacy education. These types of tools can target elementary school children by enhancing their experience with the support of a

reading teacher. This powerful tool will be able to help learners become proficient readers using school-provided devices that present these simple steps and make it easier to break the code, thus assisting children with the goal to become skillful readers!

**Hans Dulimarta**

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&

**William Dickinson**

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## **Composite Command Pattern in Spherical Geometry**

Spherical Easel (<https://easelgeo.app>) is a free web application for researching, teaching, and learning spherical geometry written in Typescript. Spherical geometry is the geometry of the Earth and is a fundamentally important in modeling real-world phenomenon including climate, navigation, and communication. To aid users learning about spherical geometry, Spherical Easel is equipped with an abundant suite of tools that enable users to create, manipulate, transform, and measure spherical objects. Users can create constructions that consist of spherical points, segments, lines, circles, parametric curves, and conics. These constructions can be transformed using spherical reflections, rotations, translations, and inversions and almost always contain with one or more dependencies. This means that while being manipulated, updates to a single object in a construction must propagate to many other objects that depend on it. For example, if a vertex of an equilateral triangle construction is moved, all parts of the triangle are updated to maintain the triangle's equilateral nature. The application stores the dependency structure using a directed acyclic graph of objects to allow these updates to propagate correctly. The entire application is contained in an open-source code base in VueJS v3 that combines several design patterns, global data structures, and cloud-based storage for storing and retrieving spherical objects under user's individual accounts.

In this paper, we describe how Spherical Easel employs the Command design pattern used in conjunction with the Composite design pattern for the app to maintain a history of construction edits, allowing its users to undo and redo edits, before finally storing the final constructions as a script to a cloud database. We also describe how the two design patterns are fully integrated with various VueJS supporting libraries. To guarantee correct rendering of the spherical objects when a construction is loaded, the stored script is also designed to preserve the structure of the directed acyclic graph. The construction script parser built into Spherical Easel is also designed to take advantage of the (Composite) Command design pattern. Using this innovative design, adding new object types does not require a major redesign of the script

parser. All these command patterns allow users to easily explore spherical geometry while allowing the application to seamlessly expand to accommodate new features.

**Opher Etzion**

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**Event Processing within the Human Body**

The event processing discipline provides the ability to analyze event patterns in real-time and make timely reactions, in reactive or proactive mode. Current developments both around sensors and actuators that can be planted within the human body, along with the advancements in the areas of big data analysis, and autonomous intelligent systems serves as a major revolution the approach to healthcare. They provide the opportunity to react to events that are detected within the human body, and provide either warnings to a human, or even autonomic reactions. These abilities has a potential to create a major revolution in life as we know it by providing the gate to singularity that brings with it eternal (or at least very long) life.. The talk concentrates upon the description of the current development that enable event processing within the human body, the notion of body area networks in general, and applications of this area to medical and non-medical applications. Among the surveyed areas: Training monitoring, Patient's monitoring in ICUs, Stress control, Sleep Disorders, Artificial pancreas, Implants for cardiovascular diseases, Cancer treatment, Bypass damaged senses and more. Some predictions about future trends in this area, especially the vision of singularity is discussed, and some philosophical observations about the implications are also discussed in detail.

**Thomas Fehlmann**

Senior Researcher, Euro Project Office AG, Switzerland

## **Measuring Knowledge - An Attempt to Define a Measurement Principle**

How should ChatGPT be measured? From the user's perspective, it is an elementary input process and a more or less well calculated output - however, we are not even sure whether an elementary data function is maintained. We know that ChatGPT has been pretrained and benefits from a large collection of data, but this is not the essence of AI.

A more sensible approach is to examine the data sets that ChatGPT moves. We don't know much about its actual implementation, but we recognize pieces of knowledge - about things, events, physics, or politics - that users can align with some specific data sources.

These pieces of knowledge have some reliability. It may depend on the sources or the sensor equipment that provides it, but it is measurable and sometimes even known in advance from the sensor specifications. When testing AI-based systems (intelligent systems), this is a promising attempt to predict its overall reliability.

However, there are other reasons to measure software besides testing. Do reliability metrics help us in this regard? Can we compare different implementations of AI by looking at their predicted reliability? It would be nice but there are a lot of open questions. This paper outlines them.



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## **The Diary of Sky: A Methodology for Teaching Astronomy Aimed at Teachers**

Observing the sky with the naked eye is usually an activity that is not encouraged in primary and secondary educational institutions in Colombia. This may be attributed to an inability to interpretate celestial observation or a lack of methodology as to how it should be done. Hence, it is often an activity discredited by teachers or the school they work when teaching astronomy. Due to this situation, this work seeks to educate the teacher from a new perspective to understand how to observe of the sky and from there create methodologies in teaching astronomy that challenge the scientific thinking of children and inspire young people to question and understand the underpinnings of this science.

To do this, a proposal developed by the Educational Cooperation Movement - MCE based in Italy was taken as a reference, which was later replicated in Brazil within the framework of education research. Four main stages were contemplated in this project, starting with the adaptation of The Diary of Sky (an instrument that is the result of MCE research) to the geographical, astronomical, and language conditions for Colombia. In the second stage, implementation tests of the instrument were carried out in a virtual classroom with members of the Physics Teaching and Learning Group - GEAF to identify situations that could arise in the methodological process of each in meeting the requirements of the target group.

In the third stage, the activities of the instrument were developed, covering nine sessions of 'The Diary of Sky', divided into twenty-three meetings, each lasting four hours. Sessions were implemented in Educational Institutions, Public Libraries, and the Planetarium of Bogotá, where forty professionals participated from different fields of knowledge (including natural sciences, human sciences, early childhood education, and technology) who guided the teaching processes in initial, preschool, primary and secondary education in

schools. Schools ranged from official, concession and private and throughout different sectors of the city of Bogotá. Although most of the participants were professionals in the areas of education, some technologists and engineers who participated were working as teachers in educational institutions.

