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Development of the Aca-Resilience Tracker Android Application to Determine Strategies for Improving Academic Resilience Among Students at the State Univeristy of Malang

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Abstract

Low academic resilience among university students can contribute to psychological well-being problems, necessitating data- and technology-based support services. This study aims to develop the "Aca-Resilience Tracker" Android application as a data-driven assessment medium for determining strategies to improve the academic resilience of students at the State University of Malang. The study employed a research & development (R&D) method using the Borg & Gall model, modified into seven stages. The research subjects consisted of 2 material experts, 2 media experts, 2 prospective administrator users (counselors), and 10 students. Academic resilience levels were measured using the Indonesian version of the ARS instrument, which has been tested for validity & reliability. Data collection for product testing considered product acceptability indicators and generated quantitative & qualitative data. Quantitative data were analyzed using inter-rater agreement and mean analysis, while qualitative data were analyzed using the Miles and Huberman model. The results showed that the "Aca-Resilience Tracker" application and administrator guidebook obtained a highly valid category in terms of accuracy, usefulness, ease of use, and attractiveness. Thus, the "Aca-Resilience Tracker" application is suitable for use as a data-driven assessment medium in the implementation of guidance and counseling services in higher education.

Keywords: application; aca-resilience tracker; determine strategies; academic resilience; university students

1. Introduction

Students' ability to adapt and persist amid the academic demands of higher education is becoming increasingly crucial. The implementation of student-centered learning requires individuals to adapt quickly to various academic changes. In addition, developments in knowledge and technology in the Society 5.0 era require students to possess good adaptive abilities in dealing with the dynamics of higher education (Julianti et al., 2026). These conditions create particular challenges in students' lives, especially regarding their ability to adapt, endure, and persevere throughout their studies (Harahap et al., 2020). An individual's ability to persist and adapt when facing various academic challenges is known as academic resilience.

Low academic resilience can affect students' study continuity. Students in Indonesia face various challenges during higher education, but not all are able to overcome these obstacles optimally. The inability to cope with academic challenges can be seen in students' failure to complete their studies (Dwiastuti et al., 2021). Data from goodstats.id show that 602,263 of 8,483,213 students (7.10%) dropped out in 2020; 480,449 of 8,992,907 students (5.34%) in 2021; and 375,134 of 9,320,410 students (4.02%) in 2022 (Lubis, 2023). These data indicate

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that a considerable number of students have not been able to persist in dealing with the dynamics of university life.

Academic resilience has a positive effect on students' commitment to their studies. Higher education institutions need to understand students' academic resilience conditions to help them adapt to academic changes and demands so that challenges are not perceived as burdens that must be avoided (Sari & Suhariadi, 2019). In addition, a study reported that academic resilience has a negative effect on students' academic stress levels. The higher an individual's academic resilience, the lower the academic stress experienced. Academic stress can disrupt students' psychological well-being (Zamroni et al., 2019) and lead to negative behaviors, such as procrastination, avoiding academic responsibilities, social withdrawal, and risky behavior (Nursaadah et al., 2024). Low academic resilience is also associated with burnout among university students (Redityani & Susilawati, 2021).

On the other hand, academic resilience has a positive relationship with students' subjective well-being. Subjective well-being refers to an individual's evaluation of their life (Purnomo & Nawangsih, 2021). This indicates that the higher an individual's academic resilience, the better their subjective well-being. Thus, academic resilience affects not only learning outcomes but also students' processes of persisting and completing their studies amid various difficulties (Dwiastuti et al., 2021).

Symptoms of low academic resilience have been found among students at the State University of Malang (UM). A preliminary study was conducted with 43 students from seven faculties at UM. The results showed that 30.2% of respondents felt anxious and panicked because their task progress lagged behind that of their peers; 37.2% chose to remain passive during class discussions; 41.9% avoided factors perceived as threatening, such as certain classes, courses, or lecturers; 33.3% had considered dropping out; and 62.8% felt that they had low levels of endurance and adaptation to academic demands. In addition, characteristics indicating low academic resilience were identified, including a tendency to leave class, fear of making mistakes, poor time management, difficulty maintaining focus, task postponement, susceptibility to stress and anxiety, low self-esteem, pessimism, fatigue, difficulty coping with failure, and poor emotion management.

