

## The Role of Building Information Modeling (BIM) in Education and Practice

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# The Role of Building Information Modeling (BIM) In Education and Practice

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## ABSTRACT

### **Purpose**

The purpose of this paper is to present the findings of a graduate thesis study on the Role of Building Information Modeling (BIM) in Interior Design education and the professional design industry. The research model was developed in the Spring 2009 semester and implemented in the Fall 2009 semester.

### **Literature Review**

The National Building Information Model Standard Project Committee (part of the National Institute of Building Sciences) defines BIM as:

*... a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition.* ([www.buildingsmartalliance.org/index.php/nbims/about](http://www.buildingsmartalliance.org/index.php/nbims/about))

While an overwhelming body of literature on BIM technology exists in the architecture, engineering, and computer fields, very few papers have explored BIM in Interior Design. This study was modeled after the exploratory research done by Professors Julie Temple and Holly Cline, Radford University, entitled, *Integrating Building Information Modeling (BIM) Technology into Interior Design Curriculum: The Reality of Technology*. Results and findings from *DesignIntelligence's 2008 and 2009 Technology Surveys* were also used in developing the research model.

### **Methodology and Findings**

The authors explore BIM adoption in design firms and BIM integration in academic curricula to determine: 1) if a gap exists between formal BIM education in academia and the technology adoption in design firms and 2) the perception in each group of who is responsible to close any gaps. Through two online surveys, the authors explore the attitudes, use, and requirements of BIM in both design firms and academia.

The first portion of the research consisted of curricular analysis of 33 CIDA accredited Interior Design programs representing ten states, (from Florida to New York). This information, when combined with the initial results of a questionnaire distributed to full-time and part-time faculty at CIDA accredited schools shows that eight out of every ten schools researched don't offer any BIM instruction

Findings from questionnaires to academia, architects, and interior designers from the Washington DC metropolitan area show that:

- 70% of designers use BIM software on projects
- A gap exists between formal BIM education in academia and the technology adoption in design firms
- Over a third of programs anticipate adding BIM
- Practitioners are most likely to utilize BIM in the design development and construction documents phases of design
- Academia and practitioners believe they share the responsibility for teaching/training BIM.

### ***Relevance to Interior Design***

This research is significant to design educators because it provides both current and future adoption trends in CIDA programs. This information provides a baseline comparison for programs considering modifications to their design technology curricula. The research also explores how industry uses BIM, which is helpful in developing learning objectives for new and existing courses. Finally, the research is significant to interior design firms because it identifies the extent current and planned BIM adoption at CIDA programs in the regions surveyed.

## NARRATIVE

### ***Purpose***

This research explored the adoption of Building Information Modeling (BIM) by design firms and the integration of BIM into academic curricula to determine the following: 1) if a gap existed between formal BIM education in academia and the technology adoption in design firms, and 2) the perception of each group of who was responsible to close any gaps.

This study is intended to serve as a tool for interior design educators to use in future modifications to Interior Design program courses and to inform design firms and other firms that utilize BIM technology in their design projects. It is significant to design educators because it provides both current and future adoption trends in interior design school programs. It is significant to interior design students because it highlights CIDA accredited programs that offer courses in BIM technology. The research also explored how industry uses BIM, which is helpful in developing learning objectives for new and existing courses. Finally, the research is significant to architecture and interior design firms because it identifies the extent of BIM adoption and planned adoption at school programs in the regions surveyed.

### ***Literature Review***

The topic of BIM has only recently been addressed by the Interior Design Educators Council (IDEC). A panel discussion on BIM was held at the 2008 Annual IDEC conference in Canada, (Crompton & Miller), and in October an exploratory study on BIM (Temple & Cline) was presented at the South Regional IDEC Conference 2008 in Alabama.

In the fall of 2008, an internet search of "BIM" showed that the interior design profession is lagging behind the architecture profession regarding information and research on BIM usage. As of the spring of 2009, no thesis or dissertations were found in interior design regarding BIM technology. The following are findings from the online web search:

- A general search on "BIM" using [www.Google.com](http://www.Google.com) produced over 1,900,000 hits.
- A website dedicated to standardizing BIM, (National BIM Standard, a buildingSMART Initiative). It was the third item listed in a "Google" search of BIM.
- American Institute of Architects (AIA)- 2,980 hits
- American Society of Interior Designers (ASID)-1hit
- International Interior Design Association (IIDA)-0 hits

The overwhelming body of literature on BIM technology was found in architecture and computer sources. The authors' study of BIM was modeled after the exploratory research done by Professors Julie Temple and Holly Cline, Radford University, entitled,

*Integrating Building Information Modeling (BIM) Technology into Interior Design Curriculum: The Reality of Technology* as published in South Regional IDEC Conference Proceedings 2008. The purpose of their exploratory study was to assess design educators and practitioners' use of and attitudes towards BIM.