In the fourth and final stage, the transcription, analysis of the information and the conclusion of the research were carried out, where it was highlighted that observing the sky with a simple view is an infinite resource of data and experience that allowed us to know the concerns, ideas and knowledge of teachers. Through dialogue and from the location of the cardinal points, the use of two-dimensional graphics, the origin and use of different time scales, the manufacture of instruments in the classroom, observation techniques and recording of celestial bodies, among other emerging contents in the development of activities, the tests offered a multitude of teaching and learning possibilities. Thus, it seemed to show that the constitution of more solid, broad and truthful discourses is possible, ratifying the need to create scenarios aimed at teachers where the learning of astronomy and methodologies for its teaching in primary and secondary education is promoted through the observation of the sky with the naked eye.

**Smita Guha**

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## **Nutrition Education for the Underprivileged Mothers and Children in India: An Ethnic Study**

**Objective:** The objective of this project was to educate underprivileged mothers on nutrition through an educational video made in Bengali language.

**Design:** The research was qualitative. Data was collected through pre and posttest survey questionnaire, observation and interview. The video was intervention.

**Setting:** Kolkata, India.

**Participants:** There were 30 mothers from accessible population, slum in Kolkata, India. The mothers were divided into two groups of 15. Return rate of survey was 100%.

**Intervention(s):** The essential feature of the intervention was informative musical video about essential diet especially during pregnancy. The video was about 6 minutes long and video was shared with mothers.

**Main Outcome:** Mothers paid attention while the video was played. Video was repeated and was paused for discussion. The posttest answers were much richer than pre-test answers. The mothers retained information from the video.

**Analysis:** The qualitative analyzed using thematic approach.

**Results:** Two themes emerged: Mothers gained knowledge about nutritional needs of themselves and their children. Maternal autonomy about diet increased.

**Conclusions and Implications:** Since poor nutritional outcomes of Indian children are steadily increasing, this project addressed maternal autonomy and health and nutrition education. The mothers received greater access to resources and knowledge of healthy diets during pregnancy.

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&

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## **Virtual Labs for Contemporary Teaching of IT-Security**

Developments in teaching like eLearning, distance learning, remote teaching etc. increased the need for virtual laboratories to allow access even without being present at the university. While being interesting and successful long before Corona hit, the pandemic pushed the relevance and acceptance of virtual labs. For a long time, virtual labs were mainly used in the life sciences or engineering disciplines where labs tend to require costly equipment and special setups. In computer science, cloud-based containers can be used to standardize programming environments. Especially in teaching IT-security, containerized labs are a valuable tool to allow students to practice with malware or exploits in a virtual setting that would be too dangerous to run in the wild.

There is wide experience of using virtual machines for simulating real world infrastructure, for example and this is still the typical way to implement such labs. While Infrastructure as a Service (IaaS) cloud services could move this approach to the cloud but is not without problems regarding running malware on public spaces. So typically, on premise solutions are used for this purpose.

A lightweight alternative to virtual machines are containers which deploy only a specific service or application. A very popular tool for containerization is Docker which is available on all common operating systems such as Linux, MacOS and Windows. Docker provides ready-to-use container images for a large variety of applications via the Docker Hub. One advantage of using Docker is that students can run Docker setups on their notebooks and hence are independent from the computing service of the university.

If containerization needs to be run on a larger scale, Kubernetes is a frequently used orchestration tool. Kubernetes is a “chameleon” somehow, because it can be used in many environments, for instance as a standalone application such as Minikube, in a self-hosted on-premise cluster or in a public cloud such as Amazon Web Services (AWS), Microsoft Azure or Google Kubernetes Engine (GKE).

With the emergence of Micro-credentials, the requirements continue to increase. This trend indicates a shift to more specialized,

flexible and personalized learning opportunities that allow individuals to acquire specific skills. Using VMs for that would require expensive resources and might lead to scalability problems.

This paper describes several ways to use containers to support personalized configurations of security labs especially for asynchronous learning experiences. The following use cases are presented in more detail. Firstly, it is explained how to deploy a standardized environment for programming exercises in applied cryptography by using an appropriate Docker container. Secondly, a simple setup is described to teach common web application vulnerabilities using a container provided on the Docker Hub. Thirdly, the architecture of a Kubernetes cluster is presented. The cluster runs on an on premise hardware and can be used for “Capture The Flag” contests, to showcase for cloud-native web application deployment, or to teach topics on Kubernetes itself. Fourthly, the setup for a virtual lab on implementation issues of distributed systems is presented. This lab is offered as a Micro-credential. The paper closes with a summarization of lessons learned, especially the advantages and disadvantages of using containerization in teaching topics on IT-security.

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**Enhancing Remote Work Competencies in Croatia:  
Findings from VirtualEdu Project**

The Erasmus+ project “VirtualEdu - Upskilling and certification scheme for virtual educators, managers, workers” aims to create a certification scheme that improves the skills of remote workers (educators, managers, and support staff) and certifies them. The overall goal is to support the European Union's digital transformation efforts and improve readiness to withstand the disruptive effects of pandemics and unforeseen events that impact education, collaboration, and professional work in general. In addition to creating a certification system, the main goals of the project are to develop innovative training methods and materials, establish a digital library of training materials, and organize a Massive Open Online Course (MOOC) to develop the skills of remote workers.

This paper presents the results of a study that aimed to identify a skills gap among remote workers in Croatia to inform the design of the training curriculum and materials for the VirtualEdu MOOC. To identify the skills gap, the questionnaire was developed based on a literature review and two European frameworks: DigComp (Digital Competence Framework for Citizens) and DigCompEdu (Digital Competence Framework for Educators). In the questionnaire, respondents assessed the relevance of a set of competencies and skills to remote work and to training designed to develop those competencies and skills. The competencies were grouped into five categories: digital competencies, self-management and organization, collaboration competencies, interpersonal, intercultural and communication skills, and specific skills of remote educators (other than those already mentioned). The questionnaire also aimed to determine users' perceptions of the usefulness of training for the development of these competencies. To identify the most stringent needs, a skills gap analysis was conducted using the competency matrix developed as part of the VirtualEdu project.

