15 Years of Cad Teaching in Jordan: How Much Has Been Accomplished?

A comparative analysis of the use of CAD in architectural schools between 1997 and 2012

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Abstract. The paper reports on a study which examines the evolution in architectural education trends arising from the changes brought about by both Socioeconomic Factors and the implications of CAAD in the last 15 years in Jordanian universities. The findings reflect the views of thirteen (13) architecture faculties/schools through a nation-wide questionnaire survey conducted in the spring of 2012. The survey was structured to cover both private and public universities in Jordan, represented by faculties of engineering, architecture and design. Structurally, the main findings of this study are summarized under six areas, namely: 1) General Students’ Information, 2) Demographic and Socioeconomic Factors, 3) CAD Competences amongst both Staff and Students, 4) Program of Study and CAD Courses, 5) Overall Satisfaction of CAD Courses and Training, 6) CAD and Social Networks. The majority of student respondents were females (144) (53.3%). The top laptop brands used were HP (17%) Toshiba (12.2%) and Dell (7.8%). The CAD packages found to be most highly used throughout universities were AutoCAD, 3D Max, Sketch-up, and Adobe Suite. The importance of new technologies, electronic book, and the social network aspects in enhancing CAD and 3D modeling software integration with the design studio was affirmed yet no relationship to the gender was noted.

Keywords. CAD Integration, Socioeconomic Factors.

INTRODUCTION
Technology is often considered a facilitator and much more as an expediter, a way of surpassing our natural limitation. At universities and in CAD labs or studios, educators employ technology with the hope that it will enable students to learn more effectively and teachers to teach more effectively (Guidry, K. R., and Brcka Lorenz, A. 2012). Hence, to evaluate computer utilization by architecture schools with regard to the massive social and economic changes, assessments at different levels must be made considering all aspects of computer involvement and integration, in tandem with the institution, staff and students. Although empirical research is often mixed or contradictory with respect to technology’s effectiveness and the reasons for that effectiveness (Robert M 2004), undergraduates expect faculty to use technology and use it well.
In such research, the program structure involving computers must be addressed in architecture, design or urban planning, etc... (QaQish 1997). The research hypothesis is that geography, economics, national integration, politics and social development may be factors that could have an impact on CAD teaching in relation to both graduate market trends/needs, and the overall institutional status. It is expected that this area of research could shed light on other areas of CAD teaching that have been neglected yet may have had strong implications on CAD integrations. Jordan is a good example to explore and investigate since it has an exceptional diversity within it that has marked its development in architectural education.

This paper investigated several variables such as skills, knowledge, and effectiveness, of both students and staff towards CAAD in relation to the above factors—in tandem with the market needs among schools of architecture in Jordan. The current on-going project surveys universities and students across all socioeconomic strata and urban and rural areas and some isolated locations in Jordan. The intention of this survey was to allow widespread comparison of differing aspirations and expectations, on the one hand, from students, and on the other hand, from staff, parents, community and the practice sector of architecture regarding CAAD/architectural education.

**LITERATURE REVIEW**

An increasing body of research has linked student engagement with technology (Guidry, K. R., and Brcka Lorenz, A. 2012). A study by Hu and Kuh (2001) found that students attending more “wired” institutions not only used computers more frequently but reported higher rates of engagement than students at other institutions. Other studies have found a positive relationship between a student's use of technologies and self-reported gains in science and technology, vocational preparation, and intellectual development. Data from NSSE have repeatedly indicated that students use of information technology is not only strongly associated with measures of learning and engagement such as academic challenge, active and collaborative learning, and student-faculty interaction, but also that students who more frequently use technology report greater gains in knowledge, skills, and personal growth (QaQish 2001).

Research in many instances has linked technology with educational outcomes and learning (QaQish 1998). For decades a number of researchers have argued convincingly that any link between technology and learning is indirect at best. The United State’s federal government’s (now-defunct) Office of Technology Assessment concluded an argument that it is becoming increasingly clear that technology, in and of itself, does not directly change teaching or learning. Rather, the critical element is how technology is incorporated into instruction and class rooms were examined in this study.

Richard Clark, Kenneth Yates, Sean Early, Katherine Moulton, and Ra’Ed QaQish provided an excellent brief overview of these arguments, while Clark provided an in-depth, book-length review. These arguments typically focus on the pedagogical changes that inevitably accompany the introduction of technology into the class or classroom, asserting that pedagogical changes are responsible for changes in learning, not the technologies themselves.

