DEVELOPMENT OF ASSESSMENT APPLICATIONS FOR CHILDREN WITH SPECIAL NEEDS WITH PROGRESSIVE WEB APP IN RAFAHA ARJASARI SPECIAL SCHOOL

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ABSTRACT

Rafaha Arjasari Special School was established in 2014 and domiciled in Bandung Regency, which is precisely located at Jln. Kenangasari, Arjasari. Rafaha Arjasari Special School is one of the schools that organize special education for children with special needs or ABK. The learning that took place at Rafaha Arjasari Special School refers to the prevailing national curriculum and then adjusted to the abilities, obstacles, and needs of each child. Information about student profiles is obtained through assessment. Assessment is an absolute process that must be carried out by educators who provide learning to children with special needs. Problems faced by teachers as assessors are the difficulty of carrying and using the files to be used in the assessment process, the teacher feels the slow recording of assessment answers if the teacher sees the child's activities at an unexpected time, and the teacher finds it difficult to use the application to carry out the assessment process if the internet conditions are lacking stable or dead. Assessment applications built in the form of web-based applications using Progressive Web App (PWA) technology to facilitate teachers in conducting assessments. The teacher no longer needs to carry assessment documents such as instruments and tools such as flashlights and vibrating devices. The process of recording answers becomes faster because when looking at children's activities at an unexpected time the teacher only needs to open an Android smartphone and run an assessment application. When the internet conditions are unstable or die the teacher no longer feels the difficulty of using the assessment application because this application can run on unstable internet conditions or even offline.

Keywords : Assessment Application, Special School, Children with Special Needs, Progressive Web App, Android..

1. INTRODUCTION

Rafaha Arjasari Special School was established in 2014 and domiciled in Bandung Regency, which is precisely located at Jln. Kenangasari, Arjasari. Rafaha Arjasari Special School is one school that facilitates special education and special services for children with special needs or ABK.

Children with special needs are children with abilities above average or also referred to as gifted children and children with abilities below average or called mental retardation, as well as children who have social aspects, meaning that it is difficult to adjust to the surrounding environment or called tunalaras and children with physical disabilities, or blindness, hearing impairment, and physical impairment [1].

In line with the above understanding, SLB Rafaha accepts students and provides educational services for children who have physical, emotional, mental, social and special intelligence and talents. Even though until March 2018 SLB Rafaha had 25 students with various obstacles. The learning that took place at Rafaha Arjasari SLB refers to the prevailing national curriculum and then adjusted to the abilities, obstacles, and needs of each child. Information about this student's profile is obtained through assessment. Assessment is a process of collecting data about students and their environment, then the data is analyzed and interpreted [2].

Based on the results of an interview with the headmaster of the Rafaha Arjasari Special School, that is Hj. Djuang Fitriani, M.Pd, there are several obstacles found when implementing the assessment process, namely:

1. Teachers as assessors have difficulty carrying and using the files that will be used in the assessment process.
2. The delay in recording the assessment answers if the assessor sees the child's activities at an unexpected time..
3. Teachers as assessors have difficulty using the application to carry out the assessment process if internet conditions are less stable or offline.

Based on the problems and observations in the manual assessment process carried out at Rafaha Arjasari Special School, it is necessary to make a web-based assessment application as a solution to the problems and utilization of existing facilities. But this solution results in new problems. After conducting further interviews, if the assessment is done with a web-based application, the assessment process will be difficult if the internet connection is less stable or offline.

Information technology is very useful to improve process effectiveness, time efficiency, and competitive advantage. If an agency already utilizes information technology, it is certain that it will have a better advantage when compared to rival companies engaged in similar businesses [3]. Progressive Web App is a mobile application concept in the form of a collection of the latest technologies to produce web applications that have capabilities such as mobile applications [4]. As for other studies conducted by Laurensius Adi, and friends revealed that Progressive Web App can run in an unstable internet condition even offline [5].

2. RESEARCH CONTENT

2.1 Theoretical Basis

This section will explain the theories that are related and used in assessment applications for children with special needs.

