



## Decision Making System for Selection of Prospective Scholarship Recipients Using the Saw (Simple Additive Waighting) Method at Vocational School Bina Negara Gubug

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**Abstract.** *The selection system at Bina Negara Gubug Vocational School Jl. KH. Hasan Anwar No.9 Gubug currently processes data on the criteria for each student for each type of scholarship. It does not yet have a database system but uses a computerized system with Microsoft Excel, so there are often delays in the selection process in preparing the selection report for scholarship recipients. This research uses the Research and Development (R & D) development model by Borg and Gall with 6 steps of development, namely Research and Information Collecting, Planning, Develop Preliminary Form of Product, Preliminary Field Testing, Main Product Revision, Main Field Testing. The scholarship selection decision support system application product uses the SAW (Simple Additive Waighting) method. Visual Basic 6.0 development software and Microsoft Access database. This system can provide a useful solution for the decision-making system for selecting scholarship recipients for schools so that a better and faster selection can be achieved.*

**Keywords:** *Decision Support Systems, Scholarship, Research and Development methods, SAW.*

### 1. INTRODUCTION

Realizing that education plays a very important role, the state strongly supports every citizen to achieve the highest possible education. Some of them provide free education programs and scholarship programs. Scholarships can be said to be funding that does not come from self-funding or parents, but is provided by the government, private companies, embassies, universities, and educational or research institutions.

Based on Law Number 48 of 2008 concerning Education Funding, Part Five, Article 27 paragraph (1), states that the government and regional governments according to their authority provide educational assistance or scholarships to students whose parents or guardians are unable to finance their education. Article 27 paragraph (2) states that the government and regional governments according to their authority can provide scholarships to outstanding students

Gubug Bina Negara Vocational School which is located at Jl. KH. Hasan Anwar No. 9 Gubug Grobogan is a private vocational high school which has 4 departments consisting of Accounting, Office Administration, Marketing and Computer Network Engineering. This vocational school provides scholarships to students which include several types, namely Supersemar (Achievement), BKM (Underprivileged Assistance) and BSM (Poor Student Assistance) scholarships.

Table 1.1 Data on Number of Students at Bina Negara Gubug Vocational School in 2015  
(Classes X-XII)

Class	Accountancy	Office	Marketing	TKJ	Qty
X	80	38	37	40	195
XI	78	36	34	37	185
XII	76	35	34	35	180
Total					560

There are several methods that can be used to determine the weight value as a solution to the problem above. Scholarship selection can be done using the weight value method, including: 1. SAW (*Simple Additive Weighting*) Method 2. WP (*Weighting Product*) Method 3. **AHP Method** (*Analytic Hierarchy Process*) 4. Topsis Method (*Technique for Order Preference by Similarity to Ideal Solution*)

Of the several existing methods, the author chose to use the SAW (*Simple Additive Weighting*) method because this method has advantages compared to other decision making methods. Its advantage lies in its ability to carry out assessments more closely and precisely because it is based on predetermined criteria and ranking values. Apart from that, the SAW (*Simple Additive Weighting*) method can also select the best alternative from a number of existing alternatives because there is a ranking process after determining the weight for each attribute and the time needed to carry out the calculation process is relatively easier and shorter.

The SAW (*Simple Additive Weighting*) method begins with determining criteria or assessment measures which are the basis for determining an alternative or choice between two possibilities that are candidates in the decision making process, and the weight value. Then the data that has been obtained will be processed using the SAW (*Simple Additive Weighting*) method . After that, the results of the calculations are ranked with the aim of getting the highest alternative, so that those determining the selection of scholarship recipients get recommendations for scholarship recipients from the ranking results. In determining the selection criteria for scholarship recipients, the types of scholarships have been defined, namely Supersemar scholarships, Underprivileged scholarships and Poor Student scholarships. Alternatives are obtained from scholarship applicant data which will later be processed using the SAW (*Simple Additive Weighting*) method . The results of the

scholarship recipient selection process produce weight values, criteria, alternatives and ranking results as material for decision making.

The criteria used in selecting applicants are 1) Achievement Index, 2) Parent's Income, 3) Parent's Dependents, 4) Poverty Certificate from the Village, and 5) Photocopy of electricity bill. Weight value criteria: 1) Very Important (SP) value 4, 2) Important (P) value 3, 3) Quite Important (CP) value 2, 4) Less Important (KP) value 1 .

