THE ROLE OF CASE IN SYSTEM ANALYSIS AND DESIGN COURSES

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ABSTRACT

This article discusses the role of computer-aided system engineering (CASE) tools in system analysis and design courses. It draws together findings from previous research with new findings on the role of CASE tools in systems development in IS departments in the United States. Based on these findings, a perceived gap exists between the use of CASE tools in the classroom and the use of CASE tools for real system development. In light of these findings, the authors call for a re-examination of the role of CASE tools in system analysis and design courses.

INTRODUCTION

The role of computer-aided system engineering (CASE) tools in system analysis and design courses needs to be addressed for many academic programs. System analysis and design courses are an important part of most curricula in information systems and computer science. In fact, four of the ten courses in the 2002 information systems model curriculum, developed collaboratively by Association for Computing Machinery (ACM), Association for Information Systems (AIS), and Association for Information Technology Professionals (AITP), deal with system analysis and design activities: IS 2002.7 Analysis and Logical Design, IS 2002.8 Physical Design and Implementation with DBMS, IS 2002.9 Physical Design and Implementation in Emerging Environments, and IS 2002.10 Project Management and Practice (Gorgone, Davis, Valacich, Topi, Feinstein, and Longenecker, 2002). The first of these courses specifically suggests the teaching of computer-aided system (or software) engineering (CASE) tools as a component of the topics to be addressed in the course. The popularity of CASE tools in system analysis and design courses is suggested by representatives from the educational sales divisions of Visible Systems, Rational Software, and Popkin Software (makers of Visible Analyst, Rational Rose, and System Architect, respectively). They indicated in telephone conversations with the authors that these CASE tool vendors are supplying their tools to thousands of educational institutions for classroom use. However, the value of teaching CASE tools in preparing students for work in the IS industry is questionable in light of the findings of recent industry practices.

BACKGROUND

CASE tools first gained popularity in the mid-1980s as automated tools to support the development of information systems (Martin, 1989). They were viewed primarily as tools to assist in the creation of programs and databases through the creation of diagrams to model objects and associations among objects. These diagrams included entity/relationship diagrams, data flow diagrams, structure charts, and program flowcharts to name a few. These were essentially the same diagrams that system analysts had been drawing by hand, but the CASE

tool could detect many inconsistencies and omissions that were difficult to detect manually and cumbersome to correct on hand-drawn figures. In subsequent generations of CASE tools, capabilities of the tools grew to support the entire development lifecycle so that CASE tools can now provide not only drawing tool support, but diagram generators, code generators, database generators, prototyping tools, version control tools, reverse-engineering tools, forward-engineering tools, query tools, and report generators (Satzinger, Jackson, and Burd, 2002). Today, CASE tools are still evolving to support growing trends such as the use of unified modeling language (UML), object-oriented analysis and design (OOA & D), and collaborative work-groups. As the feature sets and methodologies supported increase, the complexity of these tools continues to grow.

In the early and mid 1990's, several investigations into the adoption of CASE tools by organizations indicated that businesses were being slow to adopt CASE tools (Hughes and Clark, 1990; Nelson and Rottman, 1996; Henderson and Cooprider, 1990; Iivari, 1996). CASE tool vendors, aware of the reluctance of organizations to adopt their products, began evolving their CASE tools to better meet the perceived needs of businesses, leading to predictions that CASE tool adoption would eventually become widespread (Hayley and Lyman, 1990; Leach, 1993; Watz, 1993). Perceiving the potential benefits of CASE tools, and anticipating the growth of CASE tool adoption, educators began integrating CASE tools into system analysis and design courses, and into model curricula such as the AITP model curriculum (Cougar, Davis, Dologite, Feinstein, Gorgone, Jenkins, Kasper, Little, Longenecker, and Valacich, 1995).

Research by Heiat, Heiat, and Spicer (1995) suggested that education had preceded businesses in the acceptance of CASE tools, as businesses did not consider CASE tools skills to be as important as educators did. McLeod (1996) found that system analysis and design instructors considered the inclusion of a CASE tool to be the most important supplemental material that could be provided with an analysis and design textbook. The continued perception of the importance of CASE tools to educators is illustrated by findings that CASE tools are ranked 4th in importance among the various tools, techniques, and methodologies covered in system analysis and design textbooks—by comparison, the SDLC ranked 9th, RAD ranked 18th and UML failed to make the top 20 (Misic and Russo, 2000).