2.1.1 Assessment

There are two types of assessments in special education, namely: 1) academic assessment, sourced from the curriculum and 2) assessments that are developmental or also called non-academic assessments. In line with the scope of the assessment, assessment is defined as a decision-making process using test or non-test instruments obtained through the measurement of learning outcomes [6].

Meanwhile, Hartati said that the assessment of child development is a systematic process that has the purpose of obtaining information about abilities, obstacles, and needs in child development. This information is used as a basis for teachers in designing learning programs and special services that suit their needs [7].

2.1.2 Progressive Web App

Osmani Said "*PWAs are a set of concepts and keywords defined by progressive, responsive, connectivity independent, application-like, fresh, safe, discoverable, reengageable, installable, and linkable"* [8]. That is, Progressive Web Apps (PWA) is defined as a series of concepts and keywords such as progressive, responsive, independent connectivity, application-like native, fresh, safe, easy to find, can be re-engineered, can be installed, and linked.

Progressive Web App is a concept that combines related technologies to produce applications with experiences like native applications. PWA is an application that is increasingly used, it will be more powerful, that is, since the user first opens the PWA concept web page, until the user closes the web page, the application has good speed, even though the internet speed is not good. Besides that, Progressive Web App has a push notification feature, can save shortcuts on the home screen, and runs in full screen [5].

2.1.3 React.js

React.Js is a library UI developed by Facebook to facilitate interactive, stateful, and easy-to-use UI web developers. React.Js has been used on the Facebook website in the production section. React.Js is also the best library for rendering complex user interfaces with high performance. The basic concept in React.Js is in the Virtual DOM. React.Js is more effective using Virtual DOM, which can render on the client or server part [9].

2.1.4 API

API is a programming application developed specifically to be used as a communication link between software components. Usually, the output from the API can be XML or JSON data, depending on which site provides the API [10].

Meanwhile, according to Saputra, API is an application that functions as a communication intermediary for software that is developed specifically to connect the components in it.

2.2 Research methods

The method used in this research is applied research. Applied research has the aim to describe a problem, as well as the events that occur at this time. There are two methods in applied research, namely data collection methods and software development methods with the waterfall model. The waterfall method is an information system model that develops systematically and sequentially [12]. The following is the waterfall flow which can be seen in Figure 1.

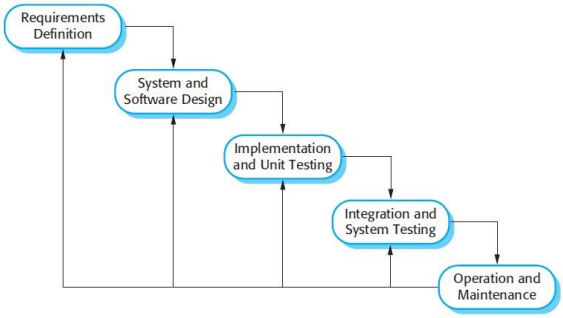


Image source : "Jurnal Penerapan Metode Waterfall Pada Desain Sistem Informasi Geografis Industri Kabupaten Tegal [2017]" [13]

Gambar 1. Illustration of the waterfall model

2.3 System Analysis

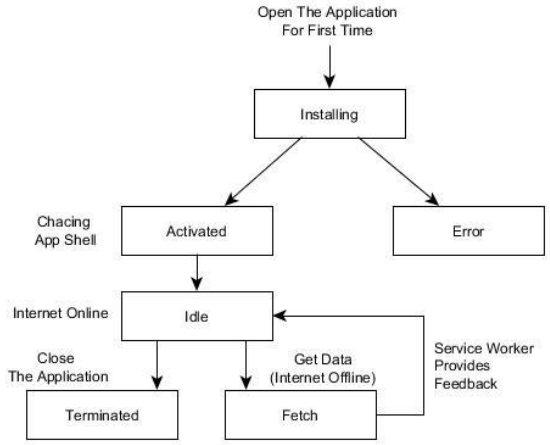
This section has a purpose for problems that occur in the system. The identification of this problem aims to find out what is needed from the system being built. This system analysis consists of problem analysis, system architecture analysis, running system analysis, functional requirements analysis, and non-functional needs analysis.