## **2. THEORETICAL FOUNDATION**

### **A. System**

- 1) A system is a collection of elements that are interrelated and responsible for processing input *to* produce output ( Amsyah, 2008).
- 2) A system is a unit that integrates a collection of data that are interconnected with each other and makes it available for various applications within an organization (Jogiyanto, 2009).
- 3) Every system has a goal and this goal is the motivation that directs a system without a goal, the system becomes uncontrollable and the goals between one system and another are different (Budiardjo, 2008).

### **B. Decision**

A decision is a reaction to several alternative solutions that is carried out consciously by analyzing the possibilities of these alternatives along with their consequences. Every decision will make the final choice, it can be an action or an opinion. It all starts when you need to do something but don't know what to do.

### **C. Decision Support Systems**

A decision support system (DSS) or *Decision Support System (DSS)* is a system that is able to provide problem solving capabilities and communication capabilities for problems with semi-structured and unstructured conditions. This system is used to assist decision making in semi-structured situations and unstructured situations, where no one knows exactly how decisions should be made (Turban, 2011).

### 3. METHODOLOGY

#### A. Types of research

The model that will be developed refers to the *Research and Development (R&D)* model from Borg & Gall. This development plan with R&D design has the aim of developing and validating the product. The R&D method is a research method used to produce certain products and test the effectiveness of these products. According to Borg and Gall (1989) the research and development method or *Research and Development (R&D)* has steps that must include *Information Collecting, Planning, Develop Preliminary Form of Product, Preliminary Field Testing, Main Product Revision, Main Field Testing*.

#### B. The scope of research

In research conducted regarding internal problems at Bina Negara Gubug Vocational School using a decision support system which aims to facilitate the selection of prospective scholarship recipients.

#### C. How to Collect Data

In conducting this research the author used several research methods so that the research results could run more effectively.

##### 1. Object of research

The research was conducted at Bina Negara Gubug Vocational School, Jl. KH. Hasan Anwar No. 9 Grobogan Huts.

##### a. Data Type

- Primary data

The data used for research is valid data from Vocational School Bina Negara Gubug.

- Secondary Data

Data taken from research objects, existing data includes *literature*, journal, book and internet data which can be used as support in research.

##### 2. Data Collection Techniques

##### a. Interview (*Interview*)

The aim of the interviews was so that the authors in the research could directly understand what data would be needed and what would be carried out. Interviews were conducted with Administration, Admin, Class Teachers, School Principals and Students at the Bina Negara Gubug Vocational School concerned in the research being carried out.

b. Observation

The second step is to make direct observations at Bina Negara Gubug Vocational School.

c. Documentation

After conducting interviews and observations, the author carries out documentation related to the research being carried out.

3. Development Procedure

Based on the development model carried out using the Borg and Gall *Research and Development (R&D) model*, the development procedure used in this research uses 6 steps due to limited time. The method used includes 6 steps, namely 1) *Research and Information Collecting*, 2) *Planning*, 3) *Develop Preliminary Form of Product*, 4) *Preliminary Field Testing*, 5) *Main Product Revision*, and 6) *Main Field Testing*. The R&D method is defined simply as a research method that is deliberate, systematic, or when it is said to formulate, improve, develop, produce, test the effectiveness of certain products, models, methods, services, procedures that are superior, new, effective, efficient, productive, and meaningful. The following are the 6 steps of the R&D model as follows:

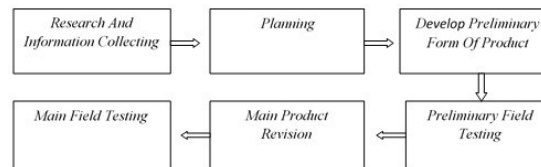


Figure 1.1 Six Step R&D Design Model (Borg & Gall, 1989)

Source: Borg & Gall, 1989

This development is carried out to produce a product, so that users can try the product that has been produced.

The SAW (*Simple Additive Weighting method*) is often also known as the weighted addition method. The basic concept of this method is to find a weighted sum of performance on each attribute. The SAW (*Simple Additive Weighting method*) can be recommended to complete solutions in multi-process decision making systems. The SAW (*Simple Additive Weighting method*) is a method that is widely used in making decisions that have many attributes. The SAW (*Simple Additive Weighting method*) requires a process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings (Kusumadewi, 2006).

