

The Trends of Computer Aided Design in the Clothing and Textiles Programs in U. S. A. Colleges & Universities

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의류학관련 학과에서의 CAD의 경향 - 미국내 대학을 중심으로 -

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Abstract

현재 미국에서 컴퓨터 디자인 (Computer aided design)은 의류산업과 의류학 교육에 중요한 역할을 하고 있다. 그러나 한국내 의류학관련 학과에서의 CAD의 도입은 아직 초기 단계에 불과하다. 이에 본 연구는 미국내 대학을 중심으로 의류학관련 학과에서의 전반적인 CAD 교육 경향을 조사 분석하여 실질적인 자료와 국내 의류학관련 학과의 CAD 교육의 나아갈 방향을 제시하는데 그 목적이 있다. 1993년 5월, 총 19문항의 질문지가 124개 대학 의류학관련 학과에 우편으로 배포되었으며 71부가 회수되어 57%의 회수율을 나타내었다. 그 결과는 다음과 같다.

조사 대상(71개 학교)중 56%가 CAD를 커리큘럼에 포함시켰다. 특히 의상디자인 전공을 가진 학과의 79%가 CAD를 도입하여, 의상디자인 전공이 없는 학과(28%가 CAD를 도입)보다 그 비율이 훨씬 높았다. 의류학 교육에서 CAD의 도입은 1988년 이후 급격한 증가 추세를 보였으며, 대부분의 강의는 의류학분야 교수진에 의해, 의류학과 시설물내에서 이루어졌다.

CAD를 독립된 과목으로 강의하는 경우 대부분 필수과목으로서 한 학기 코오스가 많았으며 3학년부터 시작되었다. CAD를 다른 의류학 과목에 포함시켜 일부분으로 강의할 경우 영역 별로는 복식 의장학 분야의 과목에, 시간 별로는 한 학기 중 “몇 주” 정도로 가르치는 경우가 가장 많았다. 전체 CAD 강의에서 다루는 주제로는 패턴 메이킹이 가장 많이 차지하였으며 그 다음에는 패턴 그레이딩, 마커 메이킹, 직물/패턴 디자인, 패션 일러스트레이션, 의상디자인 순이며 스토어 레이아웃·상품전시 및 디스플레이 계획이 가장 적었다.

본 연구 결과는 현재 CAD를 강의하고 있거나 앞으로 CAD를 커리큘럼에 도입하려는 한국 의류학 분야 교육자에게 유용한 정보를 제공할 수 있을 것으로 기대된다.

* This research was conducted while the author was a visiting scholar at the University of Texas at Austin

I. INTRODUCTION

The rapidly changing environment of the apparel industry has been influenced by technology. The apparel industry is entering a period of rapid technological transformation. New technologies used in the industry are providing retailers with quicker response times which offer the advantages of fashion forecasts closer to selling seasons and less markdown loss. In an industry with rapid changes and dynamic interactions, constant effort must be maintained to keep curricula fresh, current, and accurate. Sheldon and Regan(1990)¹⁾ suggested that institutions of higher education must develop programs that not only keep pace but perhaps lead industry in the use of technology. Driven by the need to keep up with increasing computer aided design (CAD) use in the profession and to enhance the marketability of clothing and textiles graduates, clothing and textiles programs across U.S.A. are increasingly adopting CAD into their curricula. CAD has become an important instruction in clothing and textiles education within the U.S.A.

Recently, educators in Korea have been increasingly interested in sharing information about incorporating CAD into clothing and textiles curriculum, even if the current CAD adoption into the clothing and textiles department is in the early stages in Korea. According to a recent study²⁾, many institutions have a five-year plan to implement computer technology at their department. In order for the CAD to be incorporated into the existing curriculum, the study of CAD instruction must be done.

However, less research is done about how CAD is integrated into the existing clothing and textiles curriculum in Korea. A look at how CAD has been adopted by clothing and textiles programs in the U.S.A. yields insights into the issues that need to be addressed for Korean clothing and textiles department to keep pace.

This study investigated how the CAD classes are integrated into the current clothing and textiles program in the U.S.A. The result of this study may enable Korean clothing and textiles educators to efficiently incorporate CAD into their curricula and provide more substantial

information concerning CAD instruction.

II. BACKGROUND

1. Computer Aided Design in the Apparel Industry

Computer technology was applied to the apparel industry beginning in the early 1960s. According to Wilhelm³⁾ (1984), computerized grading was introduced in the late 1960s, marking in the early 1970s, cutting in the mid 1970s, pattern making in the early 1980s, and fashion design/illustration in 1984.