Recent research dealing with complex technological innovations has addressed the need for training in the use of the innovation in comparison with the importance of formal education within the subject area domain (Marshall, Rainer, and Morris, 2003). Researchers found that when comparing the performance of groups using a CASE tool, subjects with little formal IS education and a longer training period (4 hours) were able to use the CASE tool more effectively than subjects with advanced IS education and a short training period (1 hour). Subjects with little formal IS education and a short training period (1 hour) were not able to effectively use the CASE tool at all (Marshall, et al., 2003). Given the limited nature of the research design task, the research tends to support the intuitive belief that to effectively use a CASE tool for "real-world" system development projects requires extensive training in the use of the CASE tool for individuals to gain advantage from the training.

The perceived benefits of using CASE tools are compelling—improved system quality, reduced development costs, shortened life cycle development times, etc. Clearly these benefits should be of great value to organizations since failed system development projects are costing American companies an estimated $140 billion per year (Thorp, 1999). Recent research, however, has called into question whether or not CASE tools have actually been able to deliver on these potential benefits (Glass, 1999; Sharma and Rai, 2000). Without the realization of these benefits, the widespread adoption of CASE tools by organizations is unlikely to occur. If businesses are not using CASE tools, the appropriateness of incorporating CASE tools in system analysis and design courses is debatable. If businesses are using CASE tools, then the way that they are using the CASE tools should inform the teaching of CASE within system analysis and design courses.

SURVEY

With the assistance of the Association for Information Technology Professionals (AITP), data was gathered from IS professionals in the United States concerning the use of CASE tools in their organizations. Potential respondents were randomly selected from the 2002 AITP membership roster. Of the 965 mail surveys sent out, 83 usable responses were returned for a response rate of 8.6%, which is consistent with other single, blind mailings when follow-up contact is not allowed (Bhattacherjee, 2002; Heiat, et al, 1995). Respondents were IS professionals representing numerous industries, such as healthcare, manufacturing, and consulting, within the United States.

Respondents were asked to indicate whether or not CASE tools were used in their organization (see Appendix A). If respondents indicated that CASE tools are used, then they were asked to specify the stages of the system development life cycle that CASE tools were used to support. For the purposes of this study, the system development life cycle was defined as: system analysis and feasibility study; system design; system development (e.g., code generation, physical data creation, system component integration, etc.); testing and implementation; and, maintenance and enhancement. The opportunity to indicate "Other" specific phases of the system development life cycle was available to the respondents. This particular definition of the system development life cycle was drawn from previous research to facilitate comparability (Clark and Hughes, 1990). Finally, respondents were asked to identify the CASE tool products they use, and specify the phases of the system development life cycle that they support with the CASE tool products.

RESULTS

Only about 36% of the respondents indicated that their organizations' use CASE tools to support their system development activities. Within the CASE tool users, the use of CASE tools by system development life cycle phases is presented in Table 1. The system development phase of actual system component construction and generation was the system development life cycle phase that was most commonly supported by CASE tools (77%). The second most commonly supported life cycle phase was system design (67%). Testing and implementation is supported with CASE tools by 60% of the respondents. Only 57% of respondents support the maintenance and enhancement phase with CASE tools, while just over half of the respondents (53%) support the system analysis and feasibility study phase. Seven percent of the respondents indicated "Additional Documentation" as an "Other" system development life cycle phase that is supported by CASE tools.

Specific CASE tool products included in-house developed tools and commercial products from vendors such as Oracle. Some of the CASES tools used by respondents were System Architect, Sybase Power Designer, WinA&D, Lansa, and Oracle Developer. Of the specific CASE tools used by respondents, only one product was reported to be used by more than 2 respondents. Twenty-three percent of the study's CASE tool users reported the use of Rational Rose.