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\text{Max}_i x_{ij}} & \text{jika j adalah atribut keuntungan (benefit)} \\ \frac{\text{Min}_i x_{ij}}{x_{ij}} & \text{jika j adalah atribut biaya (cost)} \end{cases}$$

Figure 2.3 SAW (*Simple Additive Weighting*) Method

Source: Kusumadewi, 2006

Where  $r_{ij}$  is the normalized performance rating of alternative  $A_i$  on attribute  $C_j$ ;  $i=1,2,\dots,m$  and  $j=1,2,\dots,n$ . The preference value for each alternative ( $V_i$ ) is given as:

A larger  $V_i$  value indicates that alternative  $A_i$  is more selected.

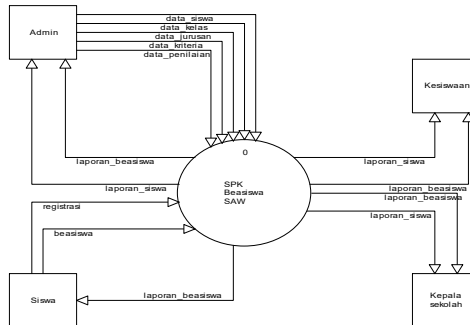
Steps for using the SAW Method:

1. Determine the criteria that will be used as a reference in decision making.
2. Determine the suitability rating of each alternative for each criterion.
3. Create a decision matrix based on criteria, then normalize the matrix based on equations adjusted to the type of attribute (profit attribute or cost attribute) to obtain a normalized matrix R.
4. The final result is obtained from the ranking process, namely the sum of the multiplication of the normalized matrix R with the weight vector to obtain the largest value which is selected as the best alternative as a solution (Wibowo, 2009).

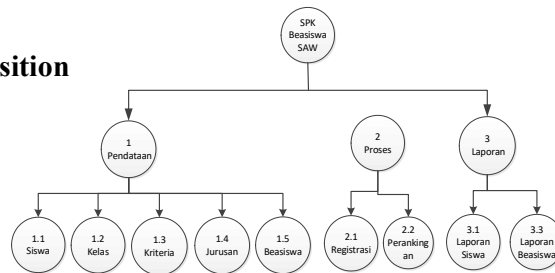
The advantage of the SAW (*Simple Additive Weighting*) method compared to other decision making models lies in its ability to carry out assessments more precisely because it is based on predetermined criteria values and preference weights, besides that SAW can also select the best alternative from a number of existing alternatives because there is a ranking process after determining the weight for each attribute (Wibowo, 2006).

## Data Flow Diagrams

Project Name: SPK Beasiswa SAW  
 Project Path: c:\gigi  
 Chart File: dfd00001.dfd  
 Chart Name: Youdon - Context Diagram  
 Created On: Jun-08-2017  
 Created By: aret  
 Modified On:  
 Modified By: aret



## Decomposition



## 4. RESULTS AND DISCUSSION

### A. Research result

This scription research was carried out by testing the product design and analysis process. ehuser or user. Valid designing products used by users A key assessment instrument that takes the form of a lid ator sheet .This important assessment is used as an indicator of the ordinal node and a way to improve the value of the dataa p h a sil v a lid a si. It follows that the assessment results and value score indicators are carried out.

Design validation carried out by experts and product validation by *users* have assessments that are used as indicators and conclusions in assigning scores to validation results, as shown in the table below:

Indicator Table

SCORE	MARK
$1 < n \leq 10$	Not good
$11 \leq n \leq 20$	Enough
$21 \leq n \leq 30$	Good
$31 \leq n \leq 40$	Very good (Valid)

Conclusion Table

No	CONCLUSION
1	It cannot be used yet and must be replaced
2	Can be used with multiple revisions
3	Can be used with minor revisions
4	Can be used without revision

- a. Testing the nv a cover on the hpar zero side

Then valid iasi de a intolerance hpar on Research this script with thought Iwan Koerniawan., SE, M.Si. EVALUATION RESULTS OF THE DESIGN VALIDATION RESULTS ARE OBTAINED BY THE CHARACTER ipsi. The results of the research instrument in the form of a questionnaire by research subjects can be seen in the attachment.

