



A Case Study on the Comparison of Fit Evaluation Results between an Expert Group and a Novice Group

- Focusing on Women's Shirts and Pants -

Kim, Youngsook · Song, Hwa Kyung⁺

Ph.D. Candidate, Dept. of Clothing and Textiles, Kyung Hee University
Associate Professor, Dept. of Clothing and Textiles, Kyung Hee University⁺
(received date: 2017. 9. 8, revised date: 2017. 11. 15, accepted date: 2017. 11. 28)

ABSTRACT

Despite its need in the clothes industry, there are a lack of experts, including technical designers, who can exactly analyze the fit of clothes. This is a case study to provide practical data for fit analysis education by distinguishing the differences in acceptance in evaluating the fit of shirts and pants between experts and novices. For this study, two groups were organized: 1) seven experts with over 15 years-experience including technical design or pattern making; and, 2) seven novices who are freshmen or sophomores majoring in clothing and Textiles. The results showed that the novice and expert groups evaluated ease at the bust, waist, cross back, and sleeve opening differently. The novice group overlooked collar stand height, band width, side seam location, dart length, sleeve silhouette, and button location. The two groups evaluated the crotch ease, thigh ease, and hem ease, and pants length differently. The novice group overlooked waist location, balance of front and back waist line, side seam location, crotch length, location of inseam and outseam, dart length, and grain line from crotch to hem. It was found that undergraduates in the first and second grades could not understand fundamental clothing construction and proper fit, so the results of this study be referred by the educators when their teaching fit evaluation in classes for students majoring in clothing and textiles.

Key words: evaluation, expert, fit, novice, pants, shirt

I. Introduction

As consumers' living standards have been improved and consumers have become to pursue better quality of life, the level of demand for clothing fit has been also enhanced. Fit is not only an important criterion for manufacturers to produce good quality clothing products, but also an important standard for consumers' purchase decisions(Ashdown & O'Connell, 2006; Howarton & Lee, 2010; Kim & Chun, 2004). Therefore, the apparel industry needs experts such as technical designers who can accurately evaluate the fit of clothes and modify the patterns accordingly, but there is a lack of related experts (Kim & Kim, 2012; Lee & Sohn, 2011).

According to a survey conducted by Kim & Kim(2012), current technical designers pointed out pattern modification methods(51.3%) and fitting techniques(35.9%) as areas for which the retraining of new technical designers is the most keenly required. A total of 189 clothing related departments are open in domestic universities and 107 of them are assumed to include the field of clothing construction in their educational courses(Oh & Choi, 2012). Although fit evaluation and fitting should be performed by students in classes, it has been shown that educators perform fit evaluation in most cases due to the poor fit evaluation techniques of students. In the case of other countries, in 2009, the Fashion Institute of Technology, a renowned fashion school in the United States, opened a curriculum named 'Technical Design' to implement specialized education to train technical designers, which is a professional occupation in this field. Although gradually more technical design courses

have been opened in domestic universities too, related specialized education is not yet sufficiently implemented.

Domestic research studies related to education of clothing fit evaluation or fitting ability have been conducted by only Kim & Nam(2012) and Lee(2013). Kim & Nam(2012) pointed out that standardized fit evaluation items and contents were absent, so they developed evaluation items and contents for pants fit. Lee(2013) analyzed the actual state of the work and education for technical designers through questionnaire surveys and in-depth interviews, and they finally developed a technical designer job training program that includes eight areas: professional terms, product dimensions, technical package, sewing, 3D virtual fitting program, grading, and field learning.

Fashion designers and technical designers should identify fit problems in a short time based on their fit evaluation senses and standards established based on their long experiences. Ashdown & O'Connell(2006) indicated that differences in the ability to evaluate fit would appear between experts and novices when they perform clothing fit evaluation work and that even the results of fit evaluation by novices could be improved to a reliable level when they have been educated for a short period of time. However, there is no study that compared the ability to evaluate fit of experts with that of novices among previous studies conducted thus far in domestic academia.

This study aimed to analyze the differences in the results of fit evaluation between novices (undergraduates majoring in clothing) and experts (technical designers and patternmakers with more than 15 years experience) by evalua-