### **Methodology and Findings**

The research design involved three methods: curricula analysis, email survey, and two online questionnaires.

The curricula analysis included an online website search of CIDA accredited interior design program websites. Curriculum and course schedules from a total of thirty-three (33) undergraduate programs were analyzed in the spring of 2009. Appendix A shows the thirty-three (33) CIDA approved schools that were analyzed. The email survey consisted of one question to follow-up on the curricula analysis. It was sent to the point of contact listed for each of the targeted 33 schools on CIDA's website.

Curricula Analysis and Survey Results:

Refer to Appendix A for complete results of the online search and email survey by school.

- 79% don't offer any BIM instruction
- 21% offer BIM instruction

The two online questionnaires were created and posted on [www.surveymonkey.com](http://www.surveymonkey.com). The first questionnaire was to interior design professors, and the second one was to interior designers and architects. A personal email with the survey link was sent to 74 points of contact for schools along the east coast of the US as listed on CIDA's website. A message with the survey link was also placed on two list serves for IDEC's South and East Regions with memberships of 166 and 88 respectively.

Questionnaire results from interior design professors (n=55):

- 85% of respondents think there is a need to offer BIM software courses to interior design students
- 64% of respondents agreed with the statement, "It is academia's responsibility to prepare students to work with BIM software, while
- 70% agreed with the statement, "It is a design firm's responsibility to train employees to work with BIM software"
- For respondents that currently offer a BIM course, over half combined BIM with an existing course, almost a third added BIM as a new course, and 17% replaced an existing course with BIM

The questionnaire to practitioners was distributed three ways:

1. A personal email was sent to 107 American Society of Interior Designers (ASID) professional members from the Washington Metro Chapter as listed in the

- membership director of the ASID website, <http://www.asid.org/>
2. Another personal email was sent to 33 International Interior Design Association (IIDA) members (who had not already received the ASID email and worked for commercial design firms) from the DC Metro Chapter as listed in the membership directory of the IIDA website, [www.iida.org](http://www.iida.org).
  3. A third personal email was sent to six design/architecture firms in the Washington DC area that hold BIM licenses.

Questionnaire results from interior designers and architects (n=136):

- Almost 70% of respondents (28% architects and 21% interior designers) are currently using BIM software on projects. Appendix B shows the breakdown of respondents.
- A third of firms have almost half of their contracts with a BIM requirement

### ***Summary and Conclusions***

The study findings demonstrated a gap between what educators believe should be offered to students and what is currently taught in Interior Design programs. While 85% of educators believe that BIM software courses should be offered to students only 20% of the programs surveyed offer such a course. Additionally, 86% of architects and 47% of interior designers use some level of BIM software on their design projects.

The secondary assertion of this study reveals the perception of each group of who is responsible for teaching BIM software. Both groups agree that they share responsibility for BIM. Appendix E illustrates the results from both academia and practitioners.

- 82% of architects believe academia should prepare students to work with BIM software
- 80% of interior designers believe academia should prepare students to work with BIM software
- 64% of professors believe academia should prepare students to work with BIM software
- 84% of architects believe a design firm should prepare employees to work with BIM software
- 66% of interior designers believe academia should prepare employees to work with BIM software
- 70% of professors believe academia should prepare employees to work with BIM software

The top three reasons why academia hasn't offered BIM software courses are because 1) there isn't space in current curriculum, 2) trained professors aren't available, and 3) there are hardware and software issues. Appendix C shows the breakdown between respondents as to why academia is not including BIM in their curriculum.

The findings show that academia is lagging behind practitioners in teaching BIM. Almost 80% of practitioners received training paid for by their firm, while only 21% of schools offer any instruction on BIM software.