In 1976, Matthews⁴⁾ reported that the use of the computer for design purposes in the textile and apparel industries is just beginning: 36 percent of 24 textiles and apparel industries in Georgia use computers for pattern grading, 18 percent for marker making, but none for design. In 1984, Fraser⁵⁾(1985) found that production managers more strongly favored implementation of CAD systems than did designers in the apparel industry. Many designers were found to be reluctant to adopt computers, indicating that design is a creative process whereas computers are mechanical. In Swanson's⁶⁾(1987) study, 53.9 percent answered "marking" as a computerized system their company used, and 50 percent of the respondents answered "grading". 25 percent and 10.5 percent answered for "patternmaking" and for "designing concepts" respectively.

In 1987, Sheldon's⁷⁾(1988) study indicated that apparel manufacturers are increasing their use of computers : 37 percent of apparel manufacturers were using computers for some apparel design functions : 65 percent projected computer use for design by 1992. The study also indicated that the greatest increases in computer use will occur in illustration and pattern making functions. 60 percent of apparel designers in the study predicted that in 1992 entry-level designers would need hands-on apparel design computer education. She suggested that educators must update curriculum and facilities now to keep with the accelerated computerization of the apparel industry.

Collier and Collier⁸⁾(1990) reported that CAD/CAM technology is becoming increasingly apparent in the textile and apparel industries in the U.S., and the linkages between textile and apparel production and distribution should be emphasized. They also suggested that training of students in textiles and clothing in the importance of electronic communication, as well as in the software and hardware involved, is an important task of textile and clothing educators.

In view of the evidence from the apparel industry that CAD use is increasing, curricular changes need to be considered to implement the requirement of sufficient number of CAD courses to train students to the point of fluency with CAD software.

2. Computer Aided Design on Higher Education

The curriculum of clothing and textiles programs should reflect contemporary and future societal and industrial trends in CAD use. Since computer aided design has been increasingly used in the clothing and textiles industry, educators have been incorporating CAD in their programs. In 1985, Fraser⁹⁾ suggested promoting use of CAD in four-year fashion design programs and developing curriculum CAD in four-year fashion design programs.

According to Knoll¹⁰⁾(1989), less than 20 percent of the clothing and textiles students were required to take a CAD course. The study suggested that use of computers within clothing and textiles programs needs to be further incorporated into existing curriculum. Unless more computer coursework is required, there will be a technology gap between what graduating students can do with computers and what they need to be able to do perform job-related work. DeLong, LaBat and Bye¹¹⁾(1991) reported a collaborative research team working between university and industry on the cutting edge of computer aided design research. The project goal was to develop an expert system that would accurately translate a clothing designer's vision into patterns for all body types and sizes, and the collaborative research effort resulted in the issuance of two pat-

ents.

Sheldon and Regan¹²⁾(1990) suggested that apparel design concepts that can be taught on the microcomputer include fashion illustration, fabrication of garments in different colors and patterns, flat pattern technique, pattern drafting, pattern grading, and marker making, all of which may be taught in one comprehensive computer course or may be expanded in separate courses. They also mentioned that computer aided design is not just for designers but also for merchants for its practical applications and for retailers for planning their private-label garments. Visual merchandisers are finding computer aided design a useful tool in retail stores layout.

Belleau and Bourgeois¹³⁾(1991) suggested that the philosophy for integration was to introduce the use of CAD/CAM system into every course in the design/production area, beginning with limited exposure and small projects in introductory courses and expanding exposure and experience with each successive course. According to them, CAD instruction was successfully implemented from introductory courses to apparel studio courses and advanced apparel design courses.

As an example of an informative case study, Im¹⁴⁾(1991) reported that the apparel CAD/CAM is a three credit course consisting of weekly one hour lecture and four hour laboratory and that the required prerequisite courses are : flat pattern, pattern alterations, and fashion design. Topics of the course include : introduction to apparel CAD/CAM products and vendors ; apparel CAD/CAM applications ; pattern making ; pattern grading ; pattern alterations ; interactive marker making ; automatic marker making ; cut-order planning ; plotting ; cutting ; and Unit Production Systems(UPS). The students mainly work on an Investronica system, also have an opportunity to experience different CAD/CAM systems(e.g. Microdynamics, Gerber, Eton). She suggested that the apparel CAD/CAM course would help students realize the potential of CAD/CAM systems so that they could apply their knowledge and experience in designing the future of U.S. apparel industry.