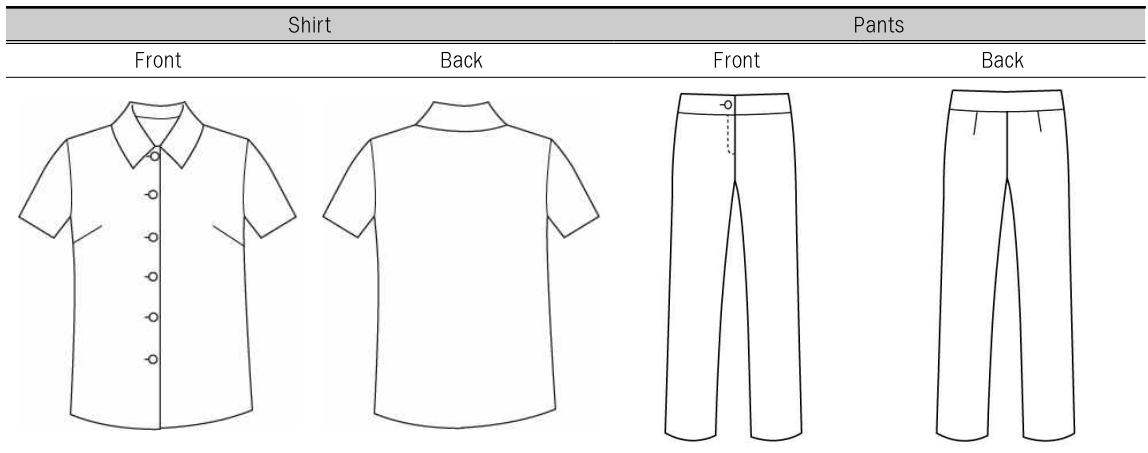
tion of fit using questionnaire and statistical techniques. The experts were assumed to be more strict during evaluation because the level of their expectation of the fit of products should be higher as they are at the location where they should sell clothes. The results of this study are expected to present what items the educators emphasize when teaching fit evaluation in classes for students majoring in clothing and textiles.

II. Methods

1. Production of experimental garments

This study selected a short sleeve shirt with bust darts and a pair of straight silhouette pants

with waist darts on the back as experimental clothes. 'Development samples' have been defined as the first samples made from a designer's sketches before receiving orders for actual production(Lee, 2013), so our experimental garments were made based on the sketch <Fig. 1> and the dimensions of a fit model as shown in <Table 1> that correspond to the normal body types(N) for tops [Hip girth-bust girth= 3~9cm(mean 6cm)] and normal body types for bottoms [hip girth-waist girth=14~22cm(mean 18cm)] defined in 'KS K 0051, Dimensions of Adult Women's Clothes (Korean Standards Association, 2009)', which are close to the mean dimensions of the clothes of adult women in their 20~30s out of the Size Korea data. The



<Fig. 1> Design sketches

<Table 1> Body measurements of a fit model

Measurement items	Body measurements
Bust girth	88.5 cm
Waist girth	77.0 cm
Hip girth	94.6 cm
Leg length	100.6 cm
Stature	161.0 cm

	Front	Side	Back
Shirts			
Pants			

〈Fig. 2〉 The actual fit of the developed shirts and pants

actual fit status was as shown in 〈Fig. 2〉.

2. Fit evaluation groups and evaluation items

To compare and analyze the degrees of shirt and pants fits, the novice group was organized with seven first or second grade undergraduates majoring in the clothing and the expert group was organized with seven technical designers or patternmakers with experience for at least 15 years. The reason that the expert group was defined as a group of technical designers or patternmakers with experience for at least 15 years is that those with experience for at least 15 years correspond to the top 5% of technical designers or patternmakers according to the pa-

per titled “A Study on the work characteristics of technical designers” published by Kim & Kim(2012).

The fit evaluation items in the questionnaire were composed based on the fit evaluation standards and items contained in eight papers related to shirts and jackets(Kim et al., 2011; Kim et al., 2014; Kim & Jang, 2013; Lee & Kim 2008; Jang & Chang, 2008; Lee & Park, 2014; Park, 2010; Hwang & Lee, 2003), and 12 papers related to pants(Kim et al., 2009; Kim, 2013; Kim, 2014; Kim & Chun, 2011; Kim & Kim, 2012; Kwon & Hong, 2013; Ha, 2011; Ha & Seong, 2013; Lee & Lee, 2011; Park, 2013; Shin & Suh, 2010; Shim et al., 2005).

The shirt fit evaluation items were composed of a total of 50 items: ease, length, height,

width, balance, symmetry, and silhouette at collar, shoulder, chest width, back width, upper chest, breast, waist, hip, hem, dart, armhole, sleeve, centerline, sideseam, and button. The pants fit evaluation items were composed of a total of 34 items related to ease, height, width, balance, symmetry, and silhouette at waist, abdomen, upper hip, hip, crotch, thigh, knee, hem, inseam, outseam, centerline, dart, zipper, and button.

In the fit evaluation, the fit judges actually saw the clothes on the live model and evaluated the fits by part using a 7-point scale[1 point (very poor fit) → 4 points(moderate) → 7 points (very good fit)]. 'Very good fit' was defined as 'fit approval state in which the clothes are sellable to consumers.'

