

1 *Communication – interview transcript*

2 **Human-Centered Design approach on Innovation,** 3 **Project Management, Prototyping, and Product** 4 **Development – Interview with Dr. Fernando Bardella**

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11 **Abstract:** Dr. Bardella is Post-Doctoral fellow and researcher at the Nuclear Energy Research
12 Institute (IPEN) / Brazilian National Nuclear Commission (CNEN) at the University of São Paulo
13 (USP). As one of the founders of the Research Group for Scientific Visualization in Materials
14 (GVCM), his multidisciplinary research focuses on integrating disruptive technologies and
15 innovations – such as Scientific Visualization, 3D Computing, Virtual and Mixed Realities
16 (AR/AV), Rapid Prototyping and Internet-based computing – with scientific knowledge diffusion
17 and development. This paper is a transcript of an interview Dr. Bardella has given on October 7th
18 2017 at Drexel University's School of Engineering, discussing GVCM's approach to innovation and
19 how group has structured a project management strategy focused on Action-Research and HCD
20 (Human-Centered Design) to enhance agility, creativity and customer empathy. A full video of the
21 interview is available at Drexel Stream's platform [1].

22 **Keywords:** Human-Centered Design; Innovation; Project Management; Prototyping; Product
23 Development

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The image shows a video player interface for Drexel Streams. At the top, there is a dark blue header with the Drexel University logo and the text "DREXEL STREAMS". Below the header is a yellow navigation bar with links for "Home", "Instructional Videos", "My Media", and "Support". The main content area features a video player with a portrait of Dr. Fernando Bardella. A blue banner at the bottom of the video frame identifies him as "DR. FERNANDO BARDELLA" and lists his affiliation as "Nuclear and Energy Research Institute (IPEN-CNEN/SP)". The video player controls at the bottom show a play button, a progress bar at 0:49 / 15:20, a volume icon, a 1x zoom level, and a share icon. Below the video player, the title "INNOVATION, PROJECT MANAGEMENT, PROTOTYPING, AND PRODUCT DEVELOPMENT" is displayed, along with a view count of 13.

25

26 **Interview**

27 **Prof. deArruda:**

28 *We are here with Dr. Fernando Bardella from the GVCM - Research Group for Scientific*
29 *Visualization in Materials [2], from the Nuclear and Energy Research Institute with the University*
30 *of São Paulo / Brazil [3]. He is here to talk about innovation, project management, prototyping and*
31 *engineering products development.*

32 *Dr. Bardella, welcome. Would you please start by telling us a little bit more about who are you and*
33 *what kind of research do you do?*

34 **Dr. Bardella:**

35 *Hello and thank you for having me, it's a great pleasure to be here in Philadelphia to talk with you*
36 *and your students. First-of-all, I have a PhD in nuclear technology and a master's degree in project*
37 *management. For over 16 years, I have worked as a project manager in various industries, leading*
38 *teams from South America, North America, EU, and the Asian Pacific ring. I also hold a PMP*
39 *certification and Project Management is a very important area of knowledge of our research group.*

40 *My research interest focuses primarily in multidisciplinary research, integrating disruptive*
41 *technologies and innovations – such as Scientific Visualization, 3D Computing, Virtual and Mixed*
42 *Realities (AR/AV), Rapid Prototyping and Internet-based computing – with scientific knowledge*
43 *diffusion and development.*

44 **Prof. deArruda:**

45 *Can you tell us a little bit about some of the recent project you've been involved with?*

46 **Dr. Bardella:**

47 *More recently we've been involved in two main projects. The first one is called the CrystalWalk [4]*
48 *and it is a web-based 3D interactive crystal editor and visualization software designed for teaching*
49 *crystallography concepts to non crystallographers. The second project on a similar approach to*
50 *CrystalWalk it is called the GrainCrawler [5] and it is sought to improve spatial understanding of*
51 *grain structures. Both of these projects were developed within the material sciences realm,*
52 *fundamentally on the education of these very foundational aspects as of it.*

53 **Prof. deArruda:**

54 *Just prior of this interview you mentioned these were open source projects, can you tell us a little bit*
55 *about this?*

56 **Dr. Bardella:**

57 *Absolutely. Both of them are open source projects that focus on providing an easy to use and*
58 *accessible platform that can support teaching material sciences and engineering and it aimed at*
59 *students, professors and researchers specifically for this effort.*

60 **Prof. deArruda:**

61 *This is really great! Could you please tell us a little bit more about the projects you and your group*
62 *develop, and try to make a connection with project management?*

63

64 **Dr. Bardella:**

65 *Sure - so, differently from hypothesis testing, typical from traditional hypothetical-deductive more*
66 *traditional way of doing science, we've taken what we call a multifaceted philosophical approach that*
67 *goes beyond the positivism itself. I don't want to bother your students with the deep details of*
68 *scientific methodologies, but we've added an interesting philosophical approach into this mix known*
69 *as critical thinking, which is traditionally used in social sciences, and we have adapted a method*
70 *known as action research as a way to develop and implement our main project deliverable - the*
71 *application itself.*

72 *In a very short way, instead of getting through a long requirement gathering process to then take*
73 *another long period to get it coded and implemented, we've taken a bit of a different approach putting*
74 *together a rough prototypes to gather feedback as soon as possible.*