This phenomenon highlights the importance of optimizing guidance and counseling (GC) services in higher education. In line with this, students' limited understanding of GC services also contributes to the low utilization of available services (Setiawan, 2006). Students also tend to be concerned about the confidentiality of personal problems and have low levels of trust in counselors (Almendarez et al., 2024). In addition, some students remain reluctant to seek professional help because they feel capable of solving problems independently and consider their problems not serious enough to require professional treatment (Rasyida, 2019). This condition indicates that students need services that are more accessible, flexible, and aligned with the characteristics of today's digital generation. In efforts to improve students' academic resilience, higher education counselors play an important role by providing services that meet students' needs (Santoso, 2022; Zamroni et al., 2016). Low academic resilience also highlights the importance of conducting needs assessments in GC services. Needs assessment helps counselors understand students' conditions so that service programs can be designed accurately and effectively (Fitriani et al., 2021). In addition, needs assessment is an important

basis for developing GC services that are appropriate to students' conditions (Wahidah et al., 2019).

Various studies have developed academic resilience instruments, such as studies by Muwakhidah et al. (2023) and Ramdani et al. (2021) for junior and senior high school students, as well as the adaptation of the Academic Resilience Scale (ARS-30) for Indonesian university students by Kumalasari et al. (2020). Other studies by Asradi & Sarman (2026) and Oktasari et al. (2026) also show that academic resilience instruments have good validity & reliability values for use with Indonesian university students. Nevertheless, most studies still focus on testing the validity and reliability of instruments and have not integrated assessment results with technology-based services. In addition, some instruments have not been developed into practical and sustainable assessment media to support GC programs and services in higher education. Therefore, technology-based service innovations are needed to assist the needs assessment process more effectively and efficiently.

Technological developments provide opportunities for developing digital-based GC services (Fadhilah et al., 2021). Android-based mobile applications can serve as a more practical, flexible, and accessible service alternative for students. In addition to facilitating students' access to assistance, applications can also help counselors manage services more efficiently (Aini & Riyantomo, 2019). In this study, application development focuses on assessing students' academic resilience needs using a data-driven assessment approach. This approach supports the collection, processing, and interpretation of data to generate service recommendations that correspond to students' needs.

Data-driven assessment is an assessment approach that uses empirical data as the primary basis for decision-making, making assessment results more accurate, relevant, and aligned with individual needs. Unlike theory-based assessment, which tends to be fixed, data-driven assessment allows continuous data updates so that decisions can be more objective and flexible (Willard, 2024). In education, this approach is used to collect, analyze, and interpret data to determine appropriate learning strategies and services for students (Hamilton et al., 2009). The use of data analysis also helps identify patterns, predict outcomes, and determine effective interventions to optimize student development (Munagandla et al., 2024). In the field of GC, data-driven assessment can be used as a basis for needs assessment to determine more targeted and appropriate services.

Through the developed application, students' academic resilience data are collected automatically and used as a basis for developing more targeted GC programs & services. The application is also expected to support the optimization of mental health services at the State University of Malang. Thus, the Aca-Resilience Tracker application functions not only as an assessment tool but also as a medium for continuously improving students' mental health literacy. The urgency of this study lies in higher education institutions' need for a technology-based academic resilience assessment medium that is practical, accessible, and capable of providing continuous service recommendations. Therefore, this study aims to develop the Aca-Resilience Tracker Android application as a data-driven assessment medium for determining strategies to improve the academic resilience of students at the State University of Malang. Application development considers product acceptability aspects based on Gregory (2014), namely accuracy, usefulness, ease of use, and attractiveness.

Based on these conditions, this study develops the "Aca-Resilience Tracker" Android application to determine strategies for improving the academic resilience of students at the State University of Malang. The application is designed to measure students' academic resilience levels, display their academic resilience levels, provide follow-up recommendations, and provide information related to self-care and mental health services accessible to students. The name "Aca-Resilience Tracker" is derived from the phrase Academic Resilience, restructured as "Aca-Resilience," while the word "Tracker" indicates the application's function as a tracker of students' academic resilience levels and their data distribution.

2. Method

This study applies an R&D (research & development) approach. Development research is an approach conducted systematically with the aim of discovering, improving, developing, and producing products, models, or specific strategies that can be tested and have better, effective-efficient, productive, and meaningful innovations (Putra, 2019). Research and development according to Borg & Gall is defined as a systematic process for developing and obtaining product validation, particularly products in the field of education (Gall et al., 2007). R&D is directed toward discovering novelty and excellence in terms of effectiveness, efficiency, and productivity. Product development in research must, of course, be adjusted to the needs of the intended target.

