Time to Add the 4th R - Reading, wRiting, aRithmetic and algoRithmic thinking - Our Liberal Arts Majors Get IT (Information Technology)!

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Abstract

On one hand there is an ongoing debate on the value of a Liberal Arts education (in a world where the majority of new jobs require science, technology and math skills) and on the other hand employers recognize the importance of liberal education and the liberal arts [1]. Eighty percent of employers agree that, regardless of their major, every college student should acquire broad knowledge in the liberal arts and sciences [1]. While employers value a four-year college degree, more than half had trouble finding recent graduates qualified to fill positions, as the graduates lacked basic workplace proficiencies: adaptability, communication skills, and the ability to solve complex problems [2]. Colleges are not adequately preparing students in written and oral communication, decision-making, and analytical & research skills. Based on an exhaustive report [3], Porter [4] and Perez-Pana [5] claim that American adults lag well behind their counterparts in most other developed countries in the mathematical and technical skills needed for a modern workplace. Perez-Pana cites a statement from Arne Duncan, the education secretary, saying that the findings "show our education system hasn't done enough to help Americans compete - or position our country to lead - in a global economy that demands increasingly higher skills." Meanwhile, a national educational movement in computer coding instruction is growing at Internet speeds [6] in schools across the US and many consider coding more like a basic life skill (which might someday lead to a great job) rather than an extracurricular activity. This research uses the App Inventor (AI) to narrow the skills gap and increase the versatility of our liberal arts college students to make them active creators of technology and "digitally" ready for the workplace rather than just being passive consumers of technology.

1. 21st Century Skills

The advent of Information and Communications Technology (ICT) has made manufacturing and other low-skill tasks in the services sector highly automated; diminishing the need for routine cognitive and craft skills. Today in addition to the "occupation-specific" or "domain-dependent" skills, employers are also demanding:

- "generic" skills such as information-processing skills (including literacy, numeracy and problem solving skills) and
- "soft" skills such as interpersonal communication, self-management, and the ability to learn new skills.

What can we educators do to enable our (liberal arts) students to master these 21st century skills using the tools currently at our disposal? Is there a way to enrich our students with generic and soft skills with contemporary devices?

2. Mobile "Apps" (Applications) Development

Sales of hand-held devices (smartphones, tablets and phablets) are exploding. These on-line, social, and increasingly mobile computing devices are ubiquitous and offer visual, tactile and personal experiences as never before. Mobile devices in our education landscape are drastically changing the ways we teach and learn. These devices are digital, portable and provide multimedia capabilities to access the Internet. Our students today are "Digital Natives" – a term coined by Mark Prensky in 2009 –"native speakers" of the digital language of: computers, video games and the Internet. To speak the language of these "natives" and to engage them we plan to use an innovative approach - mobile application development, so that they can experience mobile technology as creators of technology, and not just as consumers. Aside from the immense benefits, this approach is burdened with several challenges. Negative perceptions around the use of mobile devices (especially phones) in educational settings; safety, security and privacy concerns; and lack of training opportunities for educators to incorporate mobile learning in their classrooms further thwart innovation. To address these challenges and to overcome the skills gap in our students we decided to design a new course for our liberal arts students which not only provides value to their education but also enhances their technology skills and makes them digitally ready as desired by the employers.

A new course, Mobile Apps Development, was designed and offered for the first time for students who did not have any knowledge of computer programming or any experience with creating technology for mobile devices. This course had no prerequisites and was intended for students who were not majoring in Computer Science. In fact, we had students majoring in various liberal arts disciplines: Creative Writing, Criminal Justice, Allied Health and Radiological Science, Biology, Chemistry, Psychology, Education, Finance, Sports Administration, etc. taking this course. Students ranged from freshmen to seniors and all in between. This course tapped into modern technology developments for mobile devices and was designed to engage our students in a way more relevant to their own digital lives – which is being online, social and highly mobile! Our digital natives got a chance to unleash their creativity, evolve from "consumers" to "creators" of technology, gain algorithmic thinking skills, and participate in GRADE (explained below).

3. Algorithmic Thinking and GRADE with App Inventor

Algorithmic thinking falls under the realm of both the generic and soft skills (mentioned earlier) and is recognized as a key skill set for all 21st century learners. Using App Inventor our students began to acquire skills (in a fun and exciting way) as they learned to "program" their mobile devices without any programming! Our students started creating very simple Apps – the first one being a "warm-up to the environment". Slowly, we started teaching some programming concepts and progressing students towards more complex and difficult apps and finally we transitioned them to create "real-world" apps which could be useful to others. We emphasized student spend considerable amount of their time in Algorithm development – write pseudo code in English language before even trying to program their Apps. This helps them to think about the functionality of their apps and try out some of the features (by hand) they intend to design before they actually implement the code.

During this course our students gained an insight into **GRADE**:

- **G**eneralization - realize that a solution to a problem may be used to solve a whole range of related problems.
- **R**euse and Pattern Recognition - appreciate that a new problem is likely to be related to other problems the learner has already solved.
- **A**bstraction - see a problem and its solution at many levels of detail.
- **D**ecomposition - understand that solving a large problem involves breaking it down into a set of smaller problems.
- **E**xciting Algorithm Development - think about tasks as a series of steps.

3. Conclusions

Our students realize that programming is everywhere and has become a part of many jobs and thus are curious to explore computing with mobile devices using GRADE with AI. AI helps them gain practical skills, foster creativity, entrepreneurship, idea formulation and acquire problem solving skills so vital in today's economy.

4. References

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