2.3.1 Analysis of The Technology Used

Technology analysis is the process of analyzing the technologies that work that are used in this application. At this stage, it will be explained what technologies exist in Progressive Web App.

1. Service Worker Analysis

Service worker is an object that works on the back of the system. Service workers can run on their own without a page and user interaction, so even though the page is not opened but service workers can continue to run. The lifecycle architecture and explanation of each event in the service worker can be illustrated in Figure 2.



Gambar 2. Life cycle Service Worker

The following is a description of Figure 2 Lifecycle Service Worker on a software system:

a) Installing

This process is the service worker registration process on the browser so that the browser can recognize the service worker used by the application. Besides that, an install event is an event that functions to save the name of the file / url that will be stored in the cache storage. Here is an example of the source code for installing service workers on a browser which can be seen in Figure 3.

```
<script>
    if ('serviceWorker' in navigator) {
      window.addEventListener('load', function() {
        navigator.serviceWorker.register('service-worker.js').then(function(registration) {
          console.log('ServiceWorker registration successful with scope: ', registration.scope);
        }, function(err) {
          // registration failed :(
          console.log('ServiceWorker registration failed: ', err);
        }).catch(function(err) {
          console.log(err)
        });
      });
    } else {
      console.log('service worker is not supported');
    }
</script>
```

```
self.addEventListener('install', function(event) {
  event.waitUntil(
    caches.open(cacheName).then(function(cache) {
      return setOfCachedUrls(cache).then(function(cachedUrls) {
        return Promise.all(
          Array.from(urlsToCacheKeys.values()).map(function(cacheKey) {
            // If we don't have a key matching url in the cache already, add it.
            if (!cachedUrls.has(cacheKey)) {
              var request = new Request(cacheKey, {credentials: 'same-origin'});
              return fetch(request).then(function(response) {
                // Bail out of installation unless we get back a 200 OK for
                // every request.
                if (!response.ok) {
                  throw new Error('Request for ' + cacheKey + ' returned a ' +
                    'response with status ' + response.status);
                }

                return cleanResponse(response).then(function(responseToCache) {
                  return cache.put(cacheKey, responseToCache);
                });
              });
            }
          })
        );
      });
    }).then(function() {

      // Force the SW to transition from installing -> active state
      return self.skipWaiting();

    })
  );
});
```

Gambar 3. Source Code Event List Installing on the Service Worker

b) Activated

This event is run if the service worker registration process in the browser is successful. Activated means the service worker is active and running in the application. Besides that, we can store some conditions at this event. The following is the source code in the Activated event which can be seen in Figure 4.

```
self.addEventListener('activate', function(event) {
  var setOfExpectedUrls = new Set(urlsToCacheKeys.values());

  event.waitUntil(
    caches.open(cacheName).then(function(cache) {
      return cache.keys().then(function(existingRequests) {
        return Promise.all(
          existingRequests.map(function(existingRequest) {
            if (!setOfExpectedUrls.has(existingRequest.url)) {
              return cache.delete(existingRequest);
            }
          })
        );
      });
    }).then(function() {

      return self.clients.claim();

    })
  );
});
```

Gambar 4. Source Code Event List Activated on Service Worker

c) Error

This event is an event that shows errors. This event runs when there is an error in the service worker registration in the browser.

d) Idle

This event is an event that indicates that the service worker is waiting.

e) Terminated

This event runs when the application is closed. Events usually function to remove service workers that have been registered with the previous browser.