The results of the analysis showed that respondents (N=86) perceived the greatest need for the development of digital competencies, self-management and organizational skills, specific skills for educators, and collaboration skills. An important finding of the research was that all of the topics originally proposed for the training curriculum were confirmed as necessary by the questionnaire results. The use of a competency matrix allowed the identification of several competencies related to time management, autonomy in task completion, and social isolation that need to be included in the training curriculum.

The interest and perceived usefulness of the training for the development of remote work competencies by Croatian remote educators, managers, and workers indicate the need for the development of lifelong learning opportunities such as the VirtualEdu training.

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## **Machine Lending and Discrimination: Evidence from Peer-to-peer FinTech Lending**

We hypothesize that statistical racial discrimination can exist in machine lending even when racial information is not directly observable. Using a large sample of loan listings from a sizeable peer-to-peer (P2P) lender in the U.S., we find strong evidence that loan listings in counties with a greater proportion of minority population are associated with higher lending rates and loan denial rates. In cross-sectional tests, we document that statistical racial discrimination is less pronounced with the availability of more traditional and non-traditional information on credit quality. Employing path analysis, we find that county-level racial information is implicitly transmitted through the P2P platform's internal rating process.



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## **CyberWuP - A Low-Threshold Cyber-Security Awareness Program for Small and Medium Enterprises**

With the ongoing digital transformation, small and medium Enterprises (SMEs) are exposed to a higher risk of cyber-attacks. The implementation of cyber-security recommendations is a challenging task for SMEs. Especially, small enterprises struggle in this context because of the lack of personnel and financial resources and the absent expertise. In 2022, the Ministry of the Interior of the State of Baden-Württemberg, Germany, funded in cooperation with the Aalen university the research project CyberWuP (Cybersecurity, Economic protection, and prevention for SMEs). The project's main goal is to develop an awareness program for cybersecurity which covers the needs of SMEs, especially the small ones, and is applicable breadthwise in the region of East Württemberg. The paper emphasis on the results and findings which have been achieved by the project. The paper is organized as follows. The first section shows the approach behind the awareness concept together with the goals to be achieved. The second section focusses on empirical studies with SMEs in East Württemberg to determine their knowledge and requirements concerning cybersecurity issues like cybercrime, insufficient equipment, and prevention. Several surveys have been rolled out. The empirical research provides important insights to design an awareness program which fits the needs of smaller enterprises. In particular, specific activities for a more sophisticated cybersecurity level, the time frame for potential consulting meetings (an hour) and the level of knowledge (low) have been derived from survey's data. The studies can confirm the particular importance of a consulting concept, since the most important influencing factor on the perceived threat of cyberattacks depends especially on the prevention measures used. The results clearly indicate that there is a lack of awareness of cybersecurity in small businesses, even among management. In addition, existing

information is not used, which is why the sustainable applicability of a consulting concept and low-threshold access to it are particularly important. The results of the survey, in combination with a systematic literature review, formed the basis for a consulting concept. Section 3 describes the development of the awareness consulting process and the respective information materials. With the involvement of experts and cooperation partners, a process model was created with the four stages "Informal Awareness Raising, Initial Impulse, Initial Consultation, and Integration of a Service Provider. Stage 3 is a central activity of the concept. It represents a low-threshold approach to improving management awareness with respect to cyber-security. The approach includes eight essential cyber-security recommendations which are mandatory to establish a minimal level of security within the enterprise. Supporting media are used, such as checklists, information cards, and IT-tools. Section 4 summarizes the results of a pretest of the awareness concept in the field. The pretest is divided into two phases. The sample size is approx.  $n = 50$  and above the standards for pretests. Finally, in section 5 a conclusion is given with limitations of the concept and a further outlook of the research project.

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## **Internet Service in the Maritime Domain**

The advent of Internet connectivity at sea is poised to revolutionize the way ships and yachts communicate, manage operations, and provide services to passengers. Shipping companies will have the capability to monitor fleet conditions and control operations, passengers will enjoy continuous Internet access during sea travel, and yachts will establish a permanent connection with the Coast Guard to enhance safety. Moreover, the Internet economy, previously limited over the sea, is expected to generate new services and business opportunities.

However, there are challenges associated with maritime connectivity, including the high cost of satellite services and the necessity to manage bandwidth in a shared environment. With ongoing technological advancements, maritime connectivity is anticipated to rapidly become more accessible and reliable, offering further advantages to the maritime industry and travelers.

This paper addresses three aspects related to the introduction of Internet connectivity over the sea: latency, rate, and the provisioning model. Latency is a crucial factor, proportional to the physical distance that data must travel. In satellite-based communication, satellite altitude significantly affects user experience compared to distances encountered directly on the planet. Geostationary satellites, positioned at approximately 36,000 km, result in a latency of 240 msec ( $2 * 36,000 \text{ km} / (300,000 \text{ km/s}) = 240 \text{ msec}$ , considering ground-to-satellite and satellite-to-ground communication. This latency affects the rate and, consequently, the perceived quality of service, due to the operational mode of Internet protocols, particularly TCP, associated to end-to-end connections protected by error control, three-way handshaking and slow-start policy.

In addition to latency, user experience is influenced by the rate supported by providers. Although the nominal rate typically supported

is of the order of tens of Kbps, up to several hundred with higher pricing, the effect of TCP reduces this nominal value and weakens connections, thereby reducing availability. This has hindered the widespread adoption of the Internet at sea, considering that the average size of a web page is around 300K Bytes (i.e., 2.4 Mbps), resulting in a download time of approximately 40 seconds at 60 Kbps. This is deemed unacceptable, as users expect an experience comparable to that of traditional and modern terrestrial communication systems.

