CA²VES

CENTER FOR AVIATION & AUTOMOTIVE TECHNICIAN EDUCATION
USING VIRTUAL E-SCHOOLS

Sustainable Manufacturing and Workforce Forum

December 16, 2013 Greenville SC CU-ICAR

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CLEMSON UNIVERSITY CENTER FOR WORKFORCE DEVELOPMENT

SCCMS
SOUTH CAROLINA'S COALITION FOR MATHEMATICS & SCIENCE
ACHIEVEMENT BY DESIGN

Youth Learning Institute
CLEMSON UNIVERSITY

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ECONOMIC DEVELOPMENT

EXECUTIVE SUMMARY

On December 16th, 2013 the Center for Aviation and Automotive Technical Education using Virtual E-Schools (CA2VES) hosted a Sustainable Manufacturing and Workforce Forum for industry representatives at CU-ICAR in Greenville, SC.

Partners for the event were the Clemson Center for Workforce Development, Clemson Office of Economic Development, and CU-ICAR. In addition to virtual reality and digital learning demonstrations, two breakout sessions were held with small groups identifying challenges and opportunities for improvement in South Carolina workforce education and the use of digital curriculum for manufacturing. Analyzing the discussions from each of the sessions provided the following findings.

1. **Participants stressed that there is a lack of technically trained workforce in South Carolina. A pipeline of educated people interested in manufacturing needs to be fostered and developed.** Participants were concerned about the current lack of interest in manufacturing of young people, possibly due to misconceptions about the manufacturing industry. Positive marketing on the achievements of SC manufacturing to STEM students has improved this, but many people still do not know about the opportunities that the manufacturing industry provides. Participants were also concerned about their inability to find local workers with the highly technical skills required to fill certain manufacturing positions.

2. **Industry representatives suggested some curriculum changes in the South Carolina education system in order to create a better prepared workforce.** Their suggestions included more extensive soft skills training, for skills such as communication, teamwork, email etiquette, and the value of punctuality. In addition to soft skills, employers would like to embed more critical thinking and problem solving into education. Workers who have the ability to troubleshoot and apply their knowledge to real world situations are assets to a company. Forum participants also suggested that students should complete more hands-on educational projects that encourage learning exploration.

3. Digital learning applications and virtual reality simulations can be effectively used to help improve the workforce both pre and post-employment. Participants felt that digital learning was an important component for the future of education. They praised digital learning platforms for their accessibility, versatility, and uniformity. Additionally, participants brainstormed a variety of different applications for virtual reality simulations in the workplace, such as for safety and new equipment training. Virtual reality can also be used to provide students with experiences in real world situations and environments to improve their understanding of the manufacturing industry as a whole.

At the end of the day, participants felt optimistic about the future of South Carolina's workforce development and digital learning. The forum allowed people from different industries to share their opinions and suggestions on how to improve the future of SC manufacturing education. This forum brings CA2VES and its partners one step closer to advancing the future of STEM education in South Carolina schools.

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OVERVIEW OF CAAVES

The Center for Aviation and Automotive Technology Educations using Virtual E-School [CA2VES] exists for the advancement of automotive and aviation technician education programs across South Carolina. CA2VES is comprised of Clemson University, the SC ATE National Center, Florence-Darlington Technical College, Greenville Technical College and Trident Technical College, and has established partnerships with SpaceTEC®, AMTEC, CARCAM, and many aviation and automotive industries throughout the state. The objectives of CA2VES are (1) creating a virtual e-school by expanding automotive and aviation (A2) technician education programs via innovative and cost-effective e-learning options; (2) increasing access in order to support recruitment and learning for automotive and aviation students through this SC- A2 network; (3) broadly disseminating advanced technology e-learning modules for use by automotive and aviation technician education programs and industry; and (4) advancing the long-term workforce impact of CA2VES initiatives and programs. CA2VES will create a regional community of scholars among research universities, community colleges, P-12 educators and industry to implement the next generation of aviation and automotive manufacturing technology curricula. Results are expected to significantly improve student learning and to encourage underrepresented students at two-year colleges to study aviation and automotive maintenance. National Science Foundation Advanced Technological Education center partnerships will expand implementation and impact across the southeastern region and nationally.

