“CloStyler” – mobile application to calculate the parameters of clothing blocks

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Abstract. Due to the COVID19 pandemic that challenged our society with necessity of distance learning it is right to provide educational institutions with tools those would be accessible anytime and anyplace for students. The aim of the current research is to develop an app that will support students studying apparel design as well as their teachers. The prototyping method was used to explore aspects of an intended design of the app. The method of semantic differential was used in order to evaluate the prototype. Comparative analysis of the already existing apps and the developed one was used to determine the level of the app competitiveness. The mobile app “CloStyler” was developed by using MIT App Inventor. Using the app allows achieving the labor productivity growth up to 568.5 %. The reduction of time costs is 29.4–85.0 %. By means of the comparative analysis of the apps those are already on the market and the developed app “CloStyler” it was determined that “CloStyler” is better suited and better equipped for the task of computing the parameters of the basic blocks of clothing.

1. Introduction
Due to the COVID19 pandemic that challenged our society with necessity of distance learning it is only right to provide educational institutions with tools those would be accessible anytime and anyplace for their students. Apparel industry is challenged to integrate technological innovation to assist students studying apparel design in their learning. Besides, there is a need in developing mobile apps to assists clothing patternmakers in their work.

While the mobile market is full of various applications that are useful enough to be considered outstanding representatives of mobile services in everyday life of clothing designers and other professionals in garment industry, in the world of science there is no wide range of papers dedicated to development of mobile apps to support garment design. The apps those are described in scientific papers are mostly connected to designing the smart-clothes and their impact on everyday life of consumers. For example, the paper [1] is dedicated to the work of textile antenna arrays for smart clothing applications.

On the other hand, the usefulness of mobile apps in educational process is widely described in scientific literature. The area of apparel design is not the exception. Author of [2] deals with the implementation of mobile applications in the training of future experts in design while studying “Computer design” and “Basics of Shape Formation”. With the example of such mobile applications...
as Pinterest, Fashion Design, Sketch, Bamboo Paper, SCANN3D, True Sculptor, d3D Sculptor and RealtimeBoard the author [2] provides practical details of how to attract mobile technologies at different stages of the project development of product.

Pedagogical and technological augmentation of mobile learning is well acknowledged by researchers all over the world [3]. Such researches were conducted in different areas such as follows: interactive learning environments for young children [3], teaching and learning in clinical medicine [4, 5], teaching languages [6, 7], learning physics with smartphones. Some advantages and disadvantages of using smartphones in the educational activities such as teaching field-based identification skills were described in [8]. Authors [9] performed a comparison of student performance and “found that students could more accurately evaluate the environmental impact of products and create more environmentally friendly ‘hypothetical’ products when using the app”. Besides that, authors [9] made a conclusion that mobile apps could be a useful tool for industry professionals and consumers.

There are several applications those are dedicated to calculating the parameters of the basic garments’ blocks. The applications are as follows: Chalk, JSK Patrones, Circle Skirt Calculator, Solo Patrones App. The mentioned apps are not entirely useful for the needs of students or their teachers. Besides that, they do not allow to calculate a wide range of constructions. Therefore, the aim of the current research is to develop an app that will support students studying apparel design as well as their teachers.

2. Methodology
The method of prototyping was used to explore different aspects of an intended design of the app “CloStyler”. The prototype was created under the name “Master Pattern” and was described in [8]. The method of semantic differential described in [10] was used in order to evaluate the prototype.

A survey was conducted in order to determine the best ways of improvement of the prototype. There were 42 experts representing 25 educational institutions from 22 regions of Ukraine. The questionnaire that was used in the survey included questions with alternative answers and open questions as well.

Comparative analysis of the already existing apps and the developed one was used to determine the level of competitiveness of the app.

3. Results and discussion

3.1. Market exploration
The first step in any application development is market exploration. Thus, we performed statistical analysis of the already existing apps those are or might be used for clothing design, pattern drafting, clothing distribution, educational purposes or for any other activity regarding clothing design. Input data for the current research are the search results on Google Play and AppStore by key words “clothing”, “clothing patterns”, “clothing design” etc. There were found 479 mobile applications that meet our requirements: 352 mobile apps with operating system Android (Google Play) and 127 apps with operating system iOS (AppStore).

According to data of the site StatCounter Global Stats, nowadays the state of the mobile operating system market share worldwide is as follows: Android – 74.25%, iOS – 25.15%, Samsung – 0.23%, Unknown – 0.08%, Windows – 0.03%. The exploration of mobile applications that are used in garment industry displays approximately the same ratio: Android – 73.5% and iOS – 26.5%.