3. Data analysis method

The results of evaluation of fits by the groups were analyzed through independent 2-sample non-Parametric tests utilizing intergroup Kolmogorov-Smirnov Z values using the SPSS 17.0 program instead of t -tests because the number of fit judges was small. In addition, differences in mean scores between the groups for fit parts that showed significant differences were divided into low(1.3~1.9 points), medium(2.0~2.5 points), and high(2.6~3.0 points) groups and presented in a table.

III. Results

1. Results of analysis of shirt fit evaluation

The results of comparison of shirt fit evaluation between the expert group and the novice

groups using the non-parametric test are shown in <Table 2>. Whereas the expert group evaluated the fits as being poor than moderate(4 points) in most items, the novice group evaluated the fits as being better than moderate(4 points) in most items.

Items that showed significant differences between the two groups were collar stand height, band width, the location and ease of back widths, bust ease, waist ease, side seam location, length of bust dart, sleeve hem ease, sleeve silhouette, and button location. Commonly, whereas the experts judged that the fits of these parts were poor, the novices did not recognize that the fits of these parts were poor.

To review in detail, regarding the items related to collar, whereas the expert group evaluated the fits of stand height(2.6) and band width(2.6) as being poor, the novice group evaluated the fits as 5.6 points and 4.9 points indicating that they did not clearly recognize the poor fits. At the collar location and drag line, differences of approximately 2 points were shown although these differences were not significant.

At the shoulder angle, although no significant difference was shown between the two groups, whereas the expert group gave 3.1 points indicating that the fit was not appropriate, the novice group gave 5.3 points indicating that they did not recognize the poor fit. At the chest width and back width, although significant differences were shown only in the back width, whereas the expert group generally evaluated the ease as moderate (4.0~4.1) fit, the novice group evaluated the ease as good fit with scores in a range of 5.4~6.1. at the items trunk girths(upper chest girth, breast girth, waist girth,

<Table 2> Comparison of means and standard deviation of fit rating scores at 50 fit locations of shirt between expert and novice groups

	Fit location	Expert		Novice		Absolute	Positive	Negative	Kolmogorov -Smirnov Z	Sig.
		Mean	SD	Mean	SD					
Collar	Location	3.9	-1.6	5.6	0.8	0.57	0.57	0.00	1.07	0.20
	Ease at neck line	4.3	-1.1	5.4	1.5	0.43	0.43	0.00	0.80	0.54
	Drag line	2.9	1.6	4.9	1.6	0.57	0.57	0.00	1.07	0.20
	Stand height	2.6	1.7	5.4	1.3	0.71	0.71	0.00	1.34	0.06*
	Band width	2.6	1.7	4.9	2.0	0.71	0.71	0.00	1.34	0.06*
	Interval between both collar tips	2.9	1.2	2.7	1.8	0.14	0.14	-0.14	0.27	1.00
	Degree of collar tips	3.0	1.8	3.3	2.1	0.14	0.14	0.00	0.27	1.00
	Symmetry	2.7	1.8	3.0	2.2	0.12	0.12	-0.12	0.21	1.00
Shoulder	Location	4.6	1.4	5.3	1.1	0.14	0.14	0.00	0.27	1.00
	Length	4.1	1.7	4	1.3	0.29	0.14	-0.29	0.53	0.94
	Slope	3.1	1.7	5.3	1.5	0.57	0.57	0.00	1.07	0.20
Cross chest	Location	4.1	1.2	5.6	1	0.57	0.57	0.00	1.07	0.20
	Ease	4.1	1.7	6.1	0.9	0.57	0.57	0.00	1.07	0.20
Cross back	Location	4.1	0.7	5.4	0.5	0.71	0.71	0.00	1.34	0.06*
	Ease	4	0.8	6.1	0.9	0.71	0.71	0.00	1.34	0.06*
Chest	Location	3.7	1.7	5.3	1.6	0.57	0.57	0.00	1.07	0.20
	Ease	3.7	1.8	5.9	0.9	0.57	0.57	0.00	1.07	0.20
Bust	Location	3.2	1.5	5.1	1.5	0.69	0.00	-0.69	1.24	0.09*
	Ease	3.1	1.3	5.9	0.9	0.86	0.86	0.00	1.60	0.01**
Waist	Location	3.7	1.8	5.7	0.8	0.57	0.57	0.00	1.07	0.20
	Ease	3.9	1.8	6	0.6	0.71	0.71	0.00	1.34	0.06*
Hip	Location	4	1.4	5.8	0.8	0.67	0.67	0.00	1.15	0.14
	Ease	3.8	1.5	6.2	1	0.67	0.67	0.00	1.15	0.14
Hem	Ease	3.4	1.6	5.7	1	0.57	0.57	0.00	1.07	0.20
Center front	Location	4.4	2.2	5.9	0.9	0.43	0.43	-0.14	0.80	0.54
	Length	4.9	2	5.9	0.9	0.43	0.43	-0.14	0.80	0.54
	Verticality	5.0	1.8	6.0	1.0	0.43	0.43	0.00	0.80	0.54
Side seam	Location	4.0	1.3	6.1	0.7	0.71	0.71	0.00	1.34	0.06*
	Verticality	3.6	1.3	5.7	1.1	0.57	0.57	0.00	1.07	0.20
Dart	Location	1.9	1.1	3.3	1.4	0.57	0.57	0.00	1.07	0.20
	B.P. location	2.7	1.6	4.7	1.6	0.57	0.57	0.00	1.07	0.20
	Length	1.9	1.1	3.7	1.6	0.71	0.71	0.00	1.34	0.06*
	Amount	3.3	2.1	4.1	1.6	0.29	0.29	-0.14	0.53	0.94
Armhole	Location	3.6	1.5	4.7	0.8	0.57	0.57	0.00	1.07	0.20
	Depth	3.6	1.7	4.4	1.5	0.29	0.29	0.00	0.53	0.94
	Width	3.6	1.7	4.7	1.3	0.43	0.43	0.00	0.80	0.54