There were several similarities between academia and practitioners:

- The software Revit and Vectorworks were the top two choices by students and practitioners for using BIM technology.
- The top three uses of BIM are the same for academia and practitioners. Both groups use BIM for construction documents, design development and schematic design. Appendix D shows the breakdown between respondents.
- Both academia and practitioners share responsibilities for BIM. Appendix E shows the breakdown between respondents.

### ***Further Study/Next Steps***

There are several areas of this study that should be modified for additional research. First, the sample groups should be identified to avoid duplications or possible skews from one institution or firm. For example, additional demographic questions should be included to define respondents by professional organization, institution, firm/employer, and by type of work (residential, commercial). This will allow the responses to be sorted and control for the number of respondents from any one institution or firm.

Secondly, additional questions to determine “why academia hasn’t implemented BIM” should be included, as this study did not address this. Finally, in order to make recommendations on closing the gap between what is taught by academia and what is required by practitioners, further study is necessary.

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## Appendix A

### Curricula Analysis & Survey Results

State	School	Dedicated BIM Course	BIM part of another course	3D Modeling	AutoCAD or Computer Graphics	No BIM	Plans to add BIM	Email Resp.
DC	George Washington Uni.	0	1	0	2			
GA	Am. Intercontinental Uni.	0	0	1	2	X		
GA	Art Institute of Atlanta	0	0	0	1	X		
GA	Brenau Uni.	0	0	0	2	X		X
GA	Georgia Southern Uni.	0	1	0	2			X
GA	Uni. Of Georgia	0	0	0	1	X		X
NJ	Kean University	0	0	0	2	X		
NY	Buffalo State	0	0	0	2	X	X	X
NY	Cornell Uni.	0	0	0	3	X		X
NY	Fashion Inst. Of Tech. State University of NY	0	0	1	3	X		
NY	NY Inst. Of Tech.-Old Westbury	0	0	0	2	X		
NY	NY School of Interior Design	1	0	1	4			X
NY	Pratt Institute	0	0	1	3	X		
NY	Rochester Inst. Of Technology	0	0	0	1	X		
NY	School of Visual Arts	0	0	0	1	X		
NY	Syracuse Uni.	0	0	0	1	X		
NC	East Carolina Uni.	0	0	0	2	X		X
NC	High Point Uni.	0	1	0	2			X
NC	Meredith College	0	0	0	2	X		
NC	Uni. Of NC	0	1	0	1			X
NC	Western Carolina Uni.	0	0	1	1	X		
PA	Art Institute of Pittsburgh	0	0	1	3	X		
PA	Drexel Uni.	0	0	0	1	X		X
PA	LeRoche College	0	0	0	1	X		
PA	Moore College of Art and Design	1	0	1	3			X
PA	Philadelphia Uni.	0	0	1	2	X		X
SC	Winthrop Uni.	0	0	0	2	X		
VA	James Madison Uni.	0	0	1	2	X		
VA	Marymount Uni.	0	0	0	1	X	X	X
VA	Radford Uni.	0	0	0	2	X	X	X
VA	VA Commonwealth Uni.	1	0	0	2			X
VA	VA Polytechnic Inst. And State Uni.	0	0	0	1	X		X
WV	West VA Uni.	0	0	0	1	X	X	X
	<b>Total</b>	3	4	9	61	26	4	17
	Percentage	9%	12%	27%	100%	79%	12%	52%

## Appendix B BIM Software Use and Need

Table 1. Practitioners Use of BIM

Are you currently using any BIM software programs on any projects?										
Answer Options	What is your primary role?								Response Percent	Response Count
	Architect		Interior Designer		Executive		Other (please specify)			
	N	%	N	%	N	%	N	%		
Yes	35	26%	23	17%	1	1%	22	16%	59.6%	81
Sometimes	3	2%	5	4%	2	1%	2	1%	8.8%	12
No	6	4%	32	24%	1	1%	4	3%	31.6%	43
<b>Answered Question</b>										<b>136</b>