This R&D uses the Borg & Gall model because it is suitable for developing needs-based educational products (Rahayu, 2025). The Borg & Gall research and development model consists of ten stages, which were adapted into seven stages. The seven stages include: (1) initial data collection; (2) planning; (3) product development; (4) expert testing; (5) initial product revision; (6) prospective user testing; and (7) final product revision. In principle, the ten research and development steps of Borg & Gall can be modified and adapted according to needs and do not have to be implemented in their entirety (Effendi & Hendriyani, 2018).

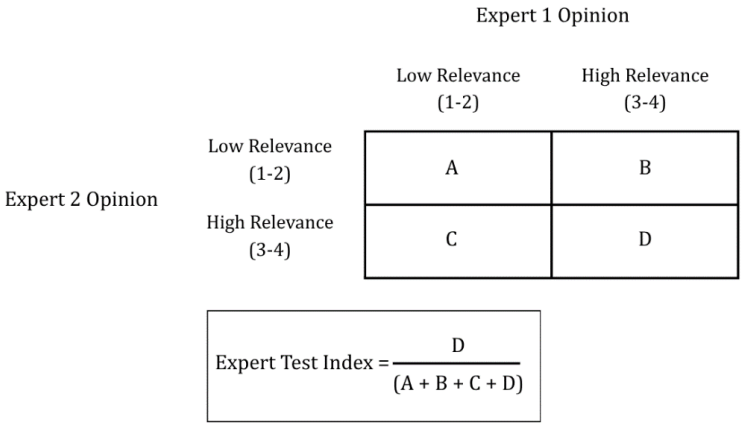


Figure 1. R&D Stages

The research and development of the Aca-Resilience application as a medium for determining strategies to improve student resilience involved several parties. The parties involved were: (1) 43 (forty-three) students from the State University of Malang as subjects of the preliminary study; (2) 2 (two) lecturers from the Guidance and Counseling program as validators for the material expert test; (3) 2 (two) lecturers from Educational Technology as validators for the media expert test; (4) 2 (two) counselor lecturers from PBK3 (Center for Guidance and Counseling, Career, and Entrepreneurship) for validation as prospective product administrator users; and (5) 10 (ten) students as subjects of the prospective product user test. The details of each stage are described below.

Data collection in this research and development study was conducted by distributing open- and closed-ended questions as material for the initial field study. To obtain academic resilience level categorization, the Indonesian version of the academic resilience instrument, which had undergone validity & reliability testing, was administered to 229 respondents. Product assessment involving material and media expert test subjects, as well as prospective administrator users and student users, used trial instruments developed based on product acceptability, including: (1) accuracy; (2) usefulness; (3) ease of use; and (4) attractiveness (Gregory, 2014).

Data analysis was conducted in two ways, namely quantitatively & qualitatively. Qualitative data were analyzed based on the Miles & Huberman analysis model. Qualitative data analysis consisted of four components: (1) data collection, (2) data reduction, (3) data presentation, and (4) conclusion drawing and verification (Sugiyono, 2021). Quantitative data analysis used the inter-rater agreement analysis model (Gregory, 2014) with the following format.

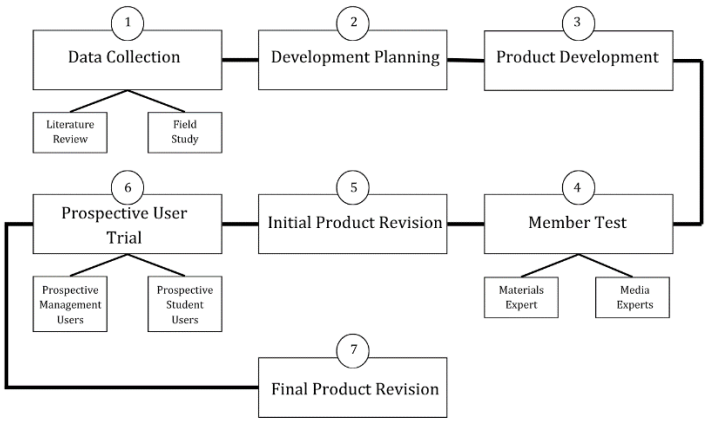


Figure 2. Inter-rater Agreement and Expert Test Index

In addition, to analyze quantitative data from user testing involving student subjects, mean analysis (Hadi; (Saputra, 2021) was used with the following format.