	Ease	3.6	1.7	4.4	1.6	0.29	0.29	0.00	0.53	0.94
Sleeve	Bicep height	3.7	1.2	5.0	1.4	0.43	0.00	-0.43	0.77	0.59
	Bicep ease	3.6	1.3	5.1	2	0.57	0.57	0.00	1.07	0.20
	Hem ease	3.5	1.2	6	0.6	0.86	0.00	-0.86	1.54	0.02**
	Sleeve length	3.8	1.2	4.6	1.8	0.43	0.00	-0.43	0.77	0.59
	Silhouette	2.4	1.4	5.4	1.4	0.71	0.71	0.00	1.34	0.06*
Button	Location	3.1	1.6	6	1.0	0.86	0.86	0.00	1.60	0.01**
	Quantity	4.0	1.5	5.7	1.5	0.57	0.57	0.00	1.07	0.20
Balance	Grain line (torso)	4.3	1.3	5.4	1.1	0.43	0.43	0.00	0.80	0.54
	Grain line (sleeve)	4.2	1.3	5.7	1.0	0.50	0.50	0.00	0.87	0.44
	Left & right	3.9	1.8	5.3	1.5	0.29	0.29	0.00	0.53	0.94
	Hem: front & back	2.9	1.3	4.7	1.7	0.57	0.57	0.00	1.07	0.20
Silhouette	Side view	4.1	0.9	4.2	1.0	0.26	0.17	-0.26	0.47	0.98
	front silhouette	3.3	1.5	5.3	0.5	0.67	0.00	-0.67	1.20	0.11

** $p < .05$, * $p < .1$. Cells which showed significance difference are shaded.

** 7-point Likert scale: 1(very bad) → 4(normal) → 7(very good)

abdomen girth, and hip girth), whereas the expert group evaluated the fit as being poor with scores not higher than 4.0, the novice group evaluated the fit as being good with scores in a range of 5.1~6.2 and in particular, the differences between the two groups were significant in bust girths and waist girths.

At the sideseam and hem, whereas the expert group evaluated the fits of the items, the location of the sideseam(4.0), the verticality of the sideseam(3.6), and hem ease(3.4) as being poor by giving scores for fits not better than moderate fits, the novice group evaluated the fits as being good with scores in a range of 5.0~6.1 and the differences between the two groups were significant in the location of the sideseam (expert 4.0, novice 6.1).

With respect to the darts, although both the expert group and the novice group evaluated the fits of the length and the dart end point (bust point) as being poor, the expert group the fits

as being poorer. About the button locations, whereas the expert group evaluated the fit as being poor with a mean score of 3.1 points, the novice group evaluated the fit as being good with a mean score of 6.0 points.

At the armhole, the expert group evaluated the fits of the location(3.6), depth(3.6), width (3.6), and ease(3.6) of the armhole as being poor and the scores were not much different from those of the novice group. Regarding the sleeve, significant differences between the groups were shown only in the ease of the cuffs and differences in mean scores were shown in the fits of the ease, height, and silhouette of the sleeve cap line region although the differences were not significant as the expert group evaluated the fits as being poor with means scores of 3.6, 3.7, and 2.4 respectively while the novice group evaluated the fits as being relatively good with mean scores in a range of 4.4~6.0 points.