Indicator No	Indicator Value
1	3
2	3
3	3
4	3
5	2
6	2
7	2
8	3
9	3
10	3
<b>Final</b>	<b>27</b>



Results of the nv alid test on the design of HP ar e mb er ic ation score scores 27. b a t h e d e s a n S y s t e m P Supporting the Selection Decision for Prospective Scholarship Recipients by Using the SAW ( Simple *Additive* Weighting ) Method at Bina Negara Gubug Vocational School has been found to be good and valuable If the sim pula can be used with a re - vision kit .

## 2. Product design v alidation testing by users

Indicator	Princip al	Admi n	Student
1	3	3	3
2	3	3	3
3	3	4	3
4	3	2	3
5	3	3	3
6	4	3	3
7	3	3	3
8	3	3	3
9	2	3	3
10	3	3	3
<b>Final</b>	<b>30</b>	<b>30</b>	<b>30</b>
<b>90/3 = 30</b>			

The results of the average scores obtained are based on the product system for the decision support system for the selection of prospective scholarship recipients by using a n SAW (*Simple Additive Waighting*) M e thod at Vocational School Bina Negara Gubug ol e h *us e r* yes a it's 30 p o int.

The results of the nv al idation test of the product design by the user or *user* have a score of 30 . This value is based on the sum of the total scores given by three users and then divided into three e to reach a silk value of 30 points . This proves that the prototype *system* for making decisions on the selection and selection of prospective scholarship recipients uses the SAW ( Simple Additive Waighting ) method as stated above .A nsan is a good fix and a fix to the node and can be used with a little revision .

## Development Results

Based on the system design that was designed in the previous chapter, the following is the implementation of the system that has been designed. The program implementation was created using the *Visual Basic 6.0 programming language* and using a *Microsoft Access database* .

### 1. Administrator *Login* Page

The first *form* that will appear in this program is the main form . The main form is not yet active for approval . So to activate this nu te , log in first . When we log in , the user must enter the correct user name and password .If *the user name* and password are incorrect , then there is nothing to enter in the system .



### 2. Main page

The main page is differentiated by the level of who is *logging in* , for the student level there is a registration menu, and a report menu with a scholarship report sub-menu. For the Admin level there is a master menu with sub menus for student data, criteria data, department data, class data, scholarship data, a process menu with registration and ranking sub menus, and a report menu with student report and scholarship report sub menus. For the principal level there is a report menu with sub menus for student reports and scholarship reports. For student level, there is a registration process menu.



### 3. User data *form* page

The user data *form* is used as access rights between students and the school principal. The principal can only see the report. Meanwhile, students have full access rights. The user data *form* is equipped with buttons for saving and deleting.

user_id	username	password	jabatan
4	NUR	NUR	KEPSEK

#### 4. Student Data Collection *Form* Page

*form* page is a *form* that is used to record students who have registered. On the student form here there is a grades section that is used to provide the student's criteria scores. This page also contains a list of student tables with buttons for deleting and changing student data, and also a report button that is used to view student data in detail.

No	Nama_siswa	Tempat_Lahir	Tgl_Lahir	Alamat	Kota	Jurusan	Jabatan
280	SEELY FITRIA A	DEMAK	1/5/2001	OS KARANGAWEN	DEMAK	IS	IS
281	ANGISA DEWI NURANI	SEMARANG	9/7/2001	A. KEDUNGKALAU	SEMARANG	IS	IS
282	DIANDEWI	GOROGUN	1/17/2001	TESAWANGI MALOH	GOROGUN	IS	IS
283	INDORI KANIKO	SEMARANG	9/18/2002	A. KARANGAWEN	SEMARANG	IS	IS
284	IKHARIFAH	SEMARANG	1/1/1999	A. KEDUNGKALAU	SEMARANG	IS	IS
285	HANINDY LARTISA	DEMAK	11/11/1990	OS KARANGAWEN	DEMAK	IS	IS
286	NOVELLA ANGISTA DEWI	SEMARANG	1/1/2002	A. KEDUNGKALAU	SEMARANG	IS	IS
287	INDRIELLA ANGISTA DWI	GOROGUN	3/1/2003	TESAWANGI VETAN	GOROGUN	IS	IS
288	TRE ANE SUGANTO	DEMAK	1/1/1999	OS KARANGAWEN	DEMAK	IS	IS
289	LUKA ANDRIANI	DEMAK	11/1/1990	OS KARANGAWEN	DEMAK	IS	IS
290	WIATRI HENDIAT	GOROGUN	1/1/2002	TESAWANGI VETAN	GOROGUN	IS	IS