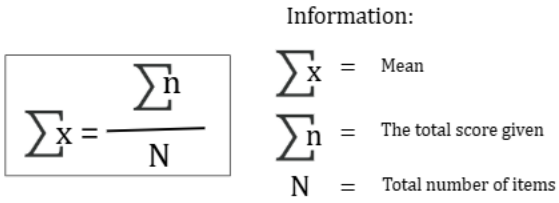


Figure 3. Mean Analysis

To determine the validity qualification, interpretation was conducted based on the product trial validity criteria table as follows.

Table 1. Validity Qualification Conversion

Score	Meaning	Description
75,01 – 100 %	Highly Valid	Can be used
50,01 - 75,00 %	Valid	Can be used with minor revisions
25,01 - 50,00 %	Less Valid	Can be used with major revisions
00,00 - 25,00%	Not Valid	Cannot be used

Source: Tejokusumo (2018)

3. Results and Discussion

3.1 Result

Based on the research and development that has been conducted, the following presents the results and discussion of the developed product, namely the "Aca-Resilience Tracker" application for determining strategies to improve academic resilience among university students.

3.1.1 Research Instrument Testing

The distribution of the academic resilience instrument yielded a total of 229 participants, and validation of the 24 (twenty-four) adopted items showed that all items were valid and reliable. The results of the validity and reliability tests are presented in the following tables.

Statement	r-Count	r-Table	P (Sig.)	Explanation
P1	0.423	0.168	0.000	Valid
P2	0.565	0.168	0.000	Valid
P3	0.480	0.168	0.000	Valid
P4	0.484	0.168	0.000	Valid
P5	0.368	0.168	0.000	Valid
P6	0.507	0.168	0.000	Valid
P7	0.414	0.168	0.000	Valid
P8	0.498	0.168	0.000	Valid
P9	0.530	0.168	0.000	Valid
P10	0.590	0.168	0.000	Valid
P11	0.490	0.168	0.000	Valid
P12	0.495	0.168	0.000	Valid
P13	0.318	0.168	0.000	Valid
P14	0.500	0.168	0.000	Valid
P15	0.570	0.168	0.000	Valid
P16	0.596	0.168	0.000	Valid
P17	0.468	0.168	0.000	Valid
P18	0.627	0.168	0.000	Valid
P19	0.482	0.168	0.000	Valid
P20	0.605	0.168	0.000	Valid
P21	0.336	0.168	0.000	Valid
P22	0.523	0.168	0.000	Valid
P23	0.617	0.168	0.000	Valid
P24	0.318	0.168	0.000	Valid

Figure 4. Validity Test Results of the Indonesian Version of the ARS Items

Case Processing Summary

		N	%
Cases	Valid	229	100.0
	Excluded[a]	0	.0
	Total	229	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.847	24

Figure 5. Reliability Test Results of the Indonesian Version of the ARS Items

The data collected from the participants were subsequently processed to obtain the empirical mean and standard deviation, which are presented in the following table.

Table 2. Mean and Standard Deviation of the 24 Indonesian Version ARS Items

Item No.	Mean	±	SD
1	5.14	±	0.88
2	5.21	±	0.78
3	3.68	±	1.36
4	4.25	±	1.44
5	4.65	±	0.99
6	4.80	±	1.16
7	4.70	±	1.01
8	5.37	±	0.69
9	4.09	±	1.48
10	5.14	±	0.67
11	3.31	±	1.45
12	5.48	±	0.60
13	4.65	±	1.13
14	5.15	±	0.80
15	4.28	±	1.42
16	5.06	±	0.77
17	4.59	±	1.11
18	5.41	±	0.79
19	5.01	±	0.87
20	5.24	±	0.69
21	5.01	±	1.16
22	5.16	±	0.76
23	4.36	±	1.48
24	5.36	±	0.66
Total	115.12	±	24.15

After obtaining the empirical mean and standard deviation, the academic resilience level categorization was calculated to be incorporated into the application. The calculation results are presented in the following table.