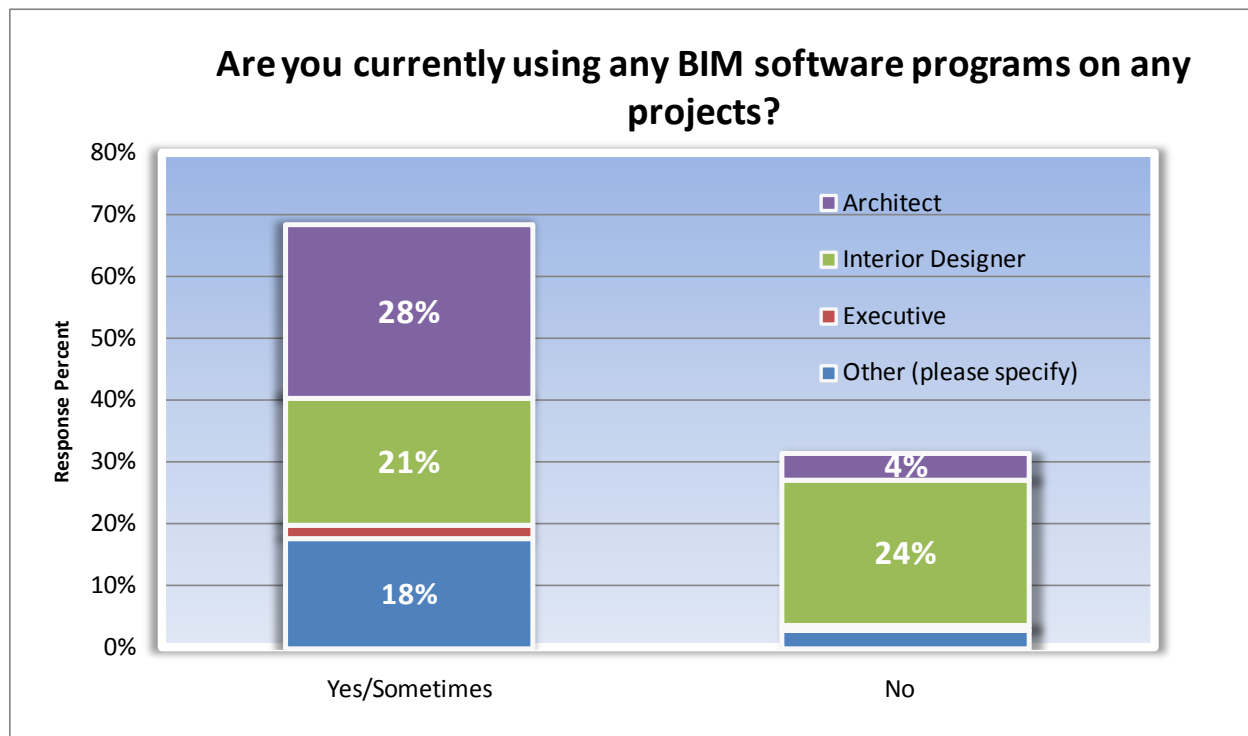
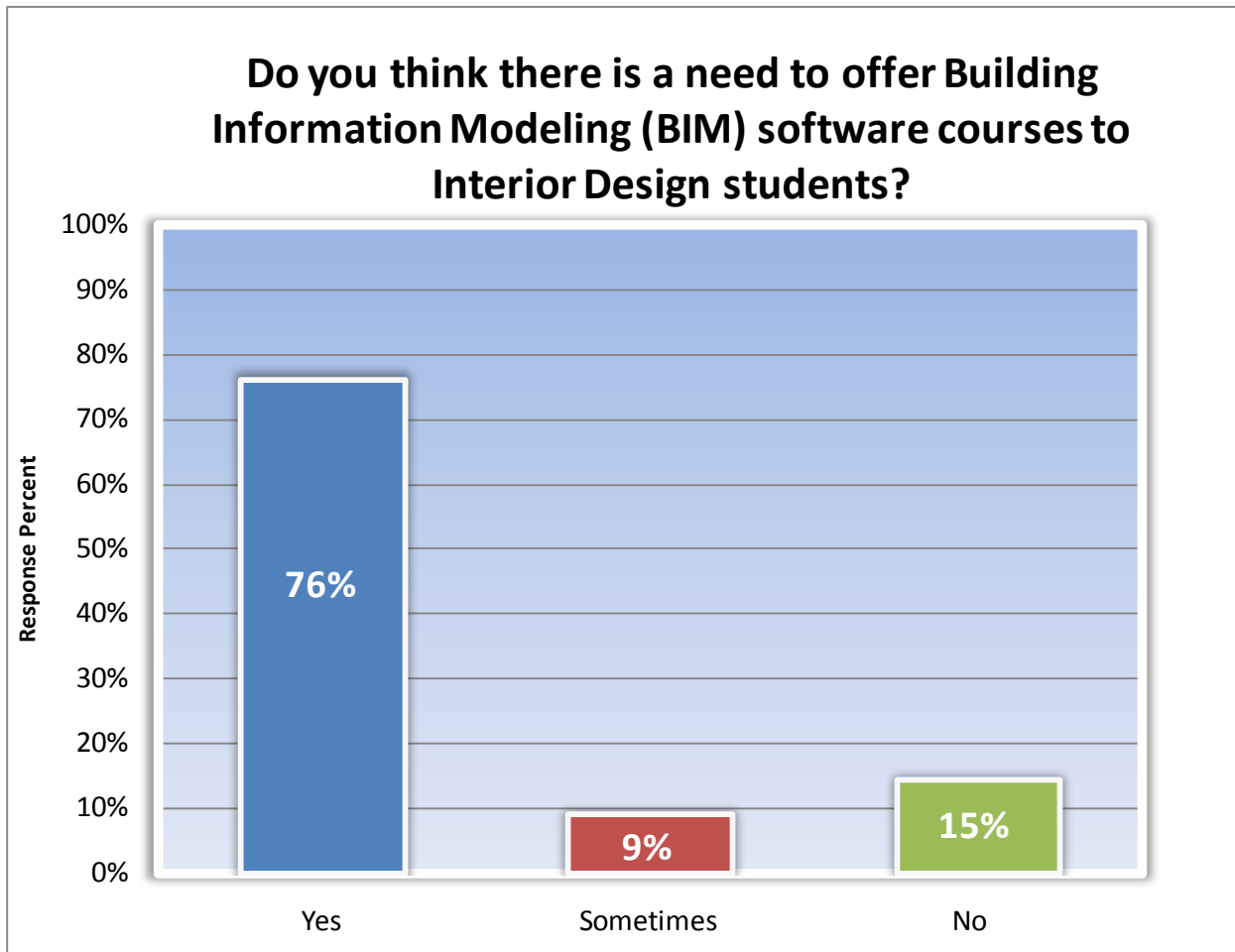