Regarding the provisioning model, today we are accustomed to Internet service providers offering user access through an IP address. Services or applications operate over the IP layer, which is agnostic and solely responsible for transferring packets from one point to another. In contrast, satellite communication providers tend to offer pricing schemes based on the specific application services used, such as email, web, streaming, etc. This approach resembles the old provisioning paradigm of telephone companies and conflicts with the Internet provisioning paradigm.

The Starlink initiative provides a solution to these issues, exhibiting low latency thanks to low orbit, high rate, and an Internet provisioning model. The paper presents a comparative analysis of Iridium, Inmarsat, Thuraya, and Starlink from the three aforementioned perspectives (latency, rate, and provisioning model), as well as from the price perspective. Additionally, it covers a range of possible applications of Internet technology in the maritime domain.

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&

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## **Computer Simulations of the Effective Properties of Dispersed Composites**

The study of structurally disordered dispersed patterns and the hidden relationships between the geometric random characteristics of composites and their physical properties is a common focus in various branches of mechanics, mathematics, and physics. Our objective is to address the challenge of providing a constructive quantitative description of the chaos/regularity, e.g., dislocations, exhibited by composites. The mathematical results are based on the generalized alternating method of Schwarz and the Riemann-Hilbert problem for a multiply connected domain.

The current state of the art of the theory of composites is outlined. We discuss the notions of *model* and *empirical method* used in the framework of material sciences, highlighting the discrepancies when various engineering approaches overlook asymptotic precision and conditionally convergent series.

We propose the computationally effective method of structural sums coinciding with the lattice sums for regular composites. In particular, the results yield new high-order analytical exact and asymptotic justified formulas for the effective conductivity and elasticity tensors of dispersed composites with isotropic phases. We specifically investigate the macroscopic properties of dispersed regular and random composites with a qualitative analysis of the degree of randomness, anisotropy, and clustering.

**Busisiwe Ndawonde**

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**Effects of the Teaching Philosophies in Life Sciences**

Teachers claim, for varied reasons, to be either constructivists, behaviourists or cognitivists in orientation. Given these claims, this conceptual paper examines whether or not these three schools of thought adequately champion the modern-day teaching and learning of Life Sciences. This is done against a spectra of agreement vice versa disagreements regarding their individual or collective relevance, appropriateness and currency as a basis for authentic teaching and learning experiences. The situations attached to the context of the theories were associated with the reflections on the teaching philosophies prior, during post COVID-19 pandemic. This is a systematic review based on the philosophies of science teachers were affected in teaching and learning practices during the period. . Based on curriculum development, teaching and learning and assessment practices, it emerged from the literature that behaviourism, cognitivism and social constructionism are complementary in nature in as far as the instructional environment is concerned.

It is therefore recommended that with recent developments in teaching praxis due to lesson learnt from COVID-19, science teachers need to revisit their philosophies to accommodate how learners learn.

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&

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## **Agile Teaching in Applied Science Universities: Integrating an Evidence-based Approach**

Hospitality is a fast-paced industry and one that requires flexibility and problem-solving skills. For students that prepare to become professionals in the industry it is important to be able to develop skills that will allow them to solve problems in business (Assen et al., 2023). In applied-science universities, it is therefore, important to ensure that students are equipped with the necessary skills to solve problems based on best available evidence and not just on own expertise. While working in a course that aims to achieve these learning goals, we also acknowledging teaching as an iterative process. Therefore, we stress the significance of continual refinement of teaching approaches based on student feedback, learning outcomes, and evolving educational methodologies in the classroom and material (Wright et al. 2016). This abstract offers insights into how evidence-based management principles enable lecturers to embrace adaptive teaching practices within challenge-based learning environments. Through this integration, student learning experiences are enhanced, better preparing them for success in their chosen fields within the applied sciences.

Central to our approach is the recognition of students' diverse needs and learning styles. Lecturers are encouraged to tailor teaching methods to accommodate these differences, creating inclusive learning environments for student engagement and success. Creating feedback mechanisms is crucial in this process. In the course of ten weeks students provide feedback formally twice and also encouraged to share after sessions their insights on learning experiences. However, we emphasize the necessity of aligning learning activities with course structures and objectives. Lecturers are urged to critically assess how approaches integrate with the overall course framework, ensuring consistency and relevance to optimize student learning outcomes. By integrating evidence-based management principles, lecturers are empowered to navigate the complexities of challenge-based learning effectively.

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**Academic Achievement in Language and Mathematics in  
Primary and Secondary Education in Mexico:  
A Comparative Analysis Before and After the COVID-19  
Pandemic**

Knowing the progress of learning is a crucial issue in any educational project. It is essential in primary and secondary education, which is the path during which children and young people acquire the knowledge, skills, and attitudes that enable them to better opportunities in the workplace. No program can improve if its results are not known. The health emergency caused by the Covid-19 pandemic in 2020 and 2021 mainly affected the educational system in Mexico and has caused a lack of knowledge about the actual level of learning of children. Children have continued their education at home, without the teacher's physical presence and in charge of adults who are not pedagogically prepared to teach academic content.

Despite all the efforts made by the different educational actors to resolve the emergency, children and young people have faced many difficulties in continuing their distance education. The fact that there is no adequate space for work, that there is no computer or tablet available, or that the number of these at home is insufficient for everyone's work, the frequent failures of the internet connection, etc., coupled with the economic difficulties exacerbated by the loss of jobs. Those are sufficient reasons to doubt that the learning established in the study programs can be achieved.

For the reasons stated, the purpose of this research was to identify levels of academic achievement in Language and Mathematics reached by students of primary and secondary education.