Regarding the items related to balance and

<Table 3> Range of mean difference (=novice-expert) at rating shirt fit

	Mean difference	Fit location	Item
Experts rated fit worse than novices.	2.6 ~ 3.0	Collar	Stand height
		Bust	Ease
		Button	Location
		Sleeve	Silhouette
	2.0 ~ 2.5	Collar	Band width
		Cross back/ Waist/ Sleeve opening	Ease
		Side seam	Location
	1.3 ~ 1.9	Cross back	Location
		Dart	Length

silhouette, although no significant difference was shown between the two groups, differences in mean scores between the two groups were shown in the items left/right symmetry(expert 3.9, novice 5.3), hem balance(expert 2.9, novice 4.7), and entire silhouette (expert 3.3, novice 5.3).

The differences in mean scores between the groups for fit parts that showed significant differences were divided into low(1.3~1.9 points), medium(2.0~2.5 points), and high(2.6~3.0 points) groups and presented in <Table 3>. Large differences(2.6~3.0 points) in mean scores between the two groups were shown in stand height, bust ease, button location, and sleeve silhouette. Moderate differences (2.0~2.5 points) in mean scores between the two groups were shown in collar band width, back width/waist/cuffs ease, and sideseam location. Relatively small differences (1.3~1.9 points) in mean scores between the two groups were shown in the items, back width location and dart length.

2. Analysis of pants fit evaluation

The results of comparison of shirt fit evaluation between the expert group and the novice

groups using the non-parametric test are shown in <Table 3>. Whereas the expert group evaluated the fits as not being better than moderate(4 points) in most items, the novice group evaluated the fits as not being poorer than moderate(4 points) in most items.

To review items that showed significant differences between the two groups, whereas the expert group evaluated the fits of waist location, front/back waist line balance, all crotch related items[ease, length, balance of front and back crotch lengths, pleat amount, and whether there are droop or drag lines], knee ease, hem ease, the locations of the inseam and outseam, length and verticality, dart length, button locations, pants length, and overall pants width as being poor, the novice evaluated the fits of all these parts as being good.

To describe in detail, at the waist, whereas the expert group evaluated the fits of the items, the location(3.1) and the balance of front/back waist lines(2.7), the novice group gave 4.9~5.5 points to the fits of these parts indicating that they did not recognize the poor fits.

At the upper hip area, although no significant difference was shown, whereas the expert group

evaluated the fit of ease(2.4) as being poor, the novice group evaluated the fit as being moderate with a mean score of 4.5 points. At the thigh, knee, and hem items, whereas the expert group evaluated the fit of the item ease as being poor with scores in a range of 2.7~3.4, the novice group evaluated the fit as being relatively good with scores not lower than 5.0 points.

Regarding the crotch related items, significant differences between the two items appeared in all items. The expert group evaluated the fits of both of the ease and the balance of front/back crotch lengths as being poor with scores in a range of 1.7~2.9 points. However, the novice group evaluated the fits as being good with scores exceeding 5.0 points in most cases.

At the center front line, although no significant difference appeared between the two groups, differences in means scores appeared between the two groups. Whereas the expert

group evaluated the fit of the location (4.0) as being moderate, the novice group evaluated the fit as being good with a mean score of 5.7 points. Regarding the inseam line and outseam line, whereas the expert group evaluated the fits of the location, length, verticality, and balance as being poor with scores in a range of 2.9~3.8, the novice group evaluated the fits as being very good with scores not lower than 5.7 points.

Regarding the dart, zipper, and button items, whereas the expert group evaluated the fits of all items as being moderated or poor, the novice group evaluated the fits as being generally good with scores in a range of 3.9~6.2 points.

At the overall balance, overall fit, and silhouette of pants items, whereas the expert group evaluated the fits of pants length(3.7), overall pants circumference(3.4), grain balance from crotch to hem(4.0), balance of left/right symmetry(3.9), and silhouette(2.6), the novice group

<Table 5> Range of mean difference (=novice-expert) at rating pants fit

	Mean difference	Fit location	Item
Experts rated fit worse than novices.	2.6 ~ 3.0	Crotch	Ease, Droop and drag line in front crotch, Droop and drag line in back crotch
		Hem	Ease
		Outseam	Location, Verticality
		Overall	Length, girth
		Balance	Balance of front and back waist line
	2.0 ~ 2.5	Crotch	Crotch length
		Knee	Ease
		Dart	Length
		Button	Location
		Inseam	Length
	1.3 ~ 1.9	Balance	Balance (left & right), Grain line from crotch to hem
		Overall	Silhouette
		Waist	Location
		Inseam	Location

<Table 4> Means and standard deviation of fit evaluation for 34 fitting areas of pants for expert and novice groups