Table 3. Calculation of Academic Resilience Level Categorization

Category	Guideline	Categorization
Very Low	X ≤ M - 1,5SD	X ≤ 79
Low	M - 1,5SD < X ≤ M - 0,5SD	79 < X ≤ 103
Moderate	M - 0,5SD < X ≤ M + 0,5SD	103 < X ≤ 127
High	M + 0,5SD < X ≤ M + 1,5SD	127 < X ≤ 151
Very High	M + 1,5SD < X	151 < X

Guideline Source: (Azwar, 2012)

3.1.2 Data from Expert Validation Testing

Expert validation testing was conducted to obtain assessments of product acceptability in terms of the developed material and media. The experts or validators were selected based on the primary criterion of their field of expertise. Material experts were selected from lecturers in the field of GC, namely Prof. Dr. Arbin Janu Setiyowati, S.Pd., M.Pd. as material expert 1, and Dr. Nugraheni Warih, S.Pd., M.Pd. as material expert 2. Meanwhile, media experts were selected from lecturers in educational technology, namely Dr. Deka Dyah Utami, M.Pd. as media expert 1, and Eka Pramono Adi, S.IP., M.Si. as media expert 2. The development of the Aca-Resilience Tracker application and administrator guidebook had undergone validation through a systematic acceptability assessment by experts in their respective fields.

Product acceptability was assessed using the indicators of accuracy, usefulness, ease of use, and attractiveness of the Aca-Resilience Tracker application and administrator guidebook. The material expert test results showed an index of 1.00 for all indicators, which corresponds to a very high validity scale, as presented below.

Table 4. Material Expert Validation Test Results for the Application

Assesment Indicator	**Material Expert Test Index**	**Validity Qualification**
Accuracy	1,00 (100%)	Highly Accurate
Usefulness	1,00 (100%)	Highly Useful
Ease of Use	1,00 (100%)	Very Easy
Attractiveness	1,00 (100%)	Highly Attractive

Table 5. Material Expert Validation Test Results for the Guidebook

Assesment Indicator	Material Expert Test Index	Validity Qualification
Accuracy	1,00 (100%)	Highly Accurate
Usefulness	1,00 (100%)	Highly Useful
Ease of Use	1,00 (100%)	Very Easy
Attractiveness	1,00 (100%)	Highly Attractive

The media expert assessment also reached an index of 1.00 for all indicators, indicating a very high validity scale, as presented in the following table.

Table 6. Media Expert Validation Test Results for the Application

Assesment Indicator	Material Expert Test Index	Validity Qualification
Accuracy	1,00 (100%)	Highly Accurate
Usefulness	1,00 (100%)	Highly Useful
Ease of Use	1,00 (100%)	Very Easy
Attractiveness	1,00 (100%)	Highly Attractive

Table 7. Media Expert Validation Test Results for the Guidebook

Assesment Indicator	Material Expert Test Index	Validity Qualification
Accuracy	1,00 (100%)	Highly Accurate
Usefulness	1,00 (100%)	Highly Useful
Ease of Use	1,00 (100%)	Very Easy
Attractiveness	1,00 (100%)	Highly Attractive

In addition to quantitative assessments, qualitative assessments from material and media experts were also obtained as input for improvements by the developer. The feedback was provided for the application and administrator guidebook. The assessment data obtained were descriptive and are presented in the following tables.

Table 8. Feedback from Material Experts

Expert	Produk Revised	Feedback
Material Expert	Application	• Add a developer profile feature

		• The "Latest Result" label is not appropriate • Add an animation of the university mascot • Add a definition of academic resilience to the "Academic Resilience Check" feature
	Guidebok	• The target users are not yet indicated on the cover • The cover layout is not appropriate; rearrange the layout • Add visualizations to the guidebook content • Add a table of contents in the form of a concept map • Add a procedural map • Add a product profile
Media Expert	Application	• Emphasize the relationship between self-care and academic resilience • Add an illustration depicting academic resilience • Improve the wording of the academic resilience instrument instructions
	Guidebook	• Emphasize the relationship between self-care and academic resilience • Include the academic resilience instrument test results • Add images to the application guide instructions • Add an illustration depicting academic resilience

3.1.3 Data from Prospective User Testing

Product acceptability data were subsequently obtained from testing with prospective user subjects. Prospective user testing was conducted with users who would become administrators, namely counselor lecturers from PBK3, as well as student users. Testing with administrator users was conducted with counselor lecturers from PBK3, Mrs. Awalya Siska Pratiwi, S.Pd., M.Pd. from GC, and Mrs. Raissa Dwifandra Putri, M.Si. from psychology as

validators 1 and 2. Quantitative product acceptability data from prospective administrator user testing are presented in the following table.