The methodology proposed for the study is quantitative, non-experimental, cross-sectional, and with a correlational/exploratory scope. In this sense, standardized tests prepared by the National Institute of Educational Evaluation were applied, which ceased to operate in 2019.



The project also sought to apply a socio-emotional skills test in the same grades and from the third year of primary school.

A total of  $n=515,652$  tests were applied, of which 431,568 were valid cases. This sample was obtained from different strategic alliances with seven state ministries of education. In addition to the analysis of student performance, a regression tree study was carried out to assess the influence of context questionnaire variables. When analyzing the results from the crossing with different context variables, we found that the variable that has the most significant effect on the results is the perception of student dropout in the different tests and educational levels.

Variables with significant weight in obtaining the score were to have or not a computer, parents' educational level, and the socioeconomic environment of the students. The results suggest that these differences were beyond the instructional differences that the students may have had during this contingency period. The use or non-use of the television program Learn at Home did not significantly affect the reported scores.

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**Early Exposure/Long Term Gains:  
Encouraging High School Students to Pursue STEM  
Degrees and Careers**

Statistics for the underrepresentation of workers in the STEM field are alarming in the African American community. The United States Census Bureau indicates that African Americans represent 12.4 percent of the U.S. population (Nicholas, et al., 2021). However, only 37% of African Americans, 18-to-24 years of age, are enrolled in college (The Condition of Education, 2020). What is even more alarming is that only 45.9% of African American students complete their degrees within six years (United Negro College Fund, 2018). Finally, according to the Pew Research Center Report, African American students earned only 7 percent of STEM bachelor's degrees (PEW, 2021). African American adults are also underrepresented among those earning advanced degrees in STEM. These rates are extremely low compared to other races and ethnicities.

Tennessee State University, a Historically Black College/University located in Nashville, Tennessee, houses the Tennessee MUREP Aerospace Academy. The MUREP project addresses the problem of increasing the number of underrepresented African-American students interested in STEM. This study examines high school students' attitudes and interests in STEM post-secondary subjects and careers. The goals of the MUREP project are to: 1) Inspire underserved and underrepresented high school students to pursue their interest in STEM post-secondary degrees and careers, 2) Engage underserved and underrepresented students in STEM experiential learning experiences utilizing technology to develop their STEM identity, skills, and knowledge, 3) Educate students by utilizing culturally relevant STEM curricula and effective evidence-based strategies, and 4) Increase high

school students' and their families' knowledge and awareness of STEM internships, degrees, careers, and professional skills. Key strategies to reach the proposed goals include multi-faceted initiatives, such as Experiential Learning Experiences, Aerospace Education Laboratory (AEL), Engagement with STEM professionals, College and Career Readiness, Family Empowerment Sessions, and STEM Professional Development.

The study employed a quantitative survey research design. This study investigated five research questions, which include: 1) How many underserved or underrepresented students does MUREP expose to NASA specific STEM careers each year?; 2) How many hours of culturally relevant STEM curricula and experiential learning sessions utilizing technology does the MUREP program provide?; 3) How does participation in the MUREP program impact students expressed interest in STEM degrees and careers?; 4) How does participation in the MUREP program enhance students' STEM identity, STEM skills, and STEM knowledge after participating in the TSU MUREP program?; and 5) How does participation in the MUREP program increase parents'/guardians knowledge and awareness of STEM degrees, internships, career awareness, and college preparation?

The project utilizes a logic model that presents all the inputs, activities, outputs, and outcomes of the programs and graphically presents how they all impact and ultimately influence the accomplishment of the set goals and objectives. The data were collected using the Middle and High School (6-12th) survey. The target population are minority high school students in grades 9th-12th. The preliminary results of the study indicate that students expressed a positive attitude and interest in the STEM subjects and pursuing post-secondary STEM careers.

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## **Transforming CS Curricula into EU-standardized Micro-Credentials - The Hard Parts**

Since the working environment continues to develop, mobility and flexibility are becoming increasingly important for both companies and employees. Therefore, universities need to transform their study programs into smaller units, so called-micro-credentials, which offer flexible and individual learning pathways. To permit EU-wide exchange, micro-credentials have to be recognized and quality-assured and the certificates have to provide a transparent and universal skill set. The process for converting modules into micro-credentials still contains some open issues: Micro-credentials typically have a size between 1 and 3 ECTS which means that bigger modules must be broken down into smaller parts. The division of units leads to the problem of assigning especially transversal skills and how to assess, verify and certify them. Additionally, it is not yet clear how micro-credentials are to be classified in the European Qualification Framework (EQF) as modules are accredited in study programs within a certain EQF level. Since micro-credentials can be taken stand-alone this is not always possible. The mapping of skills from the educational sector to ESCO skills which refer to the European labor market is not trivial due to the different domains they're coming from. Therefore, the process to identify and request new ESCO skills needs to be documented.

This paper discusses these problems in detail, gives an overview of the state of the art for solving some of them and provides ideas for solving the other ones. Therefore the concept of partial skills is introduced.

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## **Batch Transformer Architecture: Case of Synthetic Image Generation for Makeup and Occlusion Face Recognition**

A novel Transformer variation architecture is proposed in the implicit sparse style. Unlike 'traditional' Transformers, instead of attention to sequential or batch entities in their entirety of whole dimensionality, in the proposed Batch Transformers, attention to the 'important' dimensions (primary components) is implemented. In such a way, the 'important' dimensions or feature selection allows for a significant reduction of the bottleneck size in the encoder-decoder ANN architectures.

The proposed architecture is tested on the synthetic image generation for the face recognition task in the case of the makeup and occlusion data set, allowing for increased variability of the limited original data set.