	Fit location	Expert		Novice		Absolute	Positive	Negative	Kolmogorov -Smirnov Z	Sig.
		Mean	SD	Mean	SD					
Waist	Location	3.1	0.9	5.1	0.7	0.86	0.86	0.00	1.60	0.01**
	Balance of front and back waist line	2.7	1.5	5.5	1.0	0.71	0.71	0.00	1.28	0.07*
	Ease	3.4	1.7	4.9	1.1	0.43	0.43	0.00	0.80	0.54
	Belt width	4.0	0.8	5.7	1.1	0.57	0.57	0.00	1.07	0.20
Abdomen	Ease	3.7	1.4	4.6	1.3	0.29	0.29	0.00	0.53	0.94
Upper hip	Ease	2.4	1.4	4.5	1.8	0.52	0.52	0.00	0.94	0.34
Hip	Location	3.6	1.7	4.3	1.9	0.29	0.29	0.00	0.53	0.94
	Ease	3.1	1.3	4.3	1.9	0.29	0.29	0.00	0.53	0.94
Center front	Location	4.0	1.3	5.7	1.3	0.57	0.57	0.00	1.07	0.20
	Verticality	3.9	1.5	5.6	1.5	0.57	0.57	0.00	1.07	0.20
Crotch	Ease	2.1	0.9	5.3	0.8	1.00	1.00	0.00	1.87	0.00**
	Length	2.0	1.0	4.3	1.3	0.86	0.86	0.00	1.60	0.01**
	Droop and drag line (front)	2.0	1.2	5.1	0.4	1.00	1.00	0.00	1.87	0.00**
	Droop and drag line (back)	1.7	0.8	4.9	0.9	0.86	0.86	0.00	1.60	0.01**
	Balance of front & back crotch length	2.9	1.5	5.4	1.0	0.71	0.71	0.00	1.34	0.06*
Thigh	Ease	2.7	0.8	5.4	1.4	0.86	0.86	0.00	1.60	0.01**
Knee	Location	3.7	1.0	4.7	1.6	0.57	0.57	0.00	1.07	0.20
	Ease	3.4	1.1	5.4	0.8	0.71	0.71	0.00	1.34	0.06*
Hem	Ease	3.4	1.1	6.1	0.7	0.86	0.86	0.00	1.60	0.01**
	Horizontality of hem line	3.9	1.3	5.0	2.0	0.57	0.00	-0.57	1.03	0.24
Inseam	Location	3.7	0.8	5.7	1.1	0.71	0.71	0.00	1.34	0.06*
	Length	3.8	0.8	5.7	1.0	0.83	0.00	-0.83	1.50	0.02**
Outseam	Location	3.4	1.5	6.1	0.9	0.71	0.71	0.00	1.34	0.06*
	Verticality	2.9	1.6	5.7	1.3	0.71	0.71	0.00	1.34	0.06*
Dart	Location	3.0	1.6	5.0	1.9	0.57	0.57	0.00	1.07	0.20
	Length	1.7	0.8	3.9	1.9	0.71	0.71	0.00	1.34	0.06*
Zipper	Length	3.9	1.3	5.7	1.1	0.57	0.57	0.00	1.07	0.20
Button	Location	4.0	0.8	6.2	0.8	0.83	0.00	-0.83	1.29	0.07*
Balance	Left & right	3.9	1.3	6.1	1.2	0.57	0.57	0.00	1.07	0.20
	Grain line (waist to crotch)	3.9	1.3	5.3	1.5	0.43	0.43	0.00	0.80	0.54
	Grain balance (crotch to hem)	4.0	1.2	5.6	1.1	0.57	0.57	0.00	1.07	0.20
Overall	Length	3.7	1.0	6.4	0.5	0.86	0.86	0.00	1.60	0.01**
	Girth	3.4	1.1	6.1	1.1	1.00	1.00	0.00	1.87	0.00**
	Silhouette	2.6	0.8	5.0	1.2	0.86	0.86	0.00	1.60	0.01**

** $p < .05$, * $p < .1$, Cells which showed significance difference are shaded.

** 7-point Likert scale: 1(very bad) → 4(normal) → 7(very good)

evaluated the fits as being good with scores in a range of 5.0~6.4 points.

The differences in mean scores between the groups for fit parts that showed significant differences were divided into low(1.3~1.9 points), medium(2.0~2.5 points), and high(2.6~3.0 points) groups and presented in <Table 5>. Items that showed large differences (2.6~3.0 points) in mean scores were crotch ease, whether there are droop and drag lines, thigh/hem ease, outseam line location and verticality, overall pants circumference, pants length, and balance of front/back waist lines.

Items that showed moderate differences (2.0~2.5 points) in mean scores were upper hip ease, crotch length, dart amount in the thigh area, knee ease, dart length, button location, inseam line length, left/right symmetry, balance of front/back crotch lengths, grain balance from crotch to hem, and the overall silhouette.

Items that showed relatively small differences (1.3~1.9 points) in mean scores were at waist location, waist belt width, waist pleat amount, centerline location, zipper length, and inseam line location.