One explanation for the evident link between technology use and positive educational outcomes might be that use of technology often increases time on task. A recent meta-analysis commissioned by the U. S. Department of Education examined the relationship between learning outcomes and online and hybrid courses. The authors concluded that both online and hybrid courses have a significant positive impact on learning outcomes, with hybrid courses having a greater impact (Guidry, K. R., and Brcka Lorenz, A. 2012).

In his 2004 analysis of students’ online habits, NSSE researcher Thomas Nelson Laird concluded that “students who spend more of their time online for academic purposes are likely to benefit to a greater degree from their collegiate experience than other students.”
Guidry and Brcka Lorenz suggested other means to explore the relationship between academic technologies and educational outcomes is to examine the different ways that students and faculty in different academic disciplines use technology. In American higher education, academic disciplines and discipline-based departments are “the foundation of scholarly allegiance and political power, and the focal point for the definition of faculty as professionals” (Gappa 2007).

Corrective relationship forms how architectural faculties conceive of knowledge and how they teach new CAD integrated subject areas, how they use technology in their teaching as new paradigms, and the impact of technology on their student as a novel outcome.

THE OBJECTIVES OF THE STUDY
The nation-wide questionnaire survey carried out an in depth investigation on some new areas and important issues of a new changing CAAD teaching environment, acknowledging a variety of measurable and objective survey styles. The main objectives for the use of computers in architectural education survey recognized and sought after were namely:

1. To identify the main key socioeconomic factors that control the extent of association between CAD and architecture/design.
2. To identify common trends in Architecture schools across the Jordanian governorates to establish whether there are any associations between them.
3. To provide an insight on the recent development in architectural education when integrated with CAD education and schools of architecture in Jordanian Universities.
4. To explore the integration of CAD into architecture schools by examining the utilization of CAD across the curriculum of architecture in Jordanian universities, whether it is a subject-based or a design-based course.
5. To examine and update new trends in relation to CAD integration and employment in the curriculum.

THE STRUCTURE OF THE NATION-WIDE QUESTIONNAIRE SURVEY
The questionnaire was divided into six sections:

A) The first section gathered general information about the participating students. It consisted of six main questions, collecting information ranging from the university name, the name, address, email of person answering the questionnaire (optional), gender (male/female), age, current academic year, cumulative grade point average. This section was correlated with other sections in the questionnaire; i.e., the relationship between the age and the CAD competency introduced was examined.

B) The second section gathered information about the demographics and socioeconomic factors. It consisted of five main questions, collecting information ranging from the name of governorate, proximity to university, methods of commuting, daily expenses or stipend, access to a computer with OEM (Original Equipment Manufacturer) CAD programs and software.

C) The third section gathered information on the overall CAD competency amongst students and staff. It consisted of five principle questions, collected information about the time consumed by students in training, competency in CAD and 3D modeling, the most CAD software used by students, overall staff competency, different CAD courses offered at the department, the current status and future expectations in regards to the importance of CAD in the curriculum.

D) The forth section gathered information on the program of study and CAD courses offered at the students department. It consisted of five questions, all of which collected information about the current and future situation in the department in relation to CAD importance in the curriculum. This section gathered information about CAD training courses, the standard of which CAD is being integrated and used with design. Finally the numbers of teaching CAD hours offered to students relevant to each course were also examined.

E) The fifth section gathered information about the overall satisfaction of students with CAD equip-
Software and laboratories in the department, and the current and future departmental policies.

F) The sixth section was dedicated to the use of social network and new technologies in relation to CAD.