f) Fetching

This event works when the internet is dead or offline. In general, this event directs all requests to the cache. The following is the source code in the fetching event which can be seen in Figure 5.

```
self.addEventListener('fetch', function(event) {
  if (event.request.method === 'GET') {
    var shouldRespond;
    var url = stripIgnoredUrlParameters(event.request.url, ignoreUrlParametersMatching);
    shouldRespond = urlsToCacheKeys.has(url);
    var directoryIndex = 'index.html';
    if (!shouldRespond && directoryIndex) {
      url = addDirectoryIndex(url, directoryIndex);
      shouldRespond = urlsToCacheKeys.has(url);
    }
    var navigateFallback = '';
    if (!shouldRespond &&
        navigateFallback &&
        (event.request.mode === 'navigate') &&
        isPathWhitelisted([], event.request.url)) {
      url = new URL(navigateFallback, self.location).toString();
      shouldRespond = urlsToCacheKeys.has(url);
    }
    if (shouldRespond) {
      event.respondWith(
        caches.open(cacheName).then(function(cache) {
          return cache.match(urlsToCacheKeys.get(url)).then(function(response) {
            if (response) {
              return response;
            }
            throw Error('The cached response that was expected is missing.');
          });
        }).catch(function(e) {
          console.warn('Couldn\'t serve response for "%s" from cache: %O', event.request.url, e);
          return fetch(event.request);
        })
      );
    }
  }
});
```

Gambar 5. Source Code Event List Installing on the Service Worker

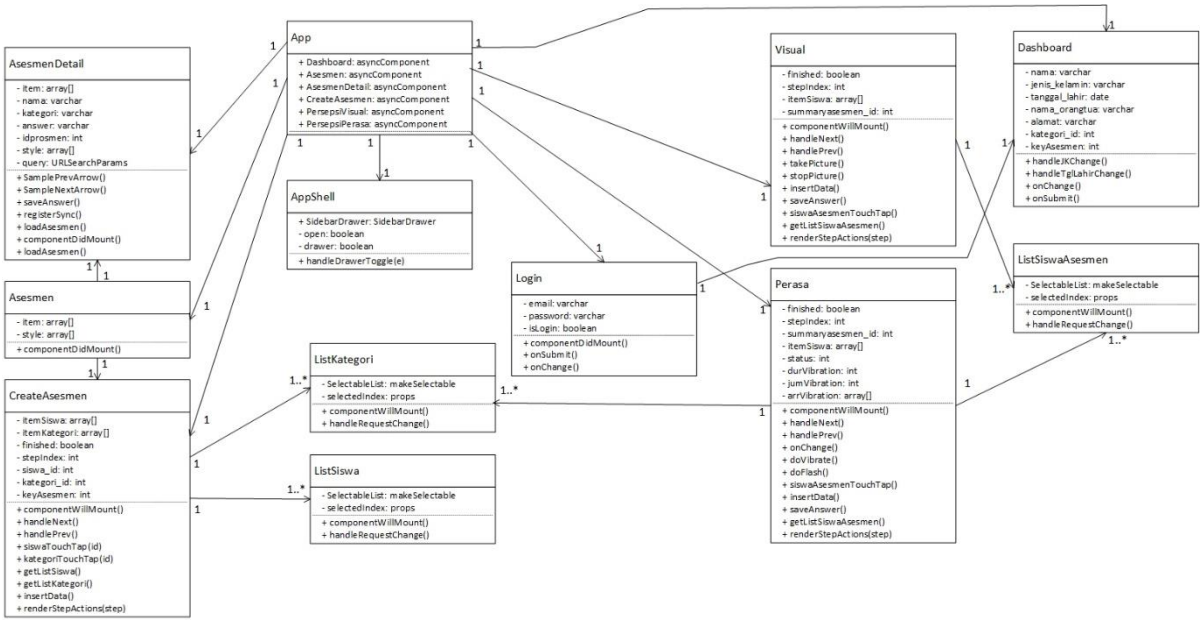
After the service worker has been successfully installed, each user opens the page or reloads the page, the service worker will start the event fetch. The urlsToCacheKeys variable is a variable that holds the file name or url that we will enter into the cache. The first step is to delete all unused parameters and fragments in the url. After that the service worker will check whether the url is in cache storage. If there is a service worker, it will retrieve data from cache storage. But if it doesn't, the service worker will check the cache storage again by adding the word index.html to the url to search. If there is still no service worker will continue the request to the server.

