

The Virtual Ideation Platform

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Introduction

The staff at Central Maine Community College, working with partners across New England and the United States, are developing a virtual ideation platform (VIP) which is being funded by the National Science Foundation, DUE-ATE #0802414 award. The VIP is a consortium of stakeholders from community colleges, universities and industry that include faculty members, administrators and industry personnel all committed to making the VIP a viable model. The VIP is designed to enable faculty members and their students to share product concepts, resources and expertise across the internet to solve complex design and manufacturing problems. The development of the VIP challenges the silo model of education. The focus of this paper is to outline the rationale for the VIP and the logistic challenges faced while working over the internet. This will be accomplished by reviewing the current institutions involved in the VIP. Each institution brings its own strengths based on their respective faculty, curriculum, available communication tools and willingness to adapt to this educational environment. Faculty and student interaction uses various communication tools and their impact will also be explored.

One of the key challenges faced by the VIP team regarding logistics is that there are few faculty members who have direct experience with this model and there are few existing models to emulate. Regardless, faculty members across the VIP are prime movers since they are willing to experiment and make the VIP a workable and sustainable model.

Rationale

The relentless evolution of Information Technology (IT) challenges traditional teaching methodologies, particularly for engineering and technology educators. The evolution of IT and its intrinsic networking capabilities stands in stark contrast to the traditional “silo” model of education delivery [1]. However the relentless evolution of IT should encourage constant examination and experimentation of alternative curriculum delivery modes by engineering and technology educators. Promising strides continue to be made by innovative educators to mitigate the silo effects. The very nature of information exchange today presents fundamental challenges and, based on one's point of view, opportunities. As business and industry assimilate IT tools to enhance digital globalization the factory-silo model loses its relevance and is not flexible enough to accommodate innovations in a timely fashion. Increasingly, IT is used to define next generation manufacturing where world class firms do a better job of engaging groups outside the firm. Another emerging issue is that students have access to a computer in their cell-phones. These students are increasingly tech-savvy and use their cell phones for communication, often for social intercourse. However, that is quickly changing as students increasingly use these devices to help coordinate projects that they are working on.

Students entering the workforce are often immersed in an IT environment and need a system perspective if they are to make sense of their company and the work they are assigned. A recent report sponsored by the New England Council and conducted by Deloitte Consulting points out that “The advanced manufacturing sector is large, vibrant, and highly-networked in New England.... Advanced manufacturing operates in a complex network of suppliers, skill sets, and innovators” [2]. There is tremendous competitive advantage by engaging the best value added vendors to a supply chain that networks regardless of state boundaries. The VIP model emulates this environment, thereby giving students first hand knowledge and skill sets to easily transition into these networked environments. The VIP network consists of community colleges, universities and industry partners.

The VIP Network

The network currently consists of Central Maine Community College (CMCC) as the lead institution. The staff at CMCC provides the leadership and manages the overall operation of the VIP. The other institutions involved with the VIP consist of stakeholders from the Manufacturers Association of Maine (MAMe), Springfield Technical College, University of Southern Maine

(USM), Keene State College (KSC), Saddleback College (SC), University of Massachusetts , Lowell (UML), and the New England Board of Higher Education (NEBHE).

Central Maine Community College

Located in Auburn, Maine CMCC is a comprehensive, public two-year college that provides quality, accessible education and lifelong learning opportunities. The college delivers career and technical degree programs; education for transfer to baccalaureate programs; and services to support economic development and community vitality. CMCC is accredited by the New England Association of Schools and Colleges. In their lead role, the staff at CMCC works closely with the Manufacturers Association of Maine by providing guidance and assistance through their National Advisory Board on an ongoing basis.

Precision Machining Technology program at CMCC

The faculty at CMCC are directly involved by providing the core “manufacturing engine” along with associated activities for the VIP. The Precision Machining Technology program offers comprehensive education to prepare individuals for employment in the metal products industry. Through a combination of classroom study and assigned shop (lab) instruction, students acquire essential background information, develop trade skills and become familiar with production methods and standards common to the industry. In the shop setting, students learn to read blueprints, operate a variety of conventional machine tools, use computer numerical control (CNC) machines and use precision measuring and inspection instruments. Students may pursue an associate in applied science degree or a one-year certificate. The Precision Machining Technology program is accredited by the National Institute for Metalworking Skills (NIMS). The Precision Machining laboratory at CMCC is housed in a 10,000 square-foot space with seventy two machines including 16 lathes, 18 milling machines, 18 grinders, 6 CNC centers and a variety of other equipment.