THE DESIGN AND METHODOLOGY OF THE NATION-WIDE QUESTIONNAIRE SURVEY

Participants and procedure

A nation-wide online survey was distributed as the method to explore computers’ use at schools of architecture in Jordan. Data collection was conducted via an online questionnaire. A cover letter was sent along with the survey link to deans, heads of departments, professors and students at the selected universities. A voluntary random stratified sample was drawn from the twelve governorates of Jordan (Amman, Irbid ... etc.). The 12 governorates’ stratified sample was represented by 13 academic institutions described in Figure 2. The majority of respondents (98%) were undergraduate students at the bachelor level. The study examined the responses from an online survey entitled “15 Years of CAD teaching in Jordan: How much has been accomplished?” The survey was administered in the spring of 2012, seventeen Jordanian universities (17) were invited to participate in the survey, but only thirteen (13) Jordanian universities responded. Out of the 13 participating universities, six are public institutions, six are private profit institutions, and one is not-for-profit institution (Figure 2). Two other institutions voluntarily participated, namely Alqudus College, and Khawarzmi College. The final online data file comprised of 276 responses from students, answering the survey of which a set of twenty six (26) questions focused on technology and its relation to CAAD. Due to the sample being one of convenience, results may not represent the Jordanian population in a statistically accurate manner. However, stratification was conducted to ensure maximum accuracy and representativeness.
The survey originally intended to cover all departments of architecture, design, art and visual communication in Jordan. The CAD teaching in Jordan analytical Survey 2012 is still an ongoing survey, in which an additional four universities are expected to participate in the Fall/Winter 2012, and perhaps additional students may also wish to participate from previous universities.

This is the first ever online survey to be carried out amongst universities in Jordan, in the field of architecture and design, the complexity of the survey rested in the following facts which ultimately endured lots of hardship and extensive hours of follow up:

1. The proximity and scattered distance between universities in Jordan was a major obstacle; although it’s an online survey yet a one to one follow up with both students and staff was carried out over a whole month to insure high respondent rate.

2. The formalities of some government universities delayed the whole process of participating in the survey, in fact some didn’t response as a result.

3. English language barrier had made it impossible for many students to participate; more emphasis was directed towards students with good command of English. This sheds light on the very important issue of language and CAD. Is English an important factor in CAD?

Consequently, for time limitation of this paper, the current analysis had included only 270 responses from the 13 institutions. The majority of students who responded were females (144) (53.3%), with males (126) forming (46.7%) (Figure 3; the majority of that age-group was between 21 to 23 years (Figure 4), mainly majoring in architecture, and architectural engineering. It may indicate that this age group is simply either more or responsive for future online surveys, is indeed eager to provide good feedback on CAD issues, and also should be considered a good target group for future research. The responses for fields of study marked in this survey were namely: architecture, architectural engineering, interior architecture, interior design, graphic design and visual communication.

The research sample was representative of the university’s profile in terms of gender, age, field of study, level of study, campus location (governorate) (Figure 5), financial situation, and social status. The analysis employed simple controls because this study seeks to understand the student and CAD experiences without making predictions or describing complicated causal relationships. Because, the list of technologies should not be exhaustively long, surveys must remain brief and focused for people to respond. It is intended at this point to pursue the same online research as a disciplines exploring further issues to perform complex analyses, yet the author sought to make this study readable and easily applied to practice. Social, cultural, and economic causes are interesting and important and were thus explored, some other areas of politics were too complex and beyond the scope of this study.
Figure 6 (left)
The relationship between owning a laptop and the hours spent.

Figure 7 (right)
Laptop brand in relation to students' numbers.

Figure 8 (left)
The relationship between owning a laptop and competency in AutoCAD.

Figure 9 (right)
Laptop brand in relation to students' numbers.

Figure 10 (left)
The most used programs amongst students who own laptop.

Figure 11 (right)
The relationship between OEM AutoCAD programs and students' competency.
THE NATION-WIDE QUESTIONNAIRE SURVEY RESPONSES

Study analysis and results

The nation-wide questionnaire online survey of CAD invigorated esteemed and high interest among schools and academics in Jordan and the response as discussed earlier in this paper was much greater than the author had originally anticipated. A genuine interest in CAD was noted among all respondents. Since this was an online survey, extra and ample care by staff and students was considered; staff spent extra time making sure students took the survey; it was an outstanding team effort and work by all means. The responses in answering the questionnaires were also regarded as a positive sign amongst educators and universities to assist understanding the new challenges of CAD integration in teaching.

Result 1: The relationship between owning a laptop and both competency in CAD and the hours spent a day in using/training on CAD or 3D modeling software

When students were asked whether or not they owned a laptop, 94.8 % answered yes, while 5.2 % answered no. Out of the 13 brands included in the survey (Figure 7), HP ranked 1st (17%) while Toshiba ranked second (12.2%), and Dell came third (7.8%). Both Apple and Sony came almost in forth (3.7% - 4.4%), indicating a rise in Apple and Sony users in Jordan. It’s important to mention that the highest percentage amongst owned Laptop (42.6%) was that of unknown brands (Generic / OEM). It’s clear that the culture of purchasing and owning laptops amongst students in terms of brands and CAD systems is evolving and more interest in market trends needs for CAD is making its way to affect education in Jordan. It was not clear whether or not owning a laptop increase the hours spent on CAD software though more than 40% of the responds indicted that they spend between 3-6 and more hours training on CAD (Figure 6). More statistical analysis will be submitted in future papers in that regard in an attempt to substantiate this argument.