III. METHODOLOGY

The survey involved a questionnaire sent in May 1993 to 124 United States institutions listed in the Chronicle Four-Year College Databook¹⁵⁾ 1990~1991, addressed to the department heads of each clothing and textiles program. Usable responses were received from 71 schools (57 percent). Among the 19 items in the questionnaire, fourteen were forced choice response and five were "open-ended" response. Of the fourteen forced choice questions, five were multiple choice with an "Other, please specify" option, two were yes/no, and seven were checklist. Among the five "open-ended" questions: two were demographic information and recommendation, and three were titles of courses.

The two-page questionnaire requested information about institutional demographics, the respondents' positions, and whether their programs offered computer introduction courses and CAD instruction. Those offering CAD were asked who taught the course(s), in which year in college it was offered, when it was incorporated, locale of the facilities, and the amount of time spent giving CAD instruction. They also were asked whether CAD instruction is offered as a separate course or/and CAD instruction was integrated into other clothing and textiles course, and what the title of CAD course(s) was or/and what the title of course integrated into was. Frequency and percentages were calculated to answer the questions. Chi-square analysis was used to test CAD incorporation based on type of programs.

IV. FINDINGS

1. Demographic Information

1) Types of Program

Clothing and textiles programs included several recognized options. Fashion merchandising was the most common program emphasis, found in 93 percent of the schools.

The next most common were fashion (apparel) design (55 percent), general clothing and textiles (24 percent), textiles or textile science (17 percent), others (15 percent). Other options include apparel (and textile) management (4 percent), apparel production management (3 percent), apparel production or apparel manufacturing (3 percent), textile design (3 percent), pattern making (1 percent), merchandising/marketing education (1 percent).

The names of fashion merchandising related options vary from retailing to apparel and textile marketing, reflecting the main emphasis of the option. These data are shown in Table 1.

Table 1. Types of Program

Types of Program	Frequency (N=71)	Percentage
Fashion Merchandising :	66	93
Fashion Marketing		
Retailing		
Apparel and Textile Marketing		
Fashion(Apparel) Design	39	55
General Clothing and Textiles	17	24
Textiles, Textile Science	12	17
Others	11	15

2) Types of Degree Programs Available

The Bachelor of Science degree was available at 80 percent of the sample institutions. Master of Science degrees were offered at 42 percent of the sample. The Bachelor of Arts degree was available at 27 percent of the institutions. The Doctor of Philosophy was available at 21 percent. A Master of Arts degree was available at 8 percent. These data are shown in Table 2.

3) Current Position

55 percent of the 71 surveys returned were completed by the department head or program coordinator. The remainder were filled out by faculty who taught CAD courses

Table 2. Types of Degree Programs Available

Characteristic	Frequency (N=71)	Percentage
Bachelor of Science	57	80
Master of Science	30	42
Bachelor of Arts	19	27
Doctor of Philosophy	15	21
Master of Arts	6	8
Others	2	3

Table 3. Current Position

Position	Frequency	Percentage
Head or Program Coordinator	39	55
Faculty who teach CAD course(s)	18	25
Other Clothing & Textiles faculty member	14	20
Total	71	100%

(25 percent) or other clothing & textiles faculty members (20 percent). These data are shown in Table 3.

2. Computer Introduction Courses

60 programs(85 percent) reported that they offered some computer introduction courses. Of those offering computer introduction courses, 71 percent of computer introduction courses were taught during the freshmen and/or sophomore year in colleges of universities.

Schools were asked to indicate the title of computer introduction course(s) and the question was "open-ended". The title of computer introduction courses varied according to the types of program offered. 30 percent of programs offered (introduction to)computer science as a computer introduction course. 27 percent of programs offered (introduction to)personal computer application course. The other titles were computer in business or business

information systems(18 percent), computer literacy(8 percent), computers and their uses(3 percent), fundamentals of computer programming(3 percent), computers and visual arts(2 percent), microcomputer concepts(2 percent), management science(2 percent).

These results suggest that a general computer introduction course with hands-on microcomputer experience would be an essential computer background in CAD to clothing and textiles students.

These results are supported by Belleau, Orzada and Wozniak's¹⁶⁾(1992) explanation : the successful use of the tutorial for the CAD system was due to the fact that many students in the class were already computer literate and had used computers in other classes. Actually, students need to take a computer introduction course before taking the professional practice course.