2.3.3 Analysis of Functional Needs

To find out the specifications of the needs needed by the assessment application system for children with special needs, it is necessary to analyze functional requirements. The analysis is modeled using the Unifed Modeling Language (UML). UML is a method that is very suitable for designing, documenting software systems. The model stages in this analysis use UML, including class diagrams and sequence diagrams.

1. Class Diagram

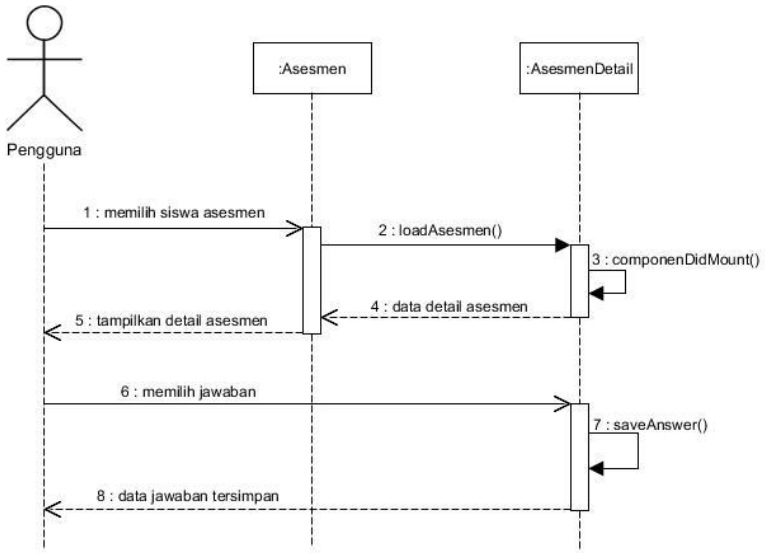
Assessment applications for children with special needs have interconnected classes. Class Diagrams are useful for giving an overview of the elements in class diagrams, as well as related relationships. Class Diagrams can give an overview of what classes will be built in the application. Of course, this will make it easier when implementing a class when making an application. The following is a class diagram which can be seen in Figure 6.



Gambar 6. Class Diagram Aplikasi Mobile

2. Sequence Diagram

At this stage, the scenario or series of steps for interaction between objects will be explained in the assessment application system for children with special needs by using sequence diagrams. This diagram is dynamic and emphasizes the system reaction in every request made by the application user. The following is a sequence diagram that can be seen in Figure 7.



Gambar 7. Sequence Diagram of Mobile Application

2.3.4 Analysis of Non Functional Needs

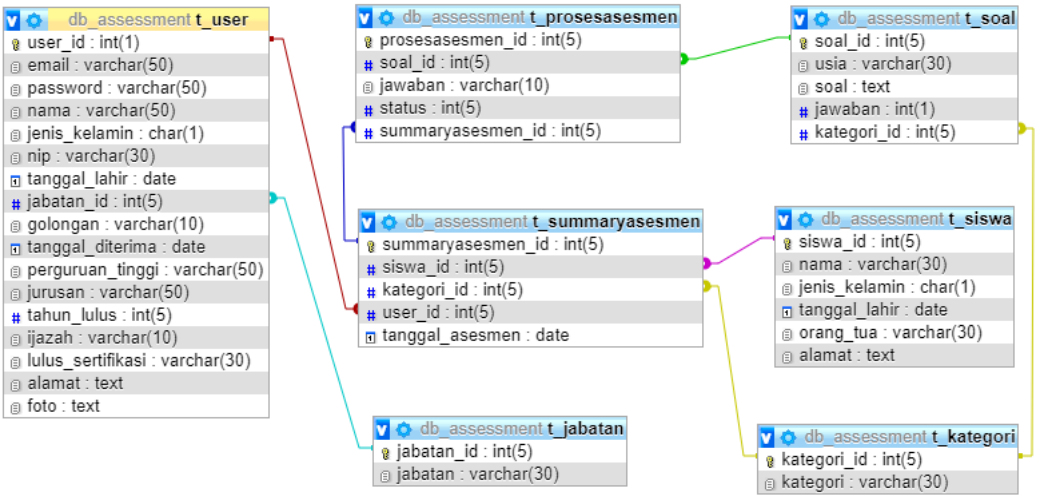
The main purpose of building an application is the needs of users can enter into the application so that the suitability of the function can be maintained. Non-functional needs analysis which includes analysis of mobile users, analysis, and software requirements, as well as analysis and hardware requirements, is done so that these goals are achieved. In other words, the non-functional needs analysis process focuses on the aspects contained in a system