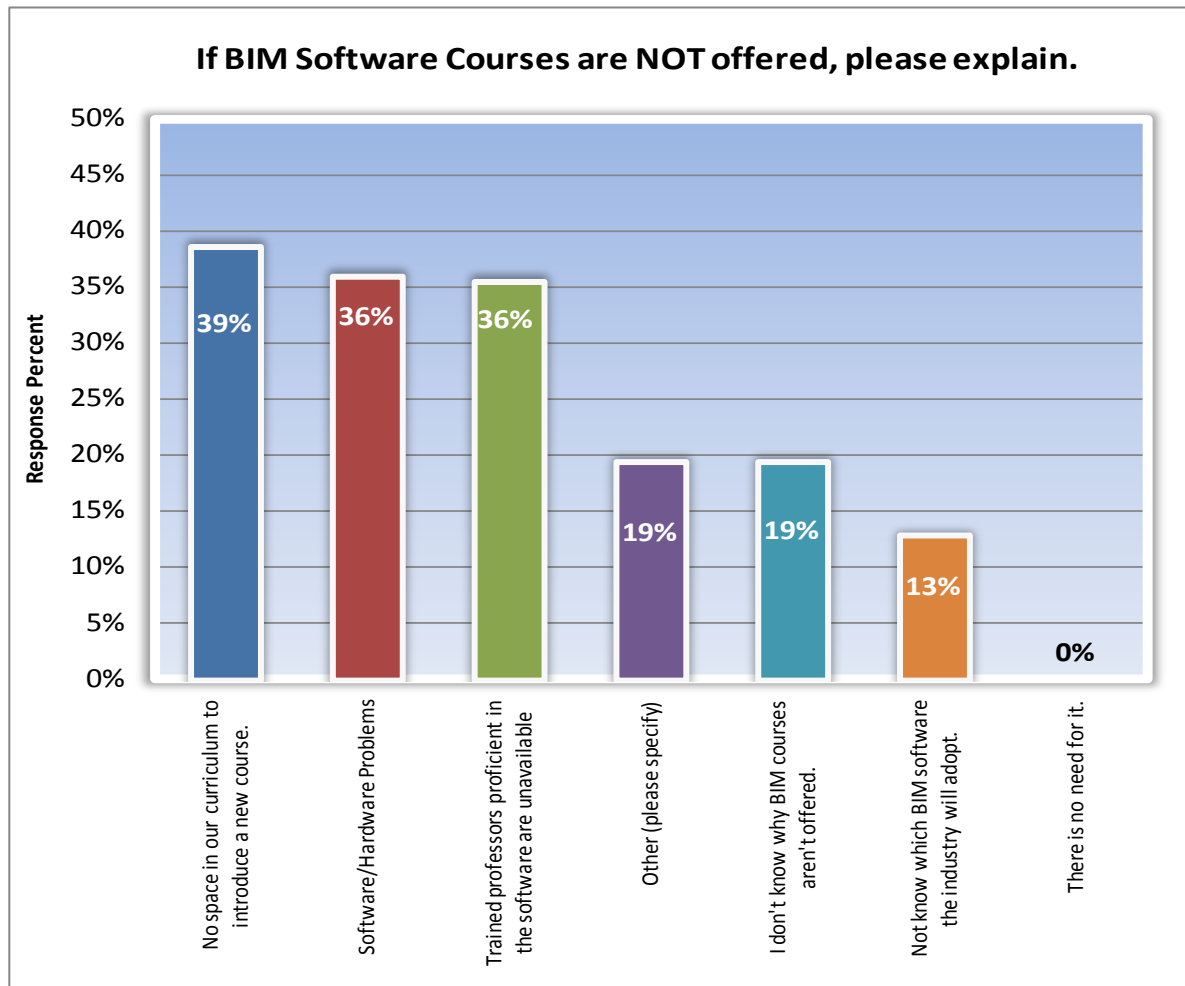
Table 2. Academia-Need to Offer BIM

Do you think there is a need to offer Building Information Modeling (BIM) software courses to Interior Design students?		