IV. Conclusion

This study aimed to analyze the differences in the results of fit evaluation between novices (undergraduates majoring clothing) and experts (technical designers and patternmakers with more than 15 years experience) by evaluation fit using questionnaire and statistical techniques. From the results of comparison of the fit evaluation between the expert group and the novice group, it was found that whereas the expert

group evaluated both the shirt and the pants as having moderate or poor fits in most items, the novice group evaluated both the shirt and the pants as having relatively good fits. The detailed results of this study are summarized as follows.

With respect to the shirt, the novice group was shown no significant difference from the expert group at the fits of the collar shape, shoulder line location, center front location and length, side view silhouette. However, at the bust/ waist/hip girths and the overall silhouettes of the shirt and sleeves, significant differences in the degree of evaluation of fits as being good were shown between the novices and the experts. In addition, regarding the verticality of the side-seam and the balance of front/back hems, whereas the novices evaluated the fits as being good with scores in a range of 4.7~5.7 points, the experts evaluated the fits as being poor with scores in a range of 2.9~3.6 points. The novices were shown to be not strict in the evaluation of the details such as collar band stand shapes, the irregularity of button locations, and breast dart end point (nipple point location).

Regarding the pants, the novice group was shown no significant difference from the expert group at the fit of waist and hip ease, but showed significant differences from the expert group in the evaluation of the fits of thigh and hem ease. In addition, the criteria for judgement of the fits of pants lengths and pants widths were shown to be significantly different between the two groups. With respect to the sideseams, the novices were shown to be not strict in the evaluation of the location and verticality for the pants in particular. The novices were also shown

to be poor in the evaluation of details such as dart lengths, zipper lengths, and button locations and likely to overlook the left/right balance of pants and the grain balance from crotch to hem.

Originally, the researchers in this study assumed that undergraduates in the first and second grades could understand fundamental clothing construction and proper fit, but we found that they are still lack of them. Therefore, it is difficult to interpret the differences between novices and experts in this study just from the differences in the levels of expertise and proficiency between the two groups. Therefore, we recommend that the results of this study be referred by the educators when their teaching fit evaluation in classes for students majoring in clothing and textiles.

As follow-up studies linked with this study, studies using 'eye trackers' were conducted. Since the eye tracking data measured using eye trackers are continuous so that the conversion process is not simple and the amount of data is large, so past research studies using eye tracking were based on the limited number of participants (e.g., 10 or smaller numbers). Therefore, this study also organized each group with seven participants so that the results of this study cannot be safely generalized. However, this study is considered meaningful in that it evaluated the degree to which evaluators regard the fit of clothes as being appropriate objectively by evaluation item using questionnaire techniques and statistical techniques.

The researchers in this study defined the '7 points' as a 'fit approval state in which the clothes are sellable to consumers' and notified to the novices in order to maximally analyze the

differences in fit evaluating ability between novices and experts. As can be seen from the results of the study, many items were found in which the degrees of strictness in the evaluation of fits were different between the novices and experts. These results are expected to suggest the items that must be particularly strictly and carefully when the students conduct fit evaluation after entering the industry because there are items more strictly evaluated by experts in the industry when ready made clothes are produced.

Although this study used questionnaire items in order to compare the fit evaluation levels of the expert group and the novice group, as a follow-up study, the eye tracking technology that enables more scientific and quantitative measurement and analyses of data will be used to identify intergroup differences in the durations of watching by fit evaluation area, the numbers of times of watching, and the routes of watching fit evaluation area. According to the results of a study conducted by Ashdown and O'Connell (2006), the results of fit evaluation by novices can be improved to a reliable level by educating them on fit evaluation for a short period of time. Although this study just compared the results of evaluation by the expert group and the novice group, it is considered necessary to measure changes in novices by education and compare the results with experts in future studies.

References

- Ashdown, S. P., & O'Connell, E. K. (2006). Comparison of test protocols for judging the fit of mature women's apparel. *Clothing and Textiles Research Journal*, 24(2), 137-148.
- Ha, H. J. (2011). A study of the development of formal