As one can see on the figure 1, there are 14 types of the mobile applications that are used in garment industry. The most populated categories of the apps are as follows: “Galleries of ready-made clothing patterns”, “Online shops apps”, and various “Galleries of clothing styles” (figure 2). The main contribution to all of the categories large and small alike is made through the Android operating system. One of the smallest categories is “Pattern calculators” group. It is represented by only four applications (Chalk, JSK Patrones, Circle Skirt Calculator, Solo Patrones App) that were found in the search results. All of them are working on Android operating system. There were no found any such
application with iOS operating system. Thus, it was confirmed that there are no enough tools on the mobile apps market to provide clothing designers with ability to calculate the parameters of the clothing blocks.

![Figure 1. Types of the mobile applications that are used in garment industry.](image1.png)

**Figure 1.** Types of the mobile applications that are used in garment industry.

![Figure 2. The most populated categories of the applications in garment industry.](image2.png)

**Figure 2.** The most populated categories of the applications in garment industry.

3.2. **Forming the requirements to the mobile application**

Requirements to the app that is under development were formulated based on results of the survey. It was discovered that the majority of experts use the pattern drafting method (PDM) called “Muller...
&Son” (19% of the respondents). The second place is occupied by the PDM EMKO REV (10%) and about 6% of experts prefer PDM CSRISI. The PDM of Republican House of Fashion is used by 5% of experts while such methods as “no pattern method”, draping method, the PDM of KNUTD and the PDM of Fashion House of Kiev were indicated by 3% of experts each. 12% of respondents indicated that they use some methods they call “computing and graphing”, and another 13% are using different methods those are not well known to majority of clothing patternmakers.

More than a half of the experts group indicated that they usually work with top wear. The garment types they are drafting the most are as follows: a coat, a jacket (48% in total), a dress, a blouse, a skirt, and trousers (another 52% in total). Most of their work is targeting female population. All the experts gave positive response for the idea of using the mobile app to calculate the parameters of basic garments’ blocks.

3.3. Evaluation of the application prototype

A prototype of the app was developed under the name “Master Pattern”. The calculation in the prototype was given for the specific instruction of the clothing block pattern drafting, which is described in [11, 12] and usually called CSRISI.

At the first step of using the method of semantic differential to evaluate the prototype formation of word pairs that form the semantic differential (SD) was performed. This process includes the selection of Kansei words (KW) with the opposite meaning and interpretation. Each pair of KW is the SD poles for a particular attribute of an investigated app: speed, precision, complexity of using the app and so on. SD scales on each of Kansei attributes of the app were developed as bipolar adjectival pairs. These tools include a few scales put horizontally on a form (questionnaire) (figure 3). Each scale has seven gradations that are expressed numerically (-3, -2, -1, 0, +1, +2, +3) or verbally (hard, medium, low, can, low, medium, hard) [10, 13].

| slow          | -3 | -2 | -1 | 0  | 1  | 2  | 3  |
|---------------|----|----|----|----|----|----|----|
| complicate    |    |    |    |    |    |    |    |
| accurate      |    |    |    |    |    |    |    |
| user-friendly interface |    |    |    |    |    |    |    |
| necessary     |    |    |    |    |    |    |    |

Figure 3. Example of questionnaire.

The next step was evaluation of the app prototype by experts using semantic differential scales and processing of survey results. The expert group consisted of 10 experts (students studying apparel design). In a survey the app prototype was valued using evaluation factors in bipolar scales defined by verbal antonyms of KW from each end of the scale (figure 4).

Figure 4. Psychographic profile of the app prototype.
After that the KW pairs were coded. The common practice of coding uses the first letters of words with opposite meaning. Thus, the codes are as follows: SQ (slow-quickly); CS (complicate-simple); AI (accurate-inaccurate); FU (user-friendly interface – user-unfriendly interface); NU (necessary-unnecessary). As a result of the survey psychographic profile of the app prototype was constructed. This profile reflects the average amount of evaluation coefficients for each pair of KW: 2.72; 2.55; 2.18.; 1.9; 2.64. These coefficients respond to the positive meanings of the KW that shows that the mobile app gets approval of the experts.

3.4. Program realization of the mobile application
The disadvantages those were listed by the experts were considered as ways of improvement of the prototype. Therefore, taking into account all the advantages and disadvantages of the prototype and the results of the conducted surveys the mobile app “CloStyler” (figure 5) was developed by using MIT App Inventor.

![CloStyler Icon](image)

**Figure 5.** Icon of the mobile app “CloStyler”.

The purpose of the mobile application is to calculate the parameters of the basic blocks of clothing. In lite version of the app it is possible to calculate two garment types’ constructions: a skirt and a top. The pro version of the app allows users to calculate clothing blocks’ parameters by three different methods of pattern drafting. Eight garment types are available: a top, pants, a suit jacket, a jacket, a skirt, a dress, a blouse, and a shirt. Available languages are as follows: English, Russian, and Ukrainian.