TABLE 1
SYSTEM DEVELOPMENT LIFE CYCLE PHASES SUPPORTED WITH CASE TOOLS

Life Cycle Phase	CASE Support
System analysis and feasibility study	53%
System design	67%
System development	77%
Testing and implementation	60%
Maintenance and enhancement	57%
Other	07%

DISCUSSION

The findings of this study indicate that the role of CASE tools in system analysis and design courses needs to be re-examined. CASE tools were incorporated into system analysis and design courses, and encouraged by models such as the AITP model curriculum, with the expectation that organizations eager for the potential benefits that CASE tools can provide would quickly adopt CASE tools in a widespread manner. Research findings from 1990 (Hughes and Clark, 1990), 1996 (Rai and Patnayakuni, 1996), 1997 (Nord and Nord, 1997) and the present indicate that the widespread adoption of CASE tools that was predicted by previous research has not occurred. The finding of the current study that only about one-third of the surveyed companies are using CASE tools is comparable to the results that previous studies obtained a decade ago.

Among CASE tool users in the current study, the most common use of CASE tools is to support the system development phase in which the actual construction of system components is performed. This suggests that system analysis and design courses that do teach CASE tools should concentrate on the use of CASE tools during this phase of the development process if they are to teach students the skills that will best serve them in a business environment. However, an examination of popular system analysis and design textbooks (e.g., Dennis and Wixom, 2003; Dennis, Wixom, and Tegarden, 2002; Kendall and Kendall, 2002; Hoffer, George, and Valacich, 2002; Whitten, Bentley, and Dittman, 2000) indicates that this phase of the development life cycle receives a relatively minor emphasis in these courses.

Most of these textbooks devote 10% or less of the page count to covering the construction of system components. The most heavily emphasized area seems to be the system analysis, or requirements gathering, phase. The findings of the current study indicate that these activities are among the ones that are least supported with CASE tools by CASE tool users.

These findings coupled with research by Marshall et al. discussed above raise an additional issue for the teaching of CASE tools. If CASE tool training is only effective in terms of promoting improved performance when the training is extensive, then the value of CASE tool training is questionable in courses that cannot devote a significant amount of time to the teaching of the tool. Further, the value of training in one CASE tool has not been shown to provide performance improvements when attempting to use a different CASE tool. Given the wide range of CASE tools identified by the respondents in this study, the probability of a system analysis and design course teaching the same CASE tool that its graduates would use in the workplace is not promising, especially considering that only about one-third of the IS organizations even use a CASE tool at all.

CONCLUSION

The current research investigated the use of CASE tools by IS professionals in the United States. The finding that only about one-third of respondents' organizations use CASE tools to support the system development life cycle is consistent with findings from a decade ago, indicating that the expected growth in CASE tool adoption has not occurred. Since the inclusion of CASE tools within system analysis and design courses was predicated, at least in part, on the belief that there would be substantial growth in CASE tool adoption, the role of CASE tools in system analysis and design courses needs to be reconsidered.

Organizations that do use CASE tools use them more dominantly in areas that do not appear to be emphasized in typical system analysis and design courses. This raises the concern that even for the minority of students that will work for an organization that uses a CASE tool, the skills being taught with the CASE tool in the classroom are not likely to match the skills required to use the CASE tool in the workplace. Based on these findings, to give the students the most usable skills with CASE tools, training with the tool needs to be extensive and it needs to focus on the use of the CASE tool to create system components such as database structures and program code. This will likely be difficult for most system analysis and design courses to accommodate since these topics are typically a minor emphasis.

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APPENDIX A
CASE SURVEY

Computer Assisted Design/Development Questionnaire

1. Are computer assisted design and / or development tools currently used in your organization?
   ____ Yes ____ No

2. In which phases of the system development life cycle are computer assisted tools and techniques currently being applied in your firm? (Given that there are multiple classifications of the phases of the life cycle, please the use the following breakdown. Please check all that apply.)
   ____ (1) System analysis and feasibility study
   ____ (2) System design
   ____ (3) System development (code generation, physical data creation, system component integration, etc.)
   ____ (4) Testing and implementation
   ____ (5) Maintenance and enhancement
   ____ (6) Other, Please specify _____

3. Please list the product(s) currently in use in your firm, circle which phase(s) of the system development life cycle in which they are used, and list the position or title of user (or class of users). Please refer to question #10 for the appropriate life cycle number.

PRODUCT NAME	LIFE CYCLE PHASES
_____	1 2 3 4 5 6
_____	1 2 3 4 5 6
_____	1 2 3 4 5 6
_____	1 2 3 4 5 6
_____	1 2 3 4 5 6
_____	1 2 3 4 5 6
_____	1 2 3 4 5 6
_____	1 2 3 4 5 6