The Manufacturers Association of Maine (MAMe)

The Manufacturers Association of Maine, Maine’s Multi-Industry Connection is a state-wide industry association representing manufacturing, corporate, affiliate and student members. Their mission is to work for economic, financial, educational and business prosperity for all members and workers. MAMe provides valuable industry based expertise regarding industry validation of the proposed work. In addition, they help by providing appropriate projects that meet or exceed NIMS standards. They also support our recruitment and dissemination efforts.

Keene State College

Keene State College is a four-year liberal arts college, founded in 1909 and is located in Keene, New Hampshire. The faculty at Keene State College is the design foundation for the VIP. Product concepts are reviewed and those that are selected are introduced into the various design classes under their Sustainable Product Design and Innovation (SPDI) program. The core of the SPDI programs involves four courses in Product Design and Development. This four course sequence involves students undertaking increasingly complex projects.

Springfield Technical Community College (STCC)

The STCC, located in Springfield, Massachusetts, was founded in 1967. STCC is one of the few community college to have established a technology park, the STCC Technology Park. The STCC was selected by the US Department of Commerce as the sole winner of the national Award for Excellence in Economic Development. STCC is dedicated to serving its community and extending its reach across the state and nation, through excellence in education, innovation in economic development and a commitment to community outreach. The faculty members at STCC

provide documentation review and development as well as first article inspection. They also provide software and telecommunications expertise that directly supports the VIP network. As a National Advanced Technology Center in Telecommunications the VIP is in an excellent position to put STCC's expertise into practice.

University of Southern Maine (USM)

The Department of Technology in the School of Applied Science, Engineering and Technology provides degree programs and services related to manufacturing, construction and information technology as well as teacher education in related areas. Technological concepts and skills are presented through a variety of approaches including lectures, laboratory activities, field experiences, industrial visits and cooperative programs.

The curricula of the Department of Technology provides a blend of general education, technical and professional courses designed to prepare individuals for careers as leaders in business and industry and as teachers. The department offers several degree programs and options leading to a Bachelor of Science degree. Each program is designed to meet the educational needs of students with a variety of backgrounds and career aspirations.

University of Massachusetts, Lowell, Plastics Engineering Department

The faculty and administration at the University of Massachusetts, Lowell, has create a world renowned Plastics Engineering program, offering undergraduate and graduate programs leading to a Doctorate of Science with extensive ongoing research. The University of Massachusetts, Lowell has laboratory facilities, which include plastics processing, testing and polymer characterization. They contribute to the VIP collaborative by providing graduate students an opportunity to perform detailed finite element analysis and mold flow analysis. This analysis will enable VIP students to optimize part and tool design.

Saddleback College

Saddleback College is a community college and is the recent recipient of a National Center in Rapid Prototyping (RP) and Additive Manufacturing called RapidTech ATE DUE #0702912. Their staff has provided the RP capacity, technical support and seminars. Their staff's efforts help VIP faculty and students create a variety of RP models in a variety of materials. This support and the RP models enable the faculty and students to better communicate and understand the requirements of a given design.

New England Board of Higher Education (NEBHE)

The New England Board of Higher Education is a seasoned NSF ATE project recipient and provides a central location for participating institutions. NEBHE will be the site used as a central meeting location for the VIP team. In addition, they will provide groupware training for faculty members as well as dissemination of results.

The VIP Product Design Scenario

Based on the VIP model the typical product development scenario has involved the following steps. The VIP team reviews and selects projects based on difficulty, ability to meet NIMS standards and how well they will engage students' interest. The initial step involves Keene State College (KSC) students creating 3D solid CAD models while having CMCC's machine tool faculty simultaneously verifying design features, tolerance requirements, fits, interference issues and functionality. This model ensures that machine tool processes will be validated in tandem as the design emerges through these iterations. The RapidTech Center's staff at Saddleback College creates RP models as needed to help minimize design ambiguity. RapidTech has the facilities to build RP models out of different materials and are actively engaged when CMCC does not have the

appropriate technology to create models. The University of Southern Maine studies the design using Six Sigma criteria and machine tool process via capability index as well as appropriate metrology techniques. As the design evolves, assemblies undergo Finite Element Analysis validation to ensure the correct materials along with associated design features are optimized. Graduate students at the University of Massachusetts, Lowell do this work. To date, projects have involved tool design, fabrication and pilot production. The pilot production parts first undergo article inspection conducted by students at Springfield Technical College. The VIP team continues to take on increasingly complex projects in an ongoing effort to establish the pedagogical limits of this model.