- pants patterns for women in their 20s and 30s with lower-body obesity. *The Research Journal of the Costume Culture*, 19(4), 820-835.
- Ha, H. J., & Seong, O. J. (2013). Developing a prototype of bi-stretch pants for women in their 20s and 30s with overweight lower bodies. *The Research Journal of the Costume Culture*, 21(2), 246-260.
- Howarton, R., & Lee, B. (2010). Market analysis of fit preferences of female boomers. *Journal of Fashion Marketing and Management*, 14(2), 219-229.
- Hwang, Y. M., & Lee, J. R. (2003). A study on the pattern and grading rule for dress shirts. *Journal of the Korean Society of Clothing and Textiles*, 27(1), 48-59.
- Jang, S. E., & Chang, J. H. (2008). A study on a men's dress shirt pattern by somatotype for mass customization system. *Journal of the Korean Society of Clothing and Textiles*, 32(2), 294-306.
- Kim, A. J., & Kim, S. R. (2012). A study on the duty specificities of technical designers - based on domestic fashion vendors. *Journal of The Korean Society of Fashion Design*, 12(3), 1-21.
- Kim, D. H., & Jang, J. A. (2013). A study on pattern development of men's slim-fit dress shirt - focus on the 25-35 aged men. *Fashion & Textile Research Journal*, 15(6), 950-962.
- Kim, H. A., & Chun, J. S. (2004). A study on the slacks fit and perception of lower body fitness of women in 20's. *The Research Journal of the Costume Culture*, 12(4), 638-647.
- Kim, H. A., & Chun, J. S. (2011). A comparative study on the fit of jean block patterns for women in their 20s. *Journal of the Korean Society of Clothing and Textiles*, 35(2), 136-145.
- Kim, I. H., Nam, Y. J., & Kim, S. M. (2011). Development of air force winter service uniform shirt pattern and automatic pattern drafting program for MTM production. *Journal of the Korean Society of Clothing and Textiles*, 35(11), 1271-1284.
- Kim, K. H. (2013). The study on comparing the fitness of women's golf slacks patterns depending on the brands: In the age group of after forties. *Journal of Korean Traditional Costume*, 16(2), 141-152.
- Kim, K. H. (2014). The study on comparing the fitness of golf skinny pants pattern. *Journal of Korean Traditional Costume*, 17(2), 73-86.
- Kim, M. J., Kim, M. O., & Park, S. K. (2014). Comparison and analysis of men's classic-fit and slim-fit shirt patterns: Utilizing the 3D virtual try-on system. *The Research Journal of the Costume Culture*, 22(2), 209-224.
- Kim, S. H., & Kim, H. S. (2012). The study of analysis the jean pants patterns wearing evaluation on compared with fabric and design of college women. *Korea Design Knowledge Journal*, 24, 94-104.
- Kim, S. O., Kweon, S. A., & Yoo, J. J. (2009). Development of slacks pattern for old aged abdominal obese women. *Korean Journal of Human Ecology*, 18(1), 152-161.
- Kim, S. Y., & Nam, Y. J. (2012). A study on establishing of fit test conditions for slacks. *Fashion & Textile Research Journal*, 14(3), 454-464.
- Kwon, S. H., & Hong, J. U. (2013). Evaluation of appearance and optimal for motion according to the back waist point of slacks pattern. *Journal of the Korean Society of Clothing and Textiles*, 37(6), 750-763.
- Lee, E. H., & Park, S. H. (2014). Comparison research on the ease of fitted dress shirt patterns. *Journal of fashion business*, 18(3), 91-103.
- Lee, E. Y. (2013). A Study on Present State of Technical Designers' Work Responsibilities and Training Conditions-Targeting Technical Designers Working for Clothing Vendors and Agents-. *Journal of the Korean Society of Clothing and Textiles*, 37(3), 292-305.
- Lee, J. S., & Lee, J. R. (2011). The development of pants pattern for the improvement of obese women's fit. *Fashion & Textile Research Journal*, 13(2), 253-262.
- Lee, M. J., & Sohn, H. S. (2011). A Study on the Cases of the Application of 3D Apparel CAD System to the Domestic and Overseas Fashion Education. *Journal of the Korean Society of Clothing and Textiles*, 35(9), 1112-1124.
- Lee, Y. S., & Kim, S. B. (2008). A study of blouse pattern to improve the uniform of the women employee of department store - Focused in the case of department store-. *Fashion & Textile Research Journal*, 10(6), 997-1005.
- Oh, S. Y., & Choi, H. S. (2012). Research on education conditions of basic clothing patterns in Korean colleges & universities. *Journal of the Korean Society of Clothing and Textiles*, 36(3), 346-359.
- Park, C. M. (2010). A study on the shirt collar with collar band. *The Research Journal of the Costume Culture*, 18(6), 1128-1241.
- Park, W. (2013). A comparative study on patternmaking method and general fit of women's pants slopers. *Korea Science and Art Forum*, 12, 83-92.
- Shin, K. Y., & Suh, M. A. (2010). A study on the low waist slacks pattern for the schoolgirl of a tween generation. *The Research Journal of the Costume Culture*, 18(6), 1165-1178.
- Shim, B. J., Suh, C. Y., & Yoo, H. (2005). A study on the functionality of engineered jean pants according to pattern analysis and clothing evaluation. *Journal of Fashion Business*, 9(4), 145-160.