3. Computer Aided Design Instruction

1) Description of CAD Instruction

(1) Incorporation of CAD Instruction

Of the responding programs(71 schools), 56 percent(40 schools) had incorporated CAD instruction into their curriculum. Some of programs which had not incorporated it gave comments. Three respondents commented that they planned implementation of CAD in spring or fall 1994, and one of them noticed that he had just received a grant to set up a lab and faculty had received training in its usage. Two respondents indicated that, even though they did not have CAD course in their programs, students can select CAD, 3-D computer art techniques, and computer graphics course(s) offered by the Art, Art Education, and Architecture department at the university. One respondent stated that CAD was offered only as special problem course if there were enough student to make class. One respondent mentioned that they had CAD course in graduate program.

The results, compared to previously research, indicate that the rate of adoption CAD is escalating in clothing and textiles education in an attempt to meet needs of the field. The trend of incorporating CAD courses into

curriculum is expected to continue in clothing and textiles programs.

Table 4 presents a frequency distribution of CAD incorporation by the programs. These results indicated that the programs which included a fashion(apparel) design option did incorporate CAD more (Chi-square=19.03, d.f.=1, p<.01). 79 percent of these programs incorporated CAD into their curricula, while only 28 percent of the programs which did not include a fashion design option incorporated CAD.

Table 4. Incorporation of CAD Instruction

Program	Including Fashion Design Option	Non-including Fashion Design Option	N(%)
CAD incorporated	31* (44%)** (79%***)	9 (13%) (28%)	40(56%)
CAD not incorporated	8 (11%) (21%)	23 (32%) (72%)	31(44%)
Total	39(55%)	32(45%)	71(100%)

* : Frequency
 ** : Percent of total
 *** : percent of column
 Chi-square=19.03
 d.f.=1
 p<.01

(2) Date of Initial CAD Instruction

The largest percentage (85 percent) of programs adopted CAD between 1988 and 1993. This results indicate that after 1988 the adoption of CAD has been increased. 1 institution(3 percent) was the early adopter of CAD and began offering CAD before 1983. Only 3 institutions began offering CAD between 1983~1987(8 percent). (see Table 5)

(3) Faculty Members who teach CAD Instruction

88 percent of CAD instruction was given by clothing and textiles faculty members. About 8 percent of the CAD instruction was given by clothing and textiles faculty members with support of a computer science instructor. Responses in an "other" category included teachers of clothing and textiles and interior design co-teaching(2 percent),

Table 5. Date of Initial CAD Instruction

Years	Frequency	Percentage
0~2(1991~1993)	17	43
3~5(1988~1990)	17	43
6~10(1983~1987)	3	8
over 10(Before 1983)	1	3
No Response	2	5
Total	40	100%

There is rounding error in 100%.

and construction (2 percent).

(4) Locale of the Facilities

70 percent of the CAD courses were taught within the clothing and textiles facilities, and 20 percent were taught in other facilities on the campus such as computer science building(8 percent), interior design/architecture building(8 percent), engineering building(4 percent). 10 percent were taught within both the clothing and textiles facilities and other facilities : in this case other facilities are computer science building, interior/architecture building, and library.

2) CAD Instruction as a Separate Course or/and a Component of Other Courses

38 percent of the institutions offering CAD offered CAD instruction as a separate course(s), 33 percent offered both as a separate course and as a component of other clothing and textiles course(s). 30 percent of institutions offered CAD as a component of other clothing and textiles courses. (see Table 6)

(1) CAD Instruction as a Separate Course

Of programs(40 schools) offering CAD instruction, 28 programs offered CAD instruction as a separate course. CAD instruction as a separate course began at varying levels in the clothing and textiles programs surveyed. A CAD course was the most common at the junior level. 61 percent(17 schools) began in the junior year. 18 percent of the programs began during the senior year. CAD instruction began in the sophomore year in 14 percent(4 schools) of the programs. Only 7 percent of the programs began CAD instruction during the freshmen year.

Table 6. CAD Instruction as a Separate Course or/and a Component of Other Courses

CAD Instruction	Frequency	Percentage
Taught as separate CAD course*	15	38
Taught as component of other clothing and textiles courses**	12	30
Taught as both(separate and component)***	13	33
Total	40	100%

- There is rounding error in 100%
- For the convenience of my research, I will use the number of 28(combine * and ***) for the CAD instruction as a separate course and the number of 25(combine ** and ***) for the CAD instruction as a component of other clothing and textiles courses.