2.4 System Planning

This section is a process of planning then describing a system that will be built into a sketch or a unification of separate elements into a complete system.

2.4.1 Relationship Scheme

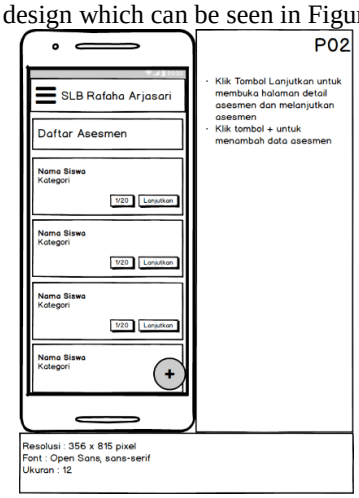
Assessment applications for children with special needs require a database for data storage media. At this stage, it will be explained how the table communicates with other tables whose results are shown in Figure 8.



Gambar 8. Relationship Scheme

2.4.2 Interface Design

The purpose of interface design is to describe the application sketch to be built, the design of this interface is in the form of a display of the program that appears when the application is opened. That way can make it easier to implement applications in accordance with the design. The following is the interface design which can be seen in Figure 9.



Gambar 9. Interface Design for Assessment Lists

2.5 System Testing

The system testing phase is an important factor in making the system. This test can find a discrepancy in the application that was built. The testing strategy used at this stage is alpha testing and beta testing.

2.5.1 Alpha Testing

Alpha testing is carried out using the Black-box method to determine the functional requirements of the software that have been met or not. The results of Alpha testing can be seen in Table 1.

Tabel 1. Testing Black-box Login

Cases and Test Results (Data True)			
Data Input	**Hope**	**Observation**	**Conclusion**
email: inas@slbrafaha-arjasari.com password: 123123	Will enter the dashboard	Successfully enter the dashboard	[√] accept [ ] reject
Cases and Test Results (Incorrect Data)			
Data Input	**Hope**	**Observation**	**Conclusion**
email: testemail@email.com password:aaa	Failed to enter the dashboard page	incorrect email or password message appears	[√] accept [ ] reject
Cases and Test Results (Blank Data)			
Data Input	**Hope**	**Observation**	**Conclusion**
email: password:	Failed to enter the dashboard page	The message "Email and password is empty" appears	[ ] accept [√] reject

2.5.2 Beta testing

This test is an objective test that involves the user directly, what is meant by the user is who will use this application assessment application for children with special needs using progressive web apps technology including headmaster and teacher. This research was carried out at Rafaha Arjasari Special School by using interviews for principals and questionnaires for teachers. The expected result of this test is to be able to solve the problems that have been identified before and know the extent to which the application has been built.

Tabel 2. Questionnaire Category

Category	Weight	Range Percentage
Strongly Disagree (STS)	1	0% - 20%
Less Agree (KS)	2	21% - 40%
Simply Agree (CS)	3	41% - 60%
Agree (S)	4	61% - 80%
Strongly agree (SS)	5	81% - 100%

After that the percentage values of each question will be obtained with the following formula:

$$Y = \frac{TS}{Ideal\ score} \times 100\%$$

Information:
Y = Percentage Value
TS = Total Value of respondents = ∑ weight x frequency
Ideal score = Maximum weight x number of respondents

The statement has given consists of 5 statements, namely:

1. Do you agree that this software can facilitate you in carrying out the assessment process.
2. Do you agree that recording assessment answers are more effective by using this application.
3. Do you agree that this application can make it easier for teachers to use applications with less stable internet conditions.
4. Do you agree that this application successfully uses the smartphone feature in assessing the assessment of visual perception and assessment of perceived perceptions.
5. Do you agree that this application is easy to use.