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## **Senses-based Learning in Tertiary Education**

Sensory skills are essential to many fields of practice. From Medicine to Museum studies, from Physical Computing to Chemistry, from Botany to Archaeology (to name just a few) most researchers and professionals are being trained to become, before all, expert observers. It is this capacity to detect symptoms, to evaluate the impact of light and smell on museum visitors or to distinguish between two textures of similarly shaped leaves that is essential to their training. The education of these experts involves attuning and developing their skills of observation. Core to this is a sharpening of their senses. In tertiary education, at best, these skills are taken for granted and not specifically catered for or evaluated in physical classes. It is the assumption that students will 'pick it up' as they go to class, attend labs or workshops, make site visits or do internships. At worst, students learn in their studies to distrust their senses and follow protocol and so-called hard skilled science. In the case of digital learning, these skills are further side-lined and, when present at all, focus on vision, and occasionally listening, rather than multiple (and connected) senses.

Senses-based Learning is a pedagogical methodology for tertiary education focusing on exploring and developing sensory awareness and skills as well as critically reflecting on their importance in education, research and professional practice. After almost three years working on the 'Senses-based Learning' Comenius Leadership project, the team is ready to share our results. We started the project (financed by NRO/NWO - i.e., the Dutch government) aiming to re-balance and reassert the importance of sensory skills in tertiary education and in professional practice. We experimented with interventions in the existing curriculum across Faculties at Maastricht university and beyond. The interventions took the shape of specifically designed learning units (courses, electives or part of courses), learning resources (physical or digital presented in the Sensory Learning Lab - [sensesbasedlearning.org](https://sensesbasedlearning.org)), activities, specifically designed internships, etc.

In this intervention we will first introduce senses-based learning and the theories behind this project, share what we found in our classroom experiments, expert interviews and literature research. We will share key senses-based learning design principles and typology of

exercises to help university teacher reintegrate the senses in their own teaching.

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### **Book Bans and Culture Wars in America: Upheavals in Schooling and Society**

Education and the reliance on literature for learning has seen renewed controversy that reflects the divergent attitudes and conflict of social mores of a divided American populace. School boards with control over curricula and content have run roughshod in deselecting curricula, textbooks and literature to be used in teaching. Banning books defies the First Amendment of the U.S. Constitutional guarantee of freedom of speech and expression as it applies to education and literature. In American classrooms, competing interests and viewpoints have been applied to justify restrictions on allegedly “discordant opinions” being cancelled: shouting fire in a public theater. Equated with studying Shakespeare to Salinger, authors such as Toni Morrison and Maya Angelou.

A cursory review of the media storm over censored books during the past century and the current torrent of eliminating books from the shelves of school libraries in America reveal a current culture war that seems to grow fiercer.

What are the societal change ramifications and who is affected by this new surge of canceling authors and freedom to read about diverse cultures and lifestyles or the history of racial oppression in America? New court battles have emerged to address and remedy violations of First Amendment rights. Obscenity has returned as a reason to burn books but with new definitions of what is offensive calculated to oppress and further minoritize certain individuals of color and LGBTQ communities. “Fahrenheit 451” is alive and well; local governments are attempting to restrict access to ideas and knowledge by denying freedom of expression and trying to spread sociocultural hatred of the culturally different.



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## **Development of Critical Thinking through the Creation of Mathematical Problems**

Through creative thinking, it is possible to acquire new attitudes and a view of the world, not only of mathematics but from several sides (Kamp, 2016). Creativity in mathematics can be defined as a process based on sensitivity to problems, deficiencies, gaps in knowledge and sensitivity to identifying missing elements, revealing difficulties in finding solutions, making estimates, formulating hypotheses, and verifying them and then forming a conclusion (Mann, 2006). The concept of critical thinking is closely related to creativity. Its essence, not only in mathematics, lies in the way of formulating and asking questions. Broader assigned tasks or complex problems lead students to new data and knowledge, which naturally creates the ability to think critically. The paper focuses on problem posing and the development of critical thinking through the creation of tasks based on Bloom's taxonomy and criterial testing requirements.

Part of the paper will also be a description of the process of creating test tasks, i.e., creating tasks, compiling a test based on various criteria, evaluating the test, diagnosing students based on the results and proposing further work with students.

Criterion testing in Slovakia is only in the beginning. Nationwide testing in 3 cycles of mathematics (after the 3rd, 5th and 8th grade of elementary school) is planned from 2026. Until then, the creators' task will be to create enough tasks for creating tests suitable for pilot testing. These will provide the test makers with feedback on the tasks as well as the entire test.

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## **Contestations of Remote Teaching and Learning of English Language during COVID-19 Pandemic: A Case of a South African University**

The coronavirus (COVID-19) which started in Wuhan, China November 2019 was declared a global pandemic and necessitated measures to curb its spread. This resulted to all countries adopting World Health Organization Protocols. One of the measures in South Africa was the closure of all schools and tertiary institutions and only remote or online teaching and learning was permitted. The aim of this study was to explore from the perspective of lecturers and students at the University of Fort Hare, Alice Campus the Contestations of Remote Teaching and Learning of English Language during COVID-19 Pandemic. Using an exploratory case study design and qualitative research approach as well as interpretivist paradigm, a sample of 34 English Language participants, made up of 26 students and eight (8) lecturers from the faculties of Education and Social Sciences and Humanities. Data was collected through in-depth interviews and focus group discussions. The Connectivism Theory of Learning by George Siemens (2005) and the Technology Acceptance Model (TAM) by Davis (1989) underpinned this study. Data analysed manually in themes and subthemes. The major findings include the fact that teaching and learning as was perceived as an unimaginable task during the COVID-19 pandemic. The participants revealed that assessment during the COVID-19 pandemic was a nightmare for both students and lecturers. COVID-19 brought with it some positive experiences such as convenience, flexibility and enables both students and lecturers to better manage their time. However, the findings show that there were enormous changes including anxiety, depression, loneliness and frustrated lonely journey. Nonetheless, the participants report that there were support structures to adapt to and overcome challenges to teaching and learning English language during the COVID-19 pandemic. Therefore, COVID-19 created fear and uncertainty in the minds of the participants, especially at the initial stages of the pandemic and introduction of remote

teaching and learning. This was later overcome, and many participants tended to like and prefer remote teaching and learning because of its advantages such as convenience and flexibility and the fact that students easily pass online tests and examinations. Recommendations have been made to Department of Higher Education and Training, University authorities, lecturers, and students.