Time spent giving CAD instruction also varied. 61 percent of programs offered a one-semester CAD course. 29 percent offered two-semester CAD courses. Just 11 percent of the programs required more than two quarters.

43 percent of schools offering CAD as a separate course (s) required students to take the course, and 33 percent offered it as an optional course. 25 percent offered CAD both in required and optional courses. Most of respondents indicated that their programs offered CAD in required course for fashion design students and optional course for other students, but this option was not mentioned on the questionnaire so the actual percentage of schools offering CAD in both required and optional courses may be higher.

Schools were asked to indicate title of CAD course(s) in an "open-ended" question. The most common title(45 percent) of CAD courses was "computer aided design (for apparel, in fashion)" and other titles of CAD were as follows : auto CAD for apparel (design) (5 percent), introduction to computer aided design(5 percent), introduction to CAD systems for apparel design, introduction

to Micro CAD, advanced CAD for apparel, computer based design methodology, computer applications for textiles & apparel, CAD ; mass market apparel, special studies in CAD, special topics in computer design, CAD flat pattern, CAD in pattern making, computer pattern design, apparel/pattern design, CAD surface design, apparel management system, apparel CAD/CAM, CAD for apparel and interior, computer assisted design & drafting, and advanced computer assisted design & drafting.

(2) CAD Instruction as a Component of Other Clothing and Textiles Courses

In the case of the programs that integrated CAD into other clothing textiles courses, respondents were asked to estimate how much time was given to CAD instruction in a course and to indicate the title of the course.

25 programs integrated CAD into 47 other clothing and textiles courses. One program, which had the most CAD instruction, indicated that CAD was integrated in 8 courses, but did not give the title of courses. Design and aesthetic area(47 percent) was the most common area which CAD was integrated into a course, and the next were fashion merchandising area(23 percent) and clothing construction area(21 percent). The CAD was taught as a component in a course through several weeks(47%), several days(34 %) or half of the course(17%). The titles are summarized in Table 7.

3) Subject Matter

The most commonly covered subject matter of CAD instruction was pattern making(85 percent). Pattern grading and marker making were covered by 68 percent and 60 percent of the programs offering CAD respectively. Textile/pattern design, fashion illustration and apparel design were covered by 58 percent, 50 percent and 48 percent respectively. The least covered subject matter was store layout, merchandising presentation and planning display(25 percent). (see Table 8).

4) U.S.A. Educators' Recommendations

The respondents described their opinions(information) regarding incorporation of CAD instruction into clothing and textiles curriculum in Korea. Those are as follows :

- ① Faculty internship and real experience in the industry

- on CAD are valuable to know its full capability and application.
- ② Form an advisory board with personnel from companies who use CAD.
- ③ Contact various CAD vendors or apparel manufacturers who are the ones who actually implement the CAD systems for their suggestions.
- ④ Purchasing hardware and getting appropriate printers, plotters, networks is necessary as having skills in operating CAD.
- ⑤ Contact schools with any CAD courses in order to evaluate

their satisfaction level with the current CAD systems that they are using.

- ⑥ Have a lab of several stations networked for beginning applications and a few commercial systems for advanced applications.
- ⑦ Training and technical assistance is needed to get started using CAD. Make sure there are enough cooperative computer science staff to support the technical operations.
- ⑧ Integrate several CAD applications into several courses after a general introduction to computers.

Table 7. CAD Instruction as a Component of Other Clothing and Textiles Courses

Other Clothing and Textiles Courses	CAD Instruction	Half of Course	Several Weeks	Several Days	No Ans.	N(%)
Fashion Illustration		2	2	1		5(11)
Apparel Design			4	1		5(11)
Fashion Illustration & Design			2			2(4)
Apparel Analysis & Design		1				1(2)
Apparel Design & Production			1			1(2)
Fashion Design & Visual Analysis			1			1(2)
Costume Design			1			1(2)
Visual Design			1			1(2)
Principles of Design				1		1(2)
Intermediate Design & Color Theory				1		1(2)
Advanced Problems in Fashion Design				1		1(2)
Aesthetics				1		1(2)
Textile Design				1		1(2)
Design and Aesthetic Area(Sub-Total)						22(47%)
Flat Pattern		2	3	2	1	8(17)
Pattern Making			1			1(2)
Apparel Structure & Fit				1		1(2)
Clothing Construction Area(Sub-Total)						10(21%)
Visual Merchandising & Display		1	1			2(4)
Fashion Merchandising			1	1		2(4)
Apparel Industry			2			2(4)
Fashion Promotion				2		2(4)
Computer Application in Retailing			1			1(2)
Fashion Industry Processes				1		1(2)
Fashion Advertising & Promotion				1		1(2)
Fashion Merchandising Area(Sub-Total)						11(23%)
Apparel Studio		2		1		3(6)
Workroom Processes			1			1(2)
Other Area(Sub-Total)						4(9%)
Total		8(17%)	22(47%)	16(34%)	1(2%)	47(100%)

- There is rounding error in 100%.
- Percentages are calculated on the number of courses integrating CAD as a component of courses.