Users may choose pattern drafting method as well as a garment type. The input data for calculation are body measurements and amount of easings. The body measurements and amount of easings might be entered by a user. The app gives users the option of completing the text fields by a shorthand method on the basis of what has been typed before. Otherwise, the fields will be autocompleted by zeros. Flowchart displaying the work of the app “CloStyler” is given in the figure 6.

![CloStyler Flowchart](image)

**Figure 6.** Flowchart showing the work of the app “CloStyler”.
The app is available at the following link: https://play.google.com/store/apps/details?id=appinventor.ai_zbirvykladach.CloStylerLight

The order of calculation is performed according to the pattern drafting method that was chosen by a user. The names of the constructive segments correspond to the points in the given figures of patterns blocks (figure 7).

![Screenhots of the mobile app “CloStyler”](image)

**Figure 7.** Screenshots of the mobile app “CloStyler”.

### 3.5. Assessment of the level of competitiveness of the app

The level of competitiveness of the app was determined by way of comparative analysis of the already existing apps and the developed one. The results of the analysis are given in the form of the table 1. As one can see the developed application provides users with more functions and more available pattern drafting methods. Besides, the language settings make it better visible on the market.
Table 1. Analysis of mobile applications computing parameters of basic garment blocks.

| Mobile application | Number of PDM | Number of garment types | Gender settings available | Illustrations | Completion | Languages                  |
|--------------------|---------------|-------------------------|---------------------------|---------------|------------|----------------------------|
| CloStyler          | 3             | 8                       | 2                         | +             | Whole cycle | Ukrainian, Russian, English |
| Circle Skirt Calculator | 1           | 1                       | 1                         | –             | Initial computing | English               |
| Chalk              | 1             | 4                       | 1                         | +             | Computing   | English, Korean             |
| JSK Patrones Solo Patrones App | 1 | 2                       | 1                         | +             | Whole cycle | Spanish                   |

In order to evaluate the impact of using the app during the lessons of apparel design the indexes of labor productivity growth and reduction of time costs were computed (table 2). We used the next symbols: Nf – number of formulas, which are used by the certain pattern drafting method; Tc – calculation time when computing is performed by using the calculator; Tm – duration of measurements input while the app is used for computing; Tca – duration of actual calculation while the app is used for computing; Ta – total calculation time when computing is performed by using the app; RTC – reduction of time cost; PG – productivity growth.

Table 2. Indexes of labor productivity growth and reduction of time costs.

| Pattern Drafting Method | Garment type | Nf | Tc, s | Tm, s | Tca, s | Ta, s | RTC, % | PG, % |
|-------------------------|--------------|----|-------|-------|--------|-------|--------|-------|
| CSRISI                  | Top          | 36 | 236.4 | 76    | 23     | 99    | 58.1   | 138.7 |
| Muller & Son            | Jacket       | 78 | 512.1 | 66    | 14     | 80    | 84.4   | 540.1 |
| Muller & Son            | Shirt        | 40 | 262.6 | 38    | 36     | 74    | 71.8   | 254.9 |
| Muller & Son            | Skirt        | 15 | 98.5  | 15    | 37     | 52    | 47.2   | 89.4  |
| Muller & Son            | Blouse       | 48 | 315.1 | 35    | 70     | 105   | 66.7   | 200.4 |
| Muller & Son            | Dress        | 86 | 564.6 | 32    | 145    | 177   | 68.7   | 219.0 |
| Muller & Son            | Trousers (women) | 30 | 197.0 | 46    | 93     | 139   | 29.4   | 41.7  |
| Muller & Son            | Trousers (man) | 34 | 223.2 | 24    | 42     | 66    | 70.4   | 238.2 |
| Muller & Son            | Suit jacket  | 91 | 597.5 | 19    | 85     | 104   | 82.6   | 474.9 |
| EMKO REV                | Jacket       | 126 | 827.3 | 222   | 205    | 427   | 48.4   | 93.7  |
| EMKO REV                | Dress        | 126 | 827.3 | 244   | 144    | 388   | 53.1   | 113.2 |
| EMKO REV                | Trousers     | 56 | 367.7 | 42    | 13     | 55    | 85.0   | 568.5 |

Using the developed app to compute the parameters of the garment blocks allows achieving the labor productivity growth up to 568.5%. The average value of labor productivity growth is 247.7%. The reduction of time costs is about 29.4-85.0 %.

4. Conclusion
By means of the comparative analysis of the apps those are already on the market and the developed app “CloStyler” it was determined that “CloStyler” is better suited and better equipped for the task of computing the parameters of the basic blocks of clothing.
The precision of the calculation is the same as of other calculation methods while the speed is much more preferable. Besides that, the risk of accidental mistakes due to the human factor is excluded from the designing process.

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