There was a positive association between owning a laptop and the students’ competency in AutoCAD (Figure 8). However, when more tests were carried on other software (Figure 9), a weak association was found. It is thus noted that there are no strong relationships between having a laptop or access to technology and competency in CAD (further investigated areas are beyond the scope of this paper). This clearly identifies the positive factors of previous CAD training as as standalone factor with which students may in fact increase their competency in any single software when they own their laptops.

When students who owned a laptop were asked whether or not they purchased (bought), installed, or downloaded any original CAD or 3D modeling software on their laptop or desktop, 17.6% of the students answered yes, while 82.4% answered no. The culture of OEM software in Jordan is still very weak, and the copy rights issue is still almost neglected or inexistent at the homeowner (students) user level. Wide-ranging OEM culture awareness is
needed and must be carried out by CAD software companies.

17.4% of the students who owned laptops with a purchased OEM AutoCAD (totaling 41%) had indicated that they are excellent in using AutoCAD (Figure 11), again emphasizing a strong association between competency in CAD and OEM hardware and software.

**Result 2: The relationship between the most used CAD and 3D modeling software and design problem.**

When students were asked to explore their experiences at school once given a design problem, during which CAD or 3D modeling software was used, out of the 8 common CAD packages brands included in the survey (Figure 12), AutoCAD ranked 1st in usage (71.9%) while Sketchup ranked second (10.7%), and Adobe CS5 came third (9.6%). ArchiCAD, Maya, Cinema 4D, and Revit Architecture forth (0.7-1.1%), indicating that AutoCAD is still the most powerful software in Jordanian universities.

It’s important to mention that the highest percentage amongst AutoCAD users were females (53.3%) (Figure 13). It’s clear that the culture of AutoCAD amongst students in terms of use, skills, and competency is shaping the way CAD affects the evolution of education in Jordan. Should Autodesk consider perusing research in Jordan, to shed light on future progress of AutoCAD in terms of way and means to integrate AutoCAD in the design methodology? It was clear that most students using AutoCAD had felt strongly about the fact that AutoCAD increases their design capabilities (Figure 13). More research must be done to verify these findings. To test this further, another strong association was found between the proximity of home from university and the competency in AutoCAD: students who live between 5-10 KM had indicated excellent use in AutoCAD (42.7%), while students who live between 1KM had suggested poor competency.

When students were asked about the importance of New Technologies, Electronic Book, and Social network aspects in enhancing CAD and 3D modeling software integration with the design studio, most students felt it was of a great importance (Figure 18-20). No relation was found in examining the gender difference in the same criteria (Figure 16-17).
Yet, when working on design using CAD and/or modeling, most students preferred their own personal laptop/desktop over the university desktop (Figure 17).

CONCLUSION
The most significant findings of this study are:
1. A strong tendencies amongst Jordanian Universities to get involved with CAD research. Responses from Government universities were higher than private, indicating a much more serious involvement amongst Government universities than private ones.
2. The architectural schools have not effectively introduced CAD course into the curriculum in the last fifteen years compared with CAD integration world-wide (QaQish, Hanna 1997),
3. The majority of student respondents were females (144) (53.3%).
4. The top laptop brands used were HP (17%) Toshiba (12.2%) and Dell (7.8%).
5. The CAD packages found to be most highly used throughout universities were AutoCAD, 3D Max, Sketch-up, and Adobe Suite.
6. The study has revealed weakness in CAD lab equipment’s as more students preferred their own laptops over universities’ computers.
7. The study revealed that most students were competent in CAD due to the fact they either were self-taught or had trained at a center indicating weakens in teaching CAD at universities.
8. The importance of new technologies, electronic book, and the social network aspects in enhancing CAD and 3D modeling software integration with the design studio was affirmed yet no relationship to the gender was noted.
9. The survey revealed that that there is a great since of enthusiasm and hope amongst the Jordanian universities. In fact, the respondents implied a great level of commitment to improve CAD in architecture school.

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