Table 8. Subject Matter of CAD Instruction

Subject Matter	Frequency (N=40)	Percentage
Pattern Making	34	85
Pattern Grading	27	68
Marker Making	24	60
Textile/Pattern Design	23	58
Fashion Illustration	20	50
Apparel Design	19	48
Store Layout, Merchandising Presentation, and Planning Display	10	25

- ⑨ CAD cannot replace knowledge and skill fundamentals in design. Creativity is one of the most important characteristics which designer should possess.

V. SUMMARY AND SUGGESTIONS

In May 1993, a study was conducted to survey the trends of CAD instruction among colleges and universities offering clothing and textiles programs within the U.S.A. A 19-item questionnaire was mailed to 124 schools and 71(57 percent) were returned. The findings of this study indicated that the rate of adoption of CAD is increasing in clothing and textiles programs. The results were summarized as follows.

First, 85 percent of responding programs offered a computer introduction course. The majority of the courses were taught during the freshman and/or sophomore year. The common titles of those courses were computer science and personal computer application.

Second, 56 percent(40 schools) of programs have incorporated CAD into their curricula. The programs which included a fashion(apparel) design option did incorporate CAD more. 79 percent of the programs which included a fashion(apparel) design option have incorporated CAD into their curricular. Most(85 percent) programs offering CAD adopted it between 1988 and 1993. The majority of CAD instruction were taught by clothing and textiles

faculty within clothing and textiles facilities.

Third, 38 percent of programs offering CAD offered CAD instruction as a separate course, 33 percent of programs offered it both as a separate course and as a component of other clothing and textiles courses, and 30 percent offered it as a component of other clothing and textiles courses.

Fourth, in the case of offering CAD as a separate course, the majority of CAD courses were offered as a one-semester required course beginning in the junior year. The most common title of CAD course was computer aided design (for apparel or in fashion).

Fifth, in the case of offering CAD as a component of other clothing and textiles courses, the majority of CAD were integrated into the design and aesthetic area(47 percent): the next were the fashion merchandising area(23 percent) and the clothing construction area(21 percent). The majority of CAD were taught through several weeks in a course.

Finally, the most common subject matter covered by CAD instruction was pattern making. The next were pattern grading, marker making, textile/pattern design, fashion illustration, apparel design, and store layout, merchandising presentation & planning display.

CAD has become an important part of fashion design education. Educators are increasingly realizing the influence of CAD on the clothing and textiles field and have introduced it to their students in the U.S.A. CAD's capabilities are already recognized and accepted. No longer does there seem to be a question of whether to incorporate CAD.

However, CAD's adoption into the clothing and textiles programs is in the early stages in Korea. Considering that CAD is an important component of the design process and should be incorporated into undergraduate clothing and textiles curriculum, Korean students need to be introduced to CAD in their education as early as possible. In this study, I tried to find effective ways to incorporate CAD into a Korean curriculum by looking at how CAD has been incorporated by clothing and textiles programs in the U.S.A. Several respondents explained that CAD

was introduced in their programs in small segments during the lower division courses and then included in various studio projects through the courses offered before graduation. When CAD is not currently offered as a separate course, educators may consider integrating CAD instruction into other clothing and textiles courses and then expanding gradually in separate courses. CAD could be incorporated in the area emphasized by the department in the beginning stage and then be expanded in various areas after evaluating the results of CAD incorporation. In consideration of the results of this study that the programs which include a fashion (apparel) design option did incorporate CAD more than the programs which did not include this option in the U.S.A., the institution which emphasizes the fashion design area may need to consider the adoption of CAD in their education in the near future.

In any case of incorporating CAD into curriculum, it is necessary to investigate implementation of CAD in the clothing and textiles industry in Korea. This study may give useful information to clothing and textiles educators in Korea, the ones who will integrate CAD into their curricula as well as the ones who are presently teaching CAD in their curricula.

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