In recognition of the importance of a system wide approach to A2 technician education, CA2VES engages in a variety of programs and partnerships. A broad range of P-12 experience and expertise has been built through partnerships with the following organizations:

The South Carolina Coalition for Mathematics and Science works together with advocates from industry, education, government and community organizations to promote quality in science, technology, engineering and math education (STEM) in South Carolina. Through advocacy, professional development, instructional material support, innovation, and research and evaluation, SCCMS aims to make South Carolina a national leader in these fields of education.

The Clemson University International Center for Automotive Research (CU-ICAR) is an advanced-technology research campus where academia, industry and government organizations engage in synergistic collaboration. ICAR supports efforts to extend STEM opportunities in K-12 schools throughout South Carolina.

The Clemson University Office of Economic Development works with public and private partners to create jobs in SC, in keeping with Clemson University's teaching, research and outreach missions.

PURPOSE OF THE FORUM

The CA2VES Sustainable Manufacturing and Workforce Forum was held on December 16, 2013 at the CU-ICAR facility in Greenville as a means to gather information on the needs of South Carolina manufacturing companies with respect to their workforce demands. Industry partners were invited to share their ideas and concerns about South Carolina's workforce and to provide suggestions for workforce improvement and development for the future. In addition to this, participants were asked to provide their opinions on digital learning and virtual reality learning and their applications in workforce education.

Multiple industry partners and organizations were represented at the Sustainable Manufacturing and Workforce Forum. These companies came from across the state to engage in discussion about the future of the manufacturing workforce. The companies represented included: Alice Manufacturing Co., Baldor, Boise Cascade, Duke Energy, Emitec Inc., Glen Raven Mills, Michelin North America, Reynolds Company, Robert Bosch LLC, and Wilbert Plastics. In addition to these companies, many local organizations were involved in the forum as well. The organizations represented included: Anderson County Economic Development, Greenville Chamber, SC Coalition for Mathematics and Science, SC Manufacturing Extension Partnership, SC Vocational Rehabilitation Center, Ten at the Top, as well as a few representatives from local community colleges. Attendees participated in small discussion groups and feedback sessions, and presentations on the future of workforce education.

OVERVIEW OF ACTIVITIES

The three hour forum began with registration of participants and an opening session discussing an introduction to workforce development, presented by Dr. Anand Gramopadhye, Dean of Clemson's College of Engineering and Science. The participants were then separated into four groups of six to eight people each. Each group was led by a moderator who read the prewritten scripts including open ended questions and guided discussion. There were two group sessions, each lasting 45 minutes, and the sessions were recorded (after receiving participants consent).

Session One Activities During the first session, the small groups discussed the needs and challenges of the manufacturing industry in South Carolina with respect to workforce. In addition to this, the groups discussed workforce ready skills that should be addressed in the SC educational system, and the future of SC workforce preparedness.

Session Two Activities During the second group discussion session, the industry representatives discussed how to improve current educational curriculum to meet industry needs. Additionally, the small groups conferred on the value of digital curriculum and virtual reality simulations, their advantages and disadvantages, and their use in both pre and post-employment education.

In between the two small group discussion sessions, there was a short break followed by a virtual reality demonstration by CUCWD's director of technology. The demonstration allowed attendees to see the types of virtual reality simulations that CUCWD has been developing, and primed them for the second session of discussion on digital learning and virtual reality. Also the Educate Workforce platform was demonstrated for further visualization of the nature and future of online learning.

FINDINGS

Session One Findings

Session one was entitled "Pathways, programs, involvement, and needs from P-20 in manufacturing education." This session focused on discussion about manufacturing companies' workforce needs and how education systems can help address these needs.

Questions and Responses:

1. What are the greatest work force needs and challenges for SC manufacturing?

The first question asked participants to discuss the challenges that manufacturing companies face when trying to acquire skilled workers. One of the biggest concerns to these industry

partners was the general public's perception of manufacturing and its job opportunities. They said that there was a lack of interest in young people to pursue a career in manufacturing and this is likely because of the perception of manufacturing jobs as being low-grade. Participants also discussed the difficulty of finding highly educated workers because the South Carolina education system is not preparing students for these jobs, and it is difficult to draw skilled workers in from other regions.

Some suggestions that participants made for improving the workforce in SC include, educating people about the achievements of South Carolina's manufacturing industry and the future of the industry, providing mentors within companies to help train new hires, and to increase the accessibility of the education opportunities that give workers the skills they need.