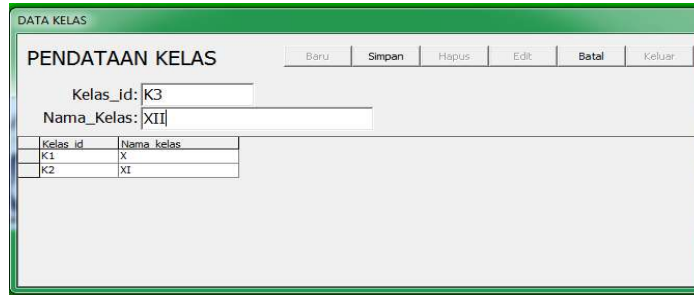
#### 5. Scholarship Registration *Form* page

*form* page is used to register students who will apply for a scholarship. This page contains a form to fill in student data. This page also contains a list of student registration tables with buttons for saving, deleting and changing student data, and also a report button that is used to view student data in detail.

Id_Reg	Tgl_Reg	Nis	Beasiswa_id
1	4/9/2017	101	B3
2	4/9/2017	102	B3
3	4/9/2017	103	B3
4	4/10/2017	104	B1
5	4/10/2017	112	B1
6	4/13/2017	102	B2
8	4/18/2017	112	B4
9	3/9/2017	102	B1

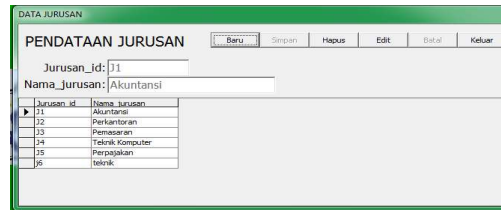
#### 6. Class *Form* Page

*form* page is a page used to enter class data in the form of class code data, class name and department code. This page also contains a list of class tables with buttons for saving, deleting and changing class data.



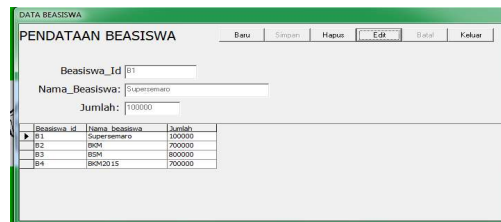
7. Department Form Page

form page is a page used to enter department data in the form of department code data and department name. This page also contains a list of department tables with buttons for deleting and changing department data.



8. Scholarship Registration Form Page

form page is a form used to add types of scholarships. On this student data page there are menus for editing data, deleting data, and saving data.



9. Student Data Report Form Page

form page is a page used to display student data.



form page , the admin inputs the Nis, scholarship ID, and value form as consideration for getting the appropriate scholarship for the student. On this page there are menus for editing data, deleting data, and saving data.

Id Req	Tgl Req	Nis	Beasiswa id
193	6/20/2017	114	B3
194	6/20/2017	115	B3
195	6/20/2017	116	B3
196	6/20/2017	117	B3
197	6/20/2017	118	B3
198	6/20/2017	119	B3
199	6/20/2017	120	B3
200	6/20/2017	121	B3
201	6/21/2017	280	B1

## 10. Scoring form

This form contains the assessment criteria for the student. Where the admin must fill in the achievement criteria, parental responsibility, average report card score, scholarship status, and electricity account. There are buttons to renew and cancel.

## 11. Ranking Report

This page contains the results of the registration and assessment process to find out whether the student received the Supersemar scholarship, Underprivileged Scholarship and Poor Student Scholarship.