Table 9. Administrator User Validation Test Results for the Application

Assesment Indicator	Prospective Administrator User Text Index	Validity Qualification
Accuracy	0,80 (80,0%)	Highly Accurate
Usefulness	1,00 (100%)	Highly Useful
Ease of Use	0,80 (80,0%)	Very Easy
Attractiveness	0,80 (80,0%)	Highly Attractive

Table 10. Administrator User Validation Test Results for the Guidebook

Assesment Indicator	Prospective Administrator User Text Index	Validity Qualification
Accuracy	1,00 (100%)	Highly Accurate
Usefulness	1,00 (100%)	Highly Useful
Ease of Use	1,00 (100%)	Very Easy
Attractiveness	1,00 (100%)	Highly Attractive

In addition to administrator users, user testing was also conducted with the primary target users of the Aca-Resilience Tracker application, namely students. The testing was conducted with 10 (ten) students, with the results described below.

Table 11. User Validation Test Results (Students) for the Application

Assesment Indicator	Student User Test Index	Validity Qualification
Accuracy	0,955 (95,5%)	Highly Accurate
Usefulness	0,965 (96,5%)	Highly Useful
Ease of Use	0,935 (93,5%)	Very Easy
Attractiveness	0,940 (94,0%)	Highly Attractive

Qualitative assessments in the form of feedback from prospective users were also considered as material for product improvement or revision. The feedback was collected and sorted into points presented in the following table.

Table 12. Feedback from Prospective Users

Prospective Users	Product Revised	Feedback
Administrator (PBK3 Counselor Lecturer)	Application	• Add reassurance that users can consult a counselor if they do not understand the results • Provide constructive reassuring statements when academic resilience is low • Make follow-up recommendations more practical by presenting them as steps
	Guidebook	• Improve consistency of spacing and indentation at the beginning of each paragraph • Use italics for foreign-language terms • Include the origin of the name “Aca • Resilience Tracker” for the application • Align the academic resilience indicators with the application because there is a typographical error
Students	Application	• The selected font is not formal • Add a mascot or animation to the application • Consider adjusting some color choices so they do not blend into the background (increase contrast)

3.1.4 Aca-Resilience Tracker Application and Guidebook Media

The working mechanism of the Aca-Resilience Tracker application was designed based on the stages of data-driven assessment, starting from data collection through assessment, data processing and analysis, to the presentation of results in the form of interpretation and follow-up recommendations. This flow enables users to obtain information about their academic resilience condition quickly and systematically. The details of the application’s operational process are presented in the flowchart below.