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## **Building Teacher Confidence and Capacity for Incorporating Computer Science and Computational Thinking into Practice**

Computational thinking is a critical skill that has gained increasing importance in education across the United States. It is essential in the education system as it prepares students for the future, fosters critical thinking and problem-solving skills, supports STEM education, and contributes to economic development and global competitiveness. Integrating computational thinking into the curriculum helps ensure that students are well-equipped to navigate the challenges of the digital age.

With that in mind, a college hosted a learning conference to support inservice and preservice teachers in learning computational thinking and computer science. It facilitated the collaboration with departments of computer science, education, the local school system, and the community college in the planning and implementation phases. With keynote speakers and content learning sessions, the conference aimed to build computer science knowledge and skills by incorporating computer science standards. The conference allowed the participants to apply and receive a mini-grant to support classroom implementation plans. The struggle for teacher educators, committed to infusing the principles of computational thinking across the preK-12 curriculum, has been to build the confidence and capacity of education faculty and reach all our new teachers in ways that scaffold their learning. The conference idea was planned with this in mind.

The presenters will give the session participants an overview of the conference they planned and hosted, the specifics around the content and format of the keynote speakers and workshops, and the assessment data from the sessions and the overall conference gathered from the external evaluator. The presenters want the participants to discuss and provide reflections, feedback, and advice about what they envisioned, what was actually done, and what was reflected in the evaluation data. The session will provide prompts around the lessons learned, challenges experienced, participation rates, participant motivation and buy-in, institutional supports and constraints, and leveraging

institutional and community collaborations. The participants' responses will guide future conference planning at the college and will frame narratives about the results of this teaching and learning format for scaffolding computational thinking in preK-12 preservice teacher preparation.

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## **Learning from Experience: Development of Culturally Responsive STEM Curriculum**

Research on summer camps has consistently highlighted the benefits of organized camping. However, it has become increasingly important for camps to document their outcomes for stakeholders and practitioners. The "*Learning from Experience: Development of Culturally Responsive STEM Curriculum*" evaluation report presents results and recommendations based on camper experience, specifically as it relates to building self-confidence, cultural connectedness, and heightened awareness in Science, Technology, Engineering, and Mathematics (STEM) fields. The evaluation project aimed to understand whether student participants experienced increased self-efficacy, a reinforcement of personal values, and a stronger connection to their Indigenous identity. Additionally, it sought to determine if these participants developed an interest in or increased knowledge of STEM. Another goal was to educate non-Native American students about the historical evolution of STEM within the context of First American culture. Data collection methods included a variety of assessments such as observations, interviews, satisfaction surveys, and Likert scales to evaluate camp practices. The results offer insights for camp teachers, administrators, coordinators, and counselors working with children in informal educational settings. The core inquiries guiding the evaluation were structured as follows:

1. To delineate optimal strategies for integrating culturally pertinent materials and pedagogical methodologies into both the realm of Oklahoma education practices and STEM programs/camps.
2. To discern evidence-based practices that facilitate the establishment of a culturally responsive STEM
3. learning milieu, and identifying the key determinants that contribute to its successful implementation.
4. To ascertain the attitudinal and learning implications stemming from Indigenous-centered STEM
5. education, differentiating its effects on Native American and non-Native American learners.

The underrepresentation of First Americans in the STEM workforce remains a persistent issue. Addressing this disparity necessitates the creation of a culturally responsive curriculum, one that empowers Native American youth to reclaim their heritage and acknowledge the substantial contributions made by Indigenous individuals to contemporary STEM practices. A holistic approach is imperative to reform all facets of the educational journey, extending from the early stages of preschool through to higher education. Within this expansive landscape, summer camps emerge as a critical element of the solution, providing fertile ground for fostering a genuine understanding of STEM disciplines through the lens of Indigenous culture.

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## **Understanding Variability: A Closer Look at the Career Assistance Requirements and Contentment of Employed and Unemployed University Students in Estonia**

This paper sought to evaluate the sufficiency of career guidance offerings available to employed and unemployed university attendees in Estonia, utilising a mixed-methods approach. The objective was to identify the differences in contentment and necessities of services among these two distinct categories of students. Data was amassed using the Eurostudent Survey VII, complemented by additional interview methodologies. The findings unveiled notable disparities in the levels of satisfaction, where employed working students articulated a desire for more adaptable and tailored guidance services that could effortlessly integrate with their scholastic, vocational, and familial commitments. Such students displayed diminished gratification with the prevailing assistance offerings, emphasising a potential requirement for services that are more versatile and pertinent. Conversely, unemployed students exhibited a preference for conventional career guidance offerings and demonstrated higher levels of satisfaction. Notwithstanding these disparities, there were universally acknowledged necessities, such as career advice and proficiency enhancement workshops, which were esteemed uniformly by all participants. This research accentuates the crucial necessity for academic institutions to refine and enhance their career guidance offerings, ensuring they are comprehensive, learner-focused, and adept at catering to the multifarious necessities of every student category, thereby acting as a pivotal resource for the augmentation and refinement of such services, as well as steering subsequent scholarly inquiries and policy enhancement in the domain of career guidance.