2. What workforce ready skills should P-12 education address? How might the SC educational system address these skills?

The second question addresses the types of skills that the SC education system should teach in order to create a better prepared workforce in the state. The main skills that were repeatedly described by participants were problem solving and troubleshooting skills, the ability to apply knowledge to real world situations, and soft skills such as teamwork, workplace and email etiquette, the value of punctuality, and communication skills. Participants suggested that to improve these skills students should have more hands-on projects that represent the kind of problems they would face in the real world, and to get students excited about learning outside of the classroom.

3. What is working well in workforce preparation for STEM related positions in SC? What do you think are some next steps to take what is currently working well to the next level of effectiveness?

The third question asks the industry representatives to discuss what is working well in the current education system in order to prepare the workforce for STEM related jobs. The consensus was that career centers and high school guidance counselors are doing a great job in promoting manufacturing jobs to students. Also hands-on experiences such as apprenticeships, school engineering labs, and summer workshops provide great opportunities to expose students to the manufacturing industry. There is still a larger push from industry partners to gear STEM education more toward manufacturing work and to provide more technical classes such as mechatronics.

4. Which industry recognized certificates and degrees hold the most value for employment in your industry (i.e. Six Sigma, MSSC, NIMS, two year degrees, four year degrees, advanced degrees)?

The fourth question was asked to determine which types of certificates and degrees

manufacturing companies look for when hiring new employees. The most common response was two year degrees in mechanical, electrical, mechatronics, maintenance, or industrial tech fields. Additionally, PLC, CNC, welding, and MSSC certificates were highly valued by participants. Lastly, industry partners also valued student participation in apprenticeships, scholarships, and co-op programs.

Summary of Session One

The group discussions from Session One provided insight into workforce needs of local manufacturing companies. Industry representatives reported that they have difficulty finding highly skilled workers, due a small number of local workers getting through the educational pipeline in a timely manner with the needed skills. The discussions acknowledged that guidance counselors and career centers are doing a good job of exposing students to different opportunities in manufacturing and providing them with a realistic view of manufacturing jobs in South Carolina. Unfortunately, the general public's misconceptions of the manufacturing industry are difficult to overcome and many people are not aware of the opportunities available to them through the field of manufacturing. "We must continue to highlight manufacturing success in South Carolina to market to STEM students and grow the talent pipeline," states one industry partner.

Another main topic discussed during Session One was the need for the educational system to give students opportunities to gain the skills they need to succeed in the manufacturing industry. These skills include problem solving and troubleshooting skills, the ability to apply knowledge to real world situations, and soft skills such as teamwork, workplace and email etiquette, the value of punctuality, and communication skills. In addition to these skills, it is important to industry that students learn how to apply their knowledge to real world situations. If students are able to apply their knowledge to the world, then they will be better problem solvers and be more likely to succeed in the field of manufacturing.

Lastly, the groups in Session One also discussed the certificates and degrees that companies look for when hiring new employees. Participants agreed that two year degrees in an electrical or mechanical field were highly valued. Specific skill certificates, such as PLC, CNC, or welding certificates, were also highly recognized. And participation in apprenticeships co-op programs or other hands on experience is always beneficial for future employees. Some companies also use their own in-house skill tests to assess employee skill levels.

Overall, Session One allowed for important discussion on the needs of the manufacturing workforce. One participant stated that "there has been a great need for preparing a pipeline of workers for skilled manufacturing jobs, with potential solutions that include early exposure, addressing preconceptions and myths about manufacturing, and providing accessible digital learning environments for skill acquisition." This quote nicely summarizes the main points of discussion from Session One.

Session Two Findings

The second session was titled "Curriculum and Online/Virtual Reality Needs and Gaps." This session focused on discussion about digital curriculum and its future applications in manufacturing education.

Questions and Responses:

1. If a school district incorporates new components into the curriculum to meet industry needs, what components should be included? What specifically should soft skill training include?

> The first question asks the industry partners what they think should be added to SC educational curriculum to better meet their workforce needs. Soft skill training was the most frequently discussed curriculum addition. This included discussion on communication skills, email etiquette, public speaking, conflict resolution, teamwork, how to dress for work and interviews, time management, and the importance of punctuality. In addition to soft skills, participants also discussed adding curriculum to encourage critical thinking and adaptability. Students should be able to apply the knowledge they learn to different situations and use their problem solving skills to determine which of their learned skills they should use for a certain situation. It was highly emphasized that problem solving is not embedded enough in the current curriculum and should be increased in all educational fields.