Answer Options	Response Percent	Response Count
Yes	76.4%	42
Sometimes	9.1%	5
No	14.5%	8
Answered Question		55



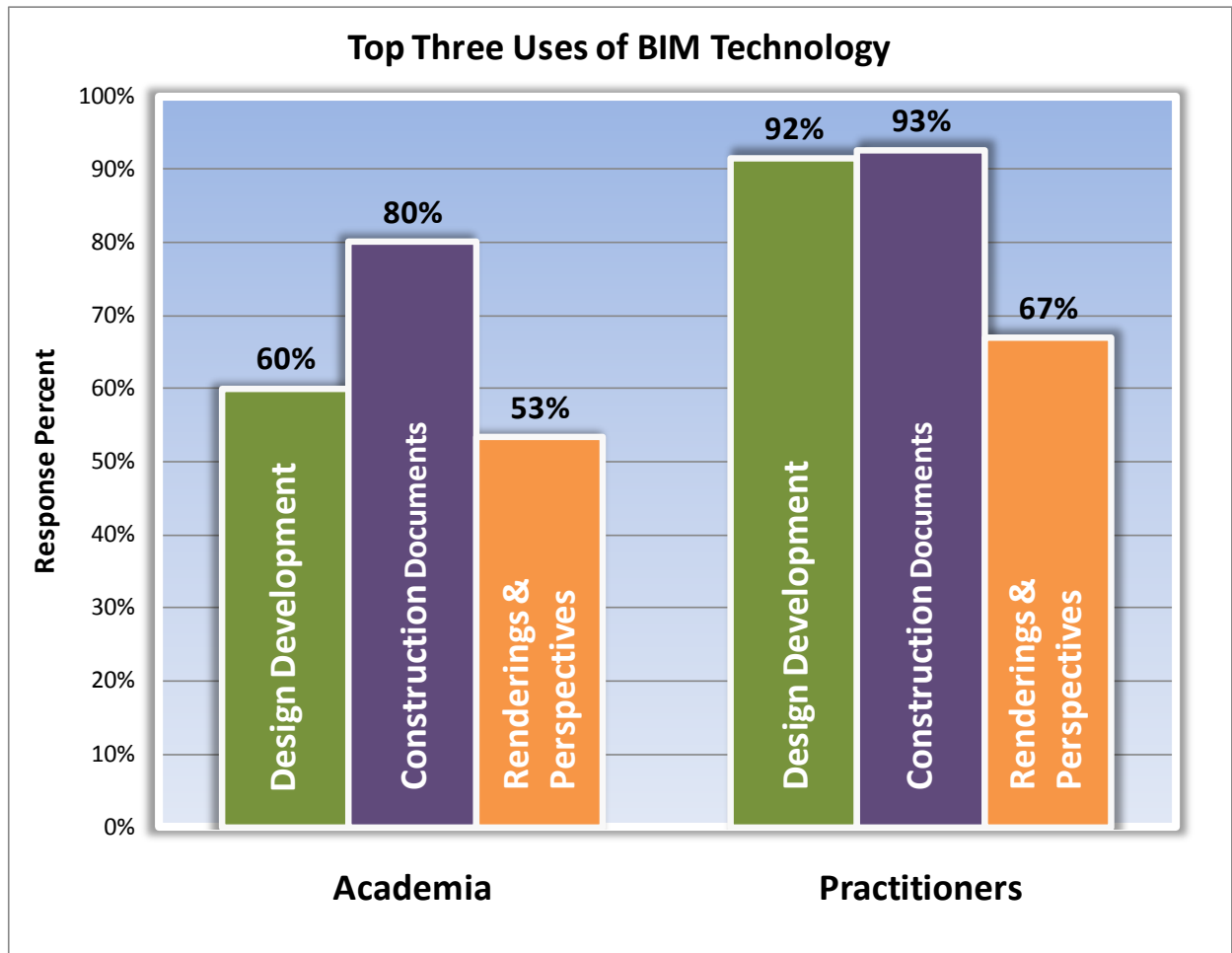
## Appendix C Why Software Courses are not Offered