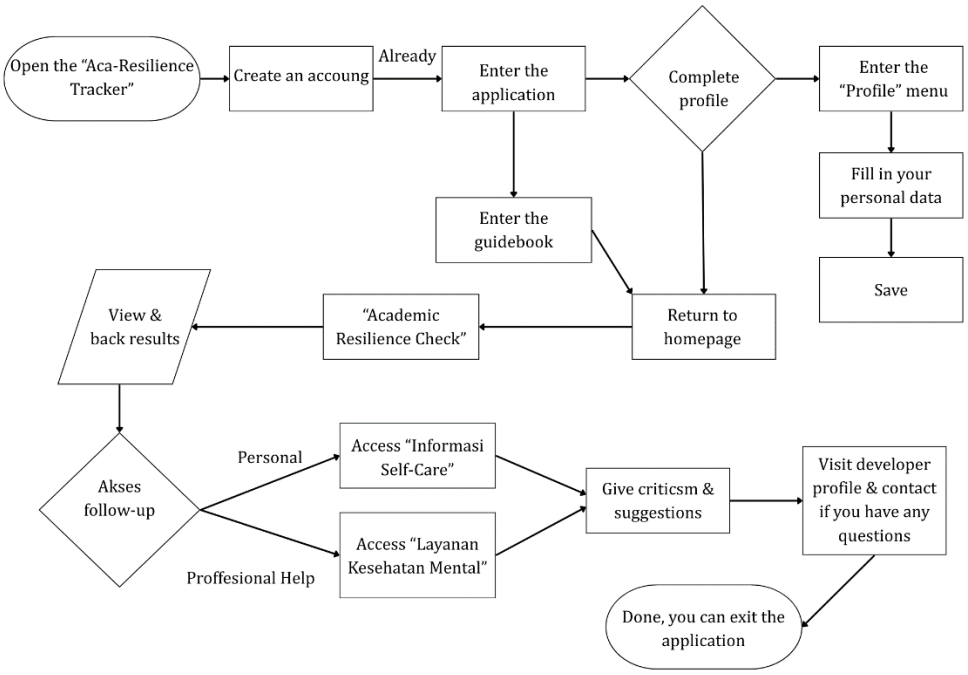


Figure 4. Aca-Resilience Tracker Application Flowchart

All feedback provided by material and media expert reviewers, as well as prospective administrator and student user test subjects, was considered in revising or improving the developed media. This was intended to ensure that the product truly met all aspects of product acceptability, rather than being assessed numerically only through assigned scores. The following shows the Aca-Resilience Tracker application and its guidebook before and after revision.

Table 13. Main Application Display

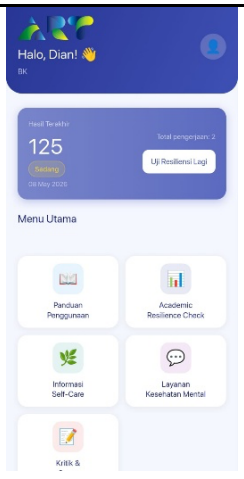
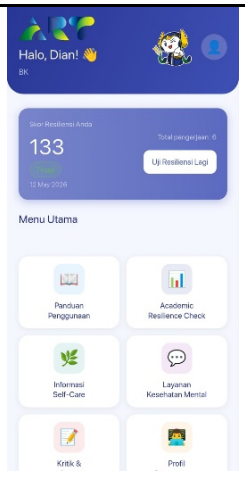
Before Revision	After Revision
	

Table 14. Guidebook Cover Display

Before Revision	After Revision
	

3.2 Discussion

3.2.1 Product Development

The main product developed was the "Aca-Resilience Tracker" application. The application development also produced other product components, namely the "Administrator Guidebook" and "Administrator Website." The product development process was based on the results of the needs assessment obtained from literature and field studies. The process then proceeded to the second stage, namely product design based on the needs assessment results. The design was carried out by creating the product interface design, complete with the content to be presented. Because the primary function of the application is to measure academic resilience levels rather than develop an instrument, the Indonesian version of the Academic Resilience Scale (ARS) from Kumalasari et al. (2020) was adopted and permission had been obtained to embed it in the application. The scale is specifically intended for higher education and has been tested for validity & reliability.

The adopted scale had undergone validity & reliability testing and could therefore be applied. The application developed for students at UM was again tested for validity and reliability. This test was conducted to determine the validity and reliability of the scale and instrument, as well as the empirical mean value for categorizing academic resilience levels among students at the State University of Malang. To produce representative categorization, the data collection in this study referred to guidelines for norm selection, namely a framework for translating initially meaningless raw scores through group norms as a specific comparison among fellow students. The application of group norms is crucial so that the relative position of an individual's academic resilience level can be evaluated objectively, because raw scores obtained from instrument measurements essentially have no meaning when considered in isolation (Gregory, 2014).

The selection of normative data sources was conducted using simple random sampling (Gregory, 2014). Based on State University of Malang Statistics, the number of students in 2026 reached 47,365 (Statistik UM, 2026). Through mathematical calculation, the ideal sample or participant size was approximately 400 students. However, Gregory (2014) also emphasizes that group norm data can still be considered representative without meeting this absolute quantity, provided that participants are from a homogeneous environment. In this study, the homogeneity assumption was met because all respondents shared the same broad characteristic, namely being active students at the State University of Malang, distributed across various faculties.

The development of the "Aca-Resilience Tracker" application and its components needs to consider several aspects. Given that the primary purpose of the application is to measure academic resilience levels and provide follow-up, it needs to follow a procedural framework in addition to the Borg and Gall R&D model. The development of this application adopts the concept of data-driven assessment, namely a process in which a person collects, examines, and interprets empirical evidence for decision-making purposes (Hamilton et al., 2009). In general, data-driven assessment procedures include: (1) problem identification, (2) planning, (3) implementation, (4) data interpretation and analysis, and (5) decision-making (Means et al., 2010). These procedures were also used as a reference in developing the application so that the system can generate follow-up recommendations.

