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Empowering STEM Education with Technology

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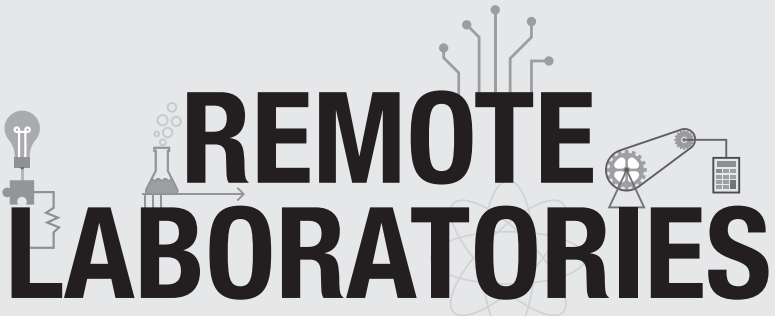

REMOTE LABORATORIES

Empowering STEM Education with Technology

Javier García-Zubía

University of Deusto, Spain

In collaboration with Luis Rodríguez-Gil

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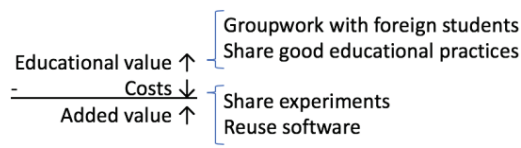
Prologue

September 22, 2005. A lecture room at the University of Catania, Italy, is being used for hosting a technical session of the 10th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA'05). Inside the room, two researchers (Gustavo Alves and Javier García Zubía) who had never met before are expected to present their work about the same topic: remote laboratories. Gustavo's presentation focuses on preliminary results of the RexNet project. His PowerPoint presentation contains seven slides for a 10 minutes' presentation. Results from most recent conversations among the project participants are still fresh on his mind and missing from the prepared slides. Luckily, there is a whiteboard and some marker pens in the room. He takes one pen and writes the following equation on the whiteboard, referring to the added value of remote experimentation to education:



q.e.d.

FORTUNE[1] and HARD WORK:

The fact Gustavo had no slide with this simple equation combined with his will to share information led him to write the equation on the whiteboard. This unusual gesture, in the context of a formal presentation within a technical conference session, made an impact in Javier's mind. The fact Javier and Gustavo were not supposed to present their works at the same session (one of them had asked to change the presentation slot in order to catch a flight later that same day) combined with the coincidence of both meeting each other at the Catania International Airport, where they continued to discuss about remote labs and remote experimentation, were a fortunate stroke of serendipity. **Hard work did the rest.**

Gustavo, as coordinator of the RexNet project, asks for an amendment to include the University of Deusto in the project consortium. This enables Javier and his research group to join the project and take part in the next project general meetings, held in Porto and Santiago de Chile, in June and December, the following year, respectively. In the meantime, i.e., November 16–17, 2006, Javier organizes an International Meeting on Professional Remote Laboratories, inviting Gustavo, Ingvar Gustavsson, Luis Gomes, Domenico Ponta, Cornel Samoila, Andreas Pester, and Dieter Mueller, among other researchers, to take part and join as authors in the first book about remote laboratories, jointly edited by him and Luis Gomes[2].

Shortly after, i.e., in 2008, Javier installs at the University of Deusto the first external node of the Virtual Instruments Systems in Reality (VISIR) remote lab, developed by Ingvar Gustavsson at the Blekinge Institute of Technology (BTH). During this period, Unai Hernández Jayo visits BTH to do part of his PhD work, supervised by Javier, in what may be seen as a good implementation example of the previously shown equation.

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[1] *Often capitalized: A hypothetical force or personified power that unpredictably determines events and issues favorably or unfavorably.* From https://www.merriam-webster.com/dictionary/fortune, accessed July 22, 2020.

[2] *Advances on Remote Laboratories and e-Learning Experiences.* Editors: Luís Gomes (Polytechnic of Porto) and Javier García-Zubía (Universidad de Deusto). Universidad de Deusto, Bilbao, 2007. Chapter 14, p. 309 ISBN 978-84-9830-662-0.

Later, Javier will edit two more books about remote labs, one in 2011 and another in 2013, respectively[3,4]. Again, sharing good educational practices emerges as a motivation for these two books.

Covers of the three books published by the University of Deusto on the subject of remote experimentation.

During this period, Javier organizes the 9th edition of the most prestigious conference in the area of remote labs, the Remote Engineering and Virtual Instrumentation (REV) conference, in Bilbao, in June 2012. This is a unique opportunity to gather and interact with the worldwide community working in this area. Later on, in 2014, Gustavo organizes the 11th REV conference edition in Porto, and invites other distinguished researchers, like Lyle Feisel[5,6] to know more about the community working on remote labs. Again, Gustavo and Javier are able to intensively learn from their peers.

[3] *Using Remote Labs in Education: Two Little Ducks in Remote Experimentation.* Editors: Javier García-Zubía (Universidad de Deusto) and Gustavo R. Alves (Polytechnic of Porto). Universidad de Deusto, Bilbao, 2011. Chapter 22, p. 465 ISBN 978-84-9830-335-3.

[4] *IT Innovative Practices in Secondary Schools: Remote Experiments.* Editors: Olga Dziabenko and Javier García-Zubía (Universidad de Deusto). Universidad de Deusto, Bilbao, 2011. Chapter 13, p. 347 ISBN 978-84-15772-01-9.

[5] Lyle Feisel is a co-author of one of the most cited papers about the importance of laboratory work in engineering education (see footnote 6). According to Google Scholar, his paper has more than 1400 citations https://scholar.google.pt/citations?user=_0i-9koAAAAJ.

[6] Feisel, L. D. and Rosa, A. J. (2005). The role of the laboratory in undergraduate engineering education. *Journal of Engineering Education*, 94: 121–130. doi:10.1002/j.2168-9830.2005.tb00833.x.

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First photo: Carisa Bohus, Gustavo Alves and WebLab-Deusto researchers during the REV conference in Bilbao.

Second photo: Lyle Feisel, Ingvar Gustavsson, Gustavo Alves and Javier García-Zubía during REV conference in Porto.

From 2012 onwards, Javier engages himself in a number of research projects related to remote experimentation, e.g., Go-Lab, ICo-op, NeReLa, VISIR+, PILAR, and Next-Lab, among others[7], building a remarkable

[7] https://weblab.deusto.es/website/projects.html.

experience in the use of remote labs for enhancing practical skills in engineering education.

The present book is a result of countless hours of hard work, pleasant conversations with his peers and, above all, an everyday reflection on the subject while walking from his home to the University of Deusto or taking his dog on a walk near his home. As a colleague and a friend, I had the pleasure to witness his career path. As a researcher, I had the unique privilege of reading this book in its early stages of development, and, in particular 'The Ten Commandments of Remote Experimentation', which perfectly summarise Javier's vision about the use of remote labs in engineering education. There could be no better summary for such a book.

Gustavo R. Alves
Polytechnic of Porto — School of Engineering

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