If BIM software courses are NOT offered, please explain. (Check all that apply)		
Answer Options	Response Percent	Response Count
No space in our curriculum to introduce a new course.	39%	12
Software/Hardware Problems	36%	11
Software for classes are NOT available	10%	3
Hardware for classes are NOT available	10%	3
Software is too costly	16%	5
Trained professors proficient in the software are unavailable	36%	11
Other (please specify)	19%	6
I don't know why BIM courses aren't offered.	19%	6
Not know which BIM software the industry will adopt.	13%	4
There is no need for it.	0%	0
<b>Answered Question</b>		<b>31</b>



## Appendix D Top Three Uses of BIM Technology

Where do you use/teach BIM technology? (Check all that apply)				
Answer Options	Practitioners Response Percent	Practitioners Response Count	Academia Response Percent	Academia Practitioners Response Count
Programming & Concept Design	36.2%	34	13.8%	4
Schematic Design	64.9%	61	27.6%	8
Design Development	91.5%	86	58.6%	17
Construction Documents	92.6%	87	79.3%	23
Construction Administration	45.7%	43	13.8%	4
Renderings & Perspectives	67.0%	63	51.7%	15
3D Presentations	46.8%	44	34.5%	10
I'm not sure	0.0%	0	0.0%	0
Other (please specify)	0.0%	0	13.8%	4
<b>Answered Question</b>		<b>94</b>		<b>29</b>



## Appendix E Who is Responsible for Teaching BIM?

How much do you agree with the following statements:											
Answer Options	What is your primary role?								Practitioners Response Count	Academia	
	Architect	Interior Designer	Executive	Other (please specify)	Architect	Interior Designer	Executive	Other (please specify)			
<b>It is academia's responsibility to prepare students to work with BIM software.</b>											
	N	%	N	%	N	%	N	%			
Strongly Agree	15	11%	23	17%	3	2%	11	8%	52	14	
Agree	21	15%	25	18%	1	1%	11	8%	58	20	
Not Sure (neutral)	4	3%	11	8%	0	0%	5	4%	20	16	
Disagree	3	2%	1	1%	0	0%	1	1%	5	3	
Strongly Disagree	1	1%	0	0%	0	0%	0	0%	1	-	
<b>It is a design firm's responsibility to train employees to work with BIM software.</b>											
	N	%	N	%	N	%	N	%			
Strongly Agree	10	7%	18	13%	1	1%	8	6%	37	13	
Agree	27	20%	22	16%	3	2%	12	9%	64	24	
Not Sure (neutral)	7	5%	12	9%	0	0%	8	6%	27	9	
Disagree	0	0%	8	6%	0	0%	0	0%	8	6	
Strongly Disagree	0	0%	0	0%	0	0%	0	0%	-	1	
<b>Answered Question</b>										<b>136</b>	