The carefully designed product was subsequently developed. The development of the "Aca-Resilience Tracker" application produced three products with two main components. The two main products were the application and the administrator guidebook intended for counselor lecturers. Another component produced was a website named "Aca-Resilience Admin" for managing the application content, accessible only to the developer and administrator. Based on this, only the main products, namely the application and administrator guidebook, were submitted for assessment and testing. Based on the seven Borg & Gall stages applied, the next step was testing by material and media experts.

The product revised based on feedback from material and media experts subsequently underwent a verification stage in accordance with research and development procedures. This verification aimed to validate that the revised media could be tested with prospective user subjects. After validation was obtained, the study continued with testing on prospective users. The test results were then used as the basis for refining the product until a final product ready for use was produced.

3.2.2 Test Results

Material and media expert testing was conducted with two experts each, with separate assessments of the application and guidebook to examine product acceptability. The results of the material and media expert tests reached a test index of 1.00 for both the application and guidebook. This means that the products were highly valid (very high validity) and could therefore be used. Based on the feedback presented in Table 6, revisions were made as follows.

Table 15. Results of Improvements Based on Expert Testing

Application
• Add the "Developer Profile" feature • Add the UM mascot (Cakra) to the main application screen • Add a definition of academic resilience to the "Academic Resilience Check" feature • Add an explanation of the relationship between self-care and academic resilience to the "Self-Care Information" feature • Add an illustration of students' academic resilience to the splash screen at the beginning of the application • Improve the instrument instructions to be more operational and easy to understand
Guidebook
• Add the target users to the guidebook cover • Rearrange the cover layout • Add visualizations of some of the content and data presented in the guidebook • Add a guide roadmap (table of contents in the form of a concept map) • Add procedures for using the guidebook and managing the application • Add a "Product Profile" page • Add an explanatory statement about the relationship between self-care and academic resilience • Add the instrument validity and reliability test results to the guidebook appendix • Add images to each explanation of application features • Add an illustration depicting students' academic resilience Penambahan kalimat penjelas kaitan *self-care* dengan resiliensi akademik

All feedback was accommodated and accepted, particularly feedback concerning media visualization. Emphasis on visual elements was considered an improvement to facilitate information delivery and enhance the appearance. This is consistent with Faudzi et al. (2023), who stated that interface design can reduce cognitive load and improve the experience of receiving information. Sahputri et al. (2024) also stated that visualization helps users process complex information quickly and clearly. Thus, emphasizing visual elements in both physical and digital media is equally important for developers to communicate information and for users to receive information.

The initial product revisions based on feedback from the material and media expert test subjects were subsequently re-verified in accordance with research and development procedures and qualitative data analysis. After validation was obtained, the research

proceeded to prospective user testing. The purpose of testing prospective users was to identify improvements or revisions based on the assessments provided by the subjects (Sugiyono, 2021). Prospective user testing was conducted with administrator users or counselor lecturers from PBK3, as well as application users or students. The administrator user test resulted in an acceptability index of 0.85 for the application and 1.00 for the guidebook. Meanwhile, the student test reached a test index of 0.95 for the application. These figures indicate that the products were highly valid (very high validity) and could therefore be implemented. Based on the feedback presented in Table 10, revisions were made as follows.

Table 16. Results of Improvements Based on Prospective User Testing

Application
• Add a note that users can contact the developer or counselor if they do not understand the application content, in the "User Guide" feature • Add a reassuring statement to the interpretation and recommendations for academic resilience levels when the result is low • Revise follow-up recommendations into bullet points to make them more practical • Change several color choices in the results display after measuring academic resilience
Guidebook
• Improve consistency of spacing and writing layout • Improve writing conventions (italics, bold, etc.) • Add the background of the application name to the "Product Profile" • Align the guidebook and application content regarding the academic resilience indicator that contains a typo

In prospective user testing, not all feedback was incorporated as revision material due to several considerations. One suggestion that was not incorporated was changing the "Roboto" font so that it would be less formal in the application, because this could make the text more difficult to read. This is supported by Hojjati & Muniandy (2014), who stated that "Sans Serif" fonts are designed for on-screen display and result in higher reading speed with better readability. Day et al. (2024) noted that several "Sans Serif" fonts include "Roboto" and "Arial," which have been shown to be read significantly faster than text in several other fonts without reducing reading comprehension.

The second suggestion that was considered but not implemented in application development was adding more images or animations. This was because the more complex the animation, the larger the document size and processing power required, which would reduce application performance (Pibernik et al., 2023). In addition