2. What value do you see in digital curriculum in manufacturing at the pre and post-employment stages? In your training needs, how might you incorporate a self-paced, digital curriculum for your employees? Which topics would be most useful?

> The second question encouraged discussion about digital curriculum for educational and training needs. Overall there was a very positive response to digital learning from the industry representatives. "The world is changing, so the education industry must stay ahead by adopting digital and other new learning strategies," states one participant. During the discussion of digital learning, participants praised it for its accessibility, ability to be self-paced for individual students, and its consistency of materials from one student to another. Digital learning provides uniform and consistent material to students, despite any differences between their school district's economic resource levels. Also digital learning was described as being versatile enough to be a good platform for learning a variety of different topics.

> The second part of this discussion question asked participants to think of potential applications for digital learning in their company. Multiple people suggested that digital learning would be a great platform for safety training programs such as OSHA fire safety training, or Lockout Tagout training. Also they suggested using digital learning as a pre-employment assessment for job placement within a company.

3. What virtual reality simulations would be valuable in pre and post-employment?

The third question focused discussion on the uses and benefits of virtual reality simulations in manufacturing education. Participants seemed excited about the use of virtual reality technology in the educational training and post-employment applications as well. There were three main suggestions for uses of virtual reality for manufacturing. First, it was suggested that simulations could be used pre-employment to allow students and potential employees to take virtual tours of the company plants and learn about the company and manufacturing jobs in general. Using simulations for these tours would provide greater accessibility to students and would not require safety precautions for visitors in the facility.

The second suggested use for virtual reality in manufacturing was to use simulations to provide safety and awareness training for employees. Simulations could be used to train employees to see problems in an environment, such as OSHA safety infractions, before they are out in the workplace. Also virtual reality could be used to simulate what would go wrong if safety procedures are not followed appropriately.

The last application for virtual reality discussed in this forum was use simulations to train employees to use new pieces of equipment. Employees could have one-on-one interaction with the equipment and they could practice using the machine, reading its meters, and troubleshooting problems that may occur, without the consequence or cost of real machine problems.

Summary of Session Two

The group discussions from Session Two provided insight into the industry's opinions on current education curriculum, digital learning, and the use of virtual reality simulations both pre and post-employment. With respect to current educational curriculum, the participants had a large number of suggestions of content to add to the curriculum to improve the workforce and better meet the needs of manufacturing companies. Soft skill training was the most frequently discussed topic. Employers would like for the workforce to have some background training in soft skills such as communication, email etiquette, and teamwork. It was suggested that giving students more group projects could encourage development of some of these soft skills.

With respect to digital learning, participants were overall very optimistic about the opportunities it can bring. One participant stated that "in order to meet the needs of industry in a global and dynamic economy, virtual and digital learning platforms can be used to provide learning accessibility and cost savings for both the student and employees." The industry representatives praised digital learning for its versatility, accessibility, consistency, and cost effectiveness.

Lastly, the groups discussed potential uses for virtual reality simulation both pre and post-employment. Overall, participants were excited about virtual reality and came up with some great applications for it in

the manufacturing field, such as virtual plant tours, safety and awareness training, and new equipment training. The use of virtual reality seemed to be a cost effective mechanic that could allow one-on-one interaction with real world scenarios that could help improve workforce readiness for the manufacturing industry.

CONCLUSION

The participants and organizers of the CA2VES Sustainable Manufacturing and Workforce Forum ended the day optimistic about the possibilities for improvement in overall workforce education and preparation in South Carolina. This forum was an opportunity for industry partners to give their input, and raise awareness of the constraints manufacturers face with respect to the local workforce.

The forum was well received by participants and generated many great ideas on how to improve the South Carolina workforce. The small group discussions allowed participants to share their ideas with other industry representatives and to hear other people's perspectives on these important issues. This event enabled important conversations between companies and local workforce development organizations in order to better the manufacturing workforce of tomorrow. CA2VES and its partners plan to host more of these forums in the future with educators, industry representatives, and local legislators to discuss the challenges that face today's workforce and to plan for the future of manufacturing in South Carolina.