Project Selection Matrix

The project selection process is currently an ad-hock process where VIP team members discuss project ideas of their own or those that have been submitted by industry personnel or students. The process is becoming increasingly structured and the underlying selection matrix is becoming more focused based on past experience. The prior project experience provides a basis of negotiation as to what can be realistically achieved to inform the final s and the ability of faculty members.

Communication and the VIP Calender

PolyCom

At the heart of the VIP is the ability to communicate. Teams of faculty and students must be able to communicate effectively and in a timely manner to resolve numerous issues. Beyond basic e-mail, the use of PolyCom continues to be a major arena for communication. Faculty and students routinely meet to discuss ideas as well as progress on various projects. This virtual face-to-face communication helps not only to solve problems, but also to build mutual understanding but and a sense of community.

The ability to find common times to meet and communicate has been a formidable task given the diversity of schedules across each campus. The major advantage of CMCC is that their faculty meet throughout the week, making them easily assessable. Unfortunately, evening communication is difficult. The use of a VIP Calender that displays faculty schedules is extremely helpful and ensures that all members of the VIP know each other's schedules and availability. Common meeting times have been identified and help the VIP team coordinate projects and resources.

File Transfer and Classroom Management

Integral to this process is the transfer of graphic and analysis files. These files are often very large and require special attention. The use of file compression has not been used to any great extent. However, "dummy" g-mail accounts have been set up to help move large files to a server that can be access by all faculty. The file size limitations imposed by Blackboard is significant and has yet to be overcome. Therefore, the VIP team is looking at alternatives such as Moodle for file transfer as well as overall classroom management.

Lessons Learned

Team Building

The key to the ultimate success of the project is the ability of faculty members across the VIP to work together in a collaborative manner. It has been proven successful to have a social network established. This helps to ease any tensions as projects and students work together. A friendly environment is essential and is reflected in the VIP meetings. Therefore, the use of an outside facilitator is very helpful to initiate the team-building process.

Logistics

There are numerous lessons that have been learned. The most basic is that coordinating logistics among the VIP members is demanding. The IT departments have been extremely cooperative but cautious in order to protect the integrity of their systems. Communication channels are improving as the members better understand the limitations of each other's communication systems and IT facilities. Work continues on moving PolyCom onto individual faculty members' computers. Regardless, there is still a lot of work to be done to improve communications and information transfer across the VIP. The issues with IT are formidable and need constant attention. The IT staff at each campus is extremely concerned, and rightfully so, of firewall breaches. The use of open source software "outside" the campus is still being investigated and may provide the long-term solution that will be needed.

An interesting observation is that students are very respectful of their fellow VIP peers and appreciate the expertise they bring to the process. This has taken some careful coaching by all faculty members but has made for excellent cooperation as progress begins.

Curriculum

Documenting the curriculum changes that are an inherent aspect of the VIP model is also a challenge. Every faculty member is alert to changes that their curriculum is undergoing. The VIP faculty are defining new student learning objectives on an ongoing basis. A major student learning objective, for example, is the ability to use various communication platforms. These arenas not only help students better understand their individual contribution to projects but also the array of techniques that can be used to discuss, communicate and critique their ideas with other VIP students. Capturing the major hurdles of each project to help instruct future teams is also an area that will need closer attention.

Conclusion

The progress to date is impressive given the short amount of time needed to get all of the key elements in place. Regardless, there remains a substantial amount of work that needs to be accomplished. Educational institutions, due to the recent downturn, are in a state of flux that affects everyone. Community colleges have been hard hit with decreased budgets but record increases in enrollment. Therefore, it will take patience and cooperation to continue to move the VIP forward and make additional gains. Regardless we are, as a team, extremely confident that we will develop a working model.

When the VIP faculty team leaves a PolyCom meeting they still think in terms of their traditional classroom routine and prioritize their approach accordingly. In this scenario the VIP is still considered an interesting add-on/supplement. The overarching hope, of everyone involved with the VIP model, is to encourage a fundamental shift away from the traditional thinking modes of curriculum delivery to one that is more holistic and replicates a "system perspective". The aim is to have educators routinely including web based collaboration identical to the digital globalization of today's workplace. Work done under the VIP will enable students to assimilate a "system" perspective that moves away from the silo education of today. It all fits into their responsibility and contribution to overall process. Faculty and students will have a clearer perspective of the various roles of their team members. There needs to be a collaborative environment where designers, managers, quality control staff and engineers all work together to see projects to a successful and profitable conclusion. The other goal is to help students understand the issues that are faced by other members of the team and how they are affected by poor quality files, miscommunication and lack of attention to detail.

References

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