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## **An Iot-Based Smart Home System Prototype with Sensors Management**

The Internet of Things (IoT) is a network system that enables the connection and remote monitoring of devices through the Internet. Over recent years, the IoT concept has undergone significant development and is presently applied in diverse areas, including smart homes automation system. In our rapidly advancing world, the integration of a smart home can greatly enhance our quality of life by providing increased comfort, convenience, and safety. These smart homes leverage cutting-edge communication and information technologies, employing IoT sensors and devices to continuously monitor our well-being. Our ongoing research is dedicated to developing a responsive smart home system prototype that can promptly detect critical deviations from regular daily activities within a residence. Examples of such situations include scenarios where a refrigerator is inadvertently left open, a stove (oven or element) has been operating for an extended period, a garage entrance door is left ajar, or cooking in the kitchen is left unattended. Our work introduces the system prototype, detailing the implementation how to gather and analyze data from various wireless sensors. The proposed system encompasses the following computing architecture:

- Raspberry Pi with display acts as the central configuration unit and human-computer interaction part for the mobile context module, enabling automatic boot with a direct connection to the home network without requiring any additional authentications.
- Sensors tag manager is capable of managing multiple wireless sensors (up to 40 within a residence) connected to the home network, providing unlimited cloud storage for logged data.
- Wireless sensor designed to sense physical information, including temperature, ambient light, air humidity, angle-based motion data, etc., and transmit the collected data back to the sensor tag manager, covering a distance of up to 200 meters.
- Wireless tag web service offers unlimited access to sensor tag information stored in the cloud, encompassing all sensor data.

In the event of a notifications, the system is able to notify a user's emergency contacts through SMS services. Additionally, a voice

message (alert) can be delivered via the residence's speaker. On the user side, options include accepting a notification, snoozing it for specific time intervals, or clearing the alert. This multi-modal approach ensures flexibility and responsiveness in addressing critical situations.

In conclusion, proposed smart home system prototype tested with one specific Case Study "My home Guardian". The main purpose of this study is to monitor sensor data, utilizing this information in decision-making scenarios to bolster support for individuals within their residences.

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## **Collaborative, Interdisciplinary and Case Study Approaches in Undergraduate Research, Teaching and Learning**

This presentation will center on our initiatives to advance collaborative, interdisciplinary, and case study approaches in undergraduate research, teaching, and learning. We will provide examples illustrating the success of these approaches and address both the effectiveness of student learning and the challenges associated with implementing such methodologies, especially in large undergraduate classes.

The case study method, traditionally employed in professional schools of business, medicine, and law, has recently gained popularity in undergraduate colleges and universities. Departing from traditional teaching methods, students engage with real cases by reading literature or news articles and then bring questions for discussion to the class, with the instructor leading the discourse. This teaching method aims to enhance critical thinking and problem-solving skills. The relevance of real-life cases motivates students to learn, and the case study method often incorporates hands-on laboratory activities directly linked to lecture content, further enriching students' learning experiences.

We have successfully implemented a case-study-based approach in our recently created Interdisciplinary course, "Chemistry and Art." This course emerged from collaborative efforts between faculty and undergraduates and has been taught by faculty members from diverse disciplines, including museum curators and professors from the humanities to the sciences. The Brown University Undergraduate Teaching and Research Awards (UTRA) enable outstanding and diverse undergraduates to collaborate with professors in researching and developing innovative teaching materials and hands-on activities. Through this collaborative endeavor, students have not only gained valuable research experiences and critical thinking skills through close interactions with faculty but have also produced highly engaging educational products based on their research findings.

This adaptable model and approach have the potential to be implemented in various other undergraduate institutes, fostering collaboration, interdisciplinary learning, and the effective integration of case study methodologies.

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&

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## **Children are Smart, the Systems are Preventing them from Achieving Success in Literacy**

For forty years, the world has tracked student progress on multiple measures of basic literacy such as reading comprehension and writing. Unfortunately, the scores have remained stubbornly resistant to change with 30 to 80 percent of children at elementary grades failing these essential skills. A robust and vibrant democracy can only survive if their population is educated and can read and write to communicate effectively. During the last 20 years, our Literacy.IO team has carefully studied the reasons why children fail to master comprehension at elementary schools. Our results were surprising to us, and all the educational communities we serve. Most notably, we reviewed the state and national test scores for reading and graphed the specific constructs that constitute reading tests – main ideas, summarization, inferencing, vocabulary, author’s purpose, retelling, and genre studies. Most striving readers performed very poorly on main ideas and summarization. We further studied how these important skills were taught in the textbooks and classrooms across the world. We observed three important factors. First, the textbooks organized their instruction as isolated skills, with spiraled skills with no emphasis on any particular construct. This led to an equal emphasis on less important skills such as author’s purpose. More time needs to be devoted to main idea and summarization to achieve comprehension. Second, there were over 30 strategies given to students for writing a main idea or summary. This resulted in too many options and poor outcomes. What was necessary was a strong evidence-based strategy that can be applied to any genre (e.g., narrative/stories, expository/content area, poetry, biography). Thus, we created the Knowledge Acquisition and Transformation (KAT) strategy that taught children how to generate a main idea using the text structure of the passage (i.e., cause and effect, problem and solution, sequence, description, and comparison). In the KAT framework, students extend the main idea to a summary by adding supporting details and evidence from the text. Third, we

observed that tests were full of academic language that was unfamiliar to many low-income families and their children. Thus, the KAT framework emphasizes the teaching of specific academic language found in tests.

Since 2016 we have conducted over eight large scale randomized controlled trials with hundreds of schools and thousands of students in elementary and middle grades. Our results showed that 62 schools achieved 100% pass rates on reading comprehension for all children. These included special education students (e.g., dyslexia, ADHD, Autism), bilingual learners, and children in under served communities (e.g., poverty). These results showcase that strong reading comprehension is possible to achieve if the systems factors are addressed. Our instructional toolset includes teacher-led lessons, web-based intelligent tutoring systems in English and Spanish, and 100 ACE podcasts in English and Spanish for families.

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