PERANGKINAN

BEASISWA\_ID: 01 SUPERSEMAR

Proses

ID	Nama Siswa	Indeks Prestasi	Tanggung Jawab	Pengalaman Diri	Status Beasiswa	Nilai Rata-Rata	Referensi Loker	Nilai
18	RUDANSAH	0.5	1	1	1	0.75	0.75	0.9
4	WIDODO	0.25	0.5	1	1	0.75	0.1	0.57
25	RIDHO BAYU AJIE	0.5	0.75	1	0.25	0.5	0.5	0.525
24	WIDI UTOMO	0.25	0.5	0.1	1	0.25	0.5	0.48
9	BUDI WALLYO	1	0.25	0.25	0.25	0.25	0.5	0.45
12	IRWAN SETYO NUGROHO	0.25	1	0.1	0.1	0.5	0.5	0.445
19	MGH NDR ALVIN	0.5	0.5	0.25	0.5	0.25	0.5	0.425
29	HRDIATI LARTIKA SARDI	0.75	0.25	0.25	0.5	0.1	0.25	0.42
26	MUHAMMAD RIZKI FIDIO	0.1	0.1	0.25	0.25	0.25	0.75	0.42
8	BUDI SANTOSO	1	1	0.25	0.1	0.25	0.1	0.415
27	AGUS SETAWAN	0.5	0.5	0.1	0.1	0.1	1	0.4
17	MUHAMMAD SIDKON	0.5	0.25	0.25	0.25	0.25	0.75	0.4
1	APRI FINTA MARDIANASARI	0.25	0.5	0.5	0.25	0.5	0.5	0.4
19	SISWYO WIDOWO	0.5	0.5	0.5	0.25	0.5	0.25	0.4
28	ARIF FAHRUDIN	0.25	0.5	0.25	0.25	1	0.1	0.385
30	EDY SUSANTO	0.75	0.1	0.5	0.5	0.1	0.25	0.38
22	JOHAN MAHENDRA	0.25	0.5	0.25	0.25	0.5	0.5	0.375
10	IMAM SETIADI	0.25	0.25	0.5	0.25	0.75	0.25	0.375
6	IMHAD ABDUL MALIK	0.25	0.1	0.25	0.1	0.25	1	0.365
16	MUHAMMAD YUSUF TRI ATMALIA	0.25	0.25	0.25	0.25	0.25	0.25	0.35
30	SULISTIOWATI	0.1	0.25	0.5	0.5	0.25	0.25	0.345

## 12. Scholarship Report

This page displays the number of students who will get each type of scholarship, students who apply for a scholarship, students who get a scholarship and students who fail to get a scholarship, which will be used as a scholarship report to the school principal.

Laporan Registrasi

DAFTAR CALON PENERIMA BEASISWA SUPERSEMAR

Total Siswa: 41

Cetak

Nama Siswa	Nilai
APRI FINTA MARDIANASARI	0.1
DZIKRON NAJIB	0.1
NURUTS TSANI ULIN NIKMAH	0.1
WIDODO	0.1
ADHY YOGA PRADHANA	0.1
AHMAD ABDUL MALIK	0.1
ANAS RUSLI	0.1
BUDI SANTOSO	0.1
BUDI WALLYO	0.1
IMAM SETIADI	0.1
INDRA PERMANA	0.1
IRWAN SETYO NUGROHO	0.1
ISKANDAR ROMADON	0.1
KUMORO ADJUNDO	0.1
MGH NDR ALVIN	0.1
MUHAMMAD YUSUF TRI ATMALIA	0.1
MUHAMMAD SIDKON	0.1
RUDANSAH	0.1
SISWYO WIDOWO	0.1
SULISTIOWATI	0.1
TEGUH SANTOSO	0.1
JOHAN MAHENDRA	0.1
YOHAN MAHENDRA	0.1
WIDI UTOMO	0.1
RIDHO BAYU AJIE	0.1
ARIF FAHRUDIN	0.1
AGUS SETAWAN	0.1
DHANANG HADIPYANTO	0.1
DWI RESTU WIDOWO	0.1
EDY SUSANTO	0.1
LENDANG PURWANINGRUM	0.1

## 13. Student Reports Not Passing Scholarship Selection

Laporan Siswa Gugur

DAFTAR SISWA TIDAK LOLOS BEASISWA SUPERSEMAR

Total Siswa: 6

Cetak

Nama Siswa	Nilai
NURUTS TSANI ULIN NIKMAH	0.1
INDRA PERMANA	0.13
JOHAN MAHENDRA	0.145
TEGUH SANTOSO	0.16
MUHAMMAD YUSUF TRI ATMALIA	0.19
DZIKRON NAJIB	0.22

## 5. CONCLUSION

The results of research based on development using the R&D method where testing was carried out by experts and product testing by users can be concluded as follows:

- a. The system used has helped schools select candidates for scholarships quickly and efficiently.
- b. A computerized system with a data storage process using *a database*, making the selection process easier in preparing selection reports for scholarship recipients more quickly.

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