2.5.3 Beta Test Results

Following are the results of the percentage calculation of the answers chosen by 13 respondents in the assessment application research:

1. Processing of the First Statement

"Do you agree that this software can facilitate you in carrying out the assessment process"

Tabel 3. Processing of the First Statement

Category	Weight	Answer Frequency	Total Value
Strongly Agree	5	3	15
Agree	4	10	40
Simply Agree	3	0	0
Less Agree	2	0	0
Strongly Disagree	1	0	0
Total		13	55

The following results are obtained:

$$Y = \frac{55}{5 \times 13} \times 100\% = 84\%$$

2. Processing of the Second Statement

"Do you agree that recording assessment answers are more effective by using this application"

Tabel 4. Second Question Processing

Category	Weight	Answer Frequency	Total Value
Strongly Agree	5	3	15
Agree	4	10	40
Simply Agree	3	0	0
Less Agree	2	0	0
Strongly Disagree	1	0	0
Total		13	55

The following results are obtained:

$$Y = \frac{55}{5 \times 13} \times 100\% = 84\%$$

3. Processing of the Third Statement

"Do you agree that this application can make it easier for teachers to use applications with less stable internet conditions"

Tabel 5. Processing of the Third Statement

Category	Weight	Answer Frequency	Total Value
Strongly Agree	5	2	10
Agree	4	9	36
Simply Agree	3	1	3
Less Agree	2	0	0
Strongly Disagree	1	0	0
Total		13	49

The following results are obtained:

$$Y = \frac{49}{5 \times 13} \times 100\% = 75\%$$

4. Processing of the fourth statement

"Do you agree that this application successfully uses the smartphone feature in assessing the assessment of visual perception and assessment of perceived perceptions"

Tabel 6. Processing of the fourth statement

Category	Weight	Answer Frequency	Total Value
Strongly Agree	5	1	5
Agree	4	5	20
Simply Agree	3	7	21
Less Agree	2	0	0
Strongly Disagree	1	0	0
Total		13	46

The following results are obtained:

$$Y = \frac{46}{5 \times 13} \times 100\% = 70\%$$

5. Processing of the fifth statement

"Do you agree that this application is easy to use"

Tabel 7. Processing of the fifth statement

Category	Weight	Answer Frequency	Total Value
Strongly Agree	5	4	20
Agree	4	9	36
Simply Agree	3	0	0
Less Agree	2	0	0
Strongly Disagree	1	0	0
Total		13	56

The following results are obtained:

$$Y = \frac{56}{5 \times 13} \times 100\% = 86\%$$

3. CLOSING

3.1 Conclusion

Based on the results of research that has gone through several stages of the research process in building applications by referring to the research objectives, it can be concluded that:

1. The teacher can use an assessment application to conduct an assessment process for children with special needs and can facilitate the assessment process. In addition, the teacher can use the flash feature and vibrating device on the smartphone so that the teacher does not need to carry assessment documents and other tools.
2. Teachers can open assessment applications on smartphones anywhere and anytime so that the process of recording assessment answers at unexpected times can be faster.
3. The teacher can continue to run applications and enter assessment data even on an internet network that is not stable or even dead. This is because the teacher does not know the condition of the intended internet network, sometimes the teacher finds a place where the internet conditions are very bad.
4. This application has only been running at the Rafaha Arjasari SLB school, so there has not been a significant development of this application to the assessment process.

3.2 Suggestion

The suggestions for developing assessment applications for children with special needs are:

1. It is better for the RT / RW to have data regarding children with special needs in their respective environments so that it makes it easier for teachers to do the screening and conduct an assessment process.

2. Develop software in terms of User Interface and User Experience in order to increase teacher comfort level in using software.
3. Develop an assessment calculation feature so that the software can provide a more detailed assessment report so that the teacher can better understand the potential and obstacles that students have.

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