75 *We've put together a group of what we've called representative stakeholders - students, professors*
76 *and researchers - people that would use the application in future that were at the university and*
77 *available to test the application.*

78 **Prof. deArruda:**

79 *Were they students of the university?*

80 **Dr. Bardella:**

81 *Yes, they were actual students from materials science courses, professors from some of these classes,*
82 *researchers that do use tools for simulating and generating graphical visualizations. With that we've*
83 *promptly identified the bad ideas, the ideas that we've quickly figured out wouldn't work and killed*
84 *them by no longer investing time or resources, The great ideas, the concepts that we've tested on our*
85 *stakeholders that we've gotten good feedback and identified opportunity, we continue to invest more*
86 *time and to further developed it as part of this approach. This iterative, cyclical, empirical method,*
87 *focuses on human-centered design approach and in a certain way is very similar to some of the agile*
88 *project management methodologies we know and use today - such as scrum, crystal and so on.*

89 **Prof. deArruda:**

90 *OK, but what are your scientific contributions so far?*

91 **Dr. Bardella:**

92 *We've had many, but I believe that our main scientific contribution was that we were able to work*
93 *with this particular group of representative stakeholders and build the scientific knowledge together*
94 *with this group, providing them the tools and the means to generate knowledge. In action research*
95 *this is called "the empowerment" so that they were empowered to use these tools in their classes, to*
96 *help their students, to use in autonomous studies, to help professors teaching their classes and so*
97 *on... In a much broader context, students, professor and researches of materials science and*
98 *engineering now have a tool to build crystal structures that is not only nice, but it's also easy to use*
99 *and don't require them to be a crystallographer to be able to use it.*

100 **Prof. deArruda:**

101 *OK, so going back to your research, have you gotten a hypothesis? Have you been able to test it?*

102

103 **Dr. Bardella:**

104 *So, as part of this multifaceted scientific approach there was a lot of the hypothetical-deductive more*
105 *traditional kind of science that was required from us to be done. So, yes we've gotten an hypothesis*
106 *and we had it tested. I know this is not Game of Thrones but I don't want be to a spoiler to your*
107 *students that may want read my research. I will have it available so that they can read and see how*
108 *this was done.*

109 **Prof. deArruda:**

110 *That's funny! Could you tell our students a bit more about how you got fast prototyping and*
111 *stakeholder management connected to your project?*

112 **Dr. Bardella:**

113 *Absolutely. So, as you can see multidisciplinary research is all about trying to connect a diverse*
114 *group of knowledge domains which as per consequence implied into bringing together a very diverse*
115 *group of stakeholders with many different interests. In one hand there was solid state physics at the*
116 *foundational science level, high end technologies such as immersive virtual reality, internet based*
117 *infrastructure within a didactic context where cognitive and learning research had a great*
118 *importance when developing tools like this.*

119 *In the other hand, additional to us - the researchers - we had other key stakeholders playing an active*
120 *role into it such as students, professors and other researchers that were aimed to use this tool. Project*
121 *managers know that in projects like this stakeholder management has an absolute critical importance.*
122 *Bringing rough prototypes quickly into life and using it as a way to get feedback from stakeholders as*
123 *soon as possible, but also using it as a tool for buy-in, for getting stakeholders onboard, participating*
124 *of the project, that was absolutely critical for the development of this product. And I believe that being*
125 *able to test, try and evaluate some of these concepts as soon as possible or before having to spend a lot*
126 *of time into developing functionalities that was also very important for time management and*
127 *resources management. It was team's key tool to aligning stakeholders' expectations before spending*
128 *a lot of time developing them.*

129 **Prof. deArruda:**

130 *We know that lessons learned is a very important concept in project management. What lessons have*
131 *you learned from these projects that you may share with our students?*

132 **Dr. Bardella:**

133 *That's a very good question. If there was a lesson learned at this project is that using rough*
134 *prototyping was an important way to engage and manage stakeholders. I personally haven't used it*
135 *this way before, but I truly believe that for the reasons I just mentioned to you as restrictions of*
136 *resources, deadlines and tight schedules... for all of these reasons I truly believe that rough*
137 *prototyping is absolutely critical for the development of engineering products that has innovation at*
138 *its center. We haven't done any of this before, we needed to test it as soon as possible – rough*
139 *prototyping was the means we used to do so.*

140 **Prof. deArruda:**

141 *Fernando, thank you for coming here to Philadelphia to meet with me and my students. I'm sure your*
142 *research will have a great impact in grad and undergrad students working with materials science and*
143 *crystallography.*

144

Dr. Bardella:

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Thank you Prof. Marcos. As a closing remark, my research is available at <http://gvcm.ipen.br>. All of you and your students are welcome to reach me for any further information, details or even - and I'm sure we will have a lot of candidates for this - for visiting us in Brazil and working in a collaborative research.

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Back Matters

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Availability of data and material

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Interview was realized on 09/07/2017 at Drexel University's School of Engineering.

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Interview Video is available online at Drexel Streams platform at [1].

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Conflict of interests

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The author(s) declare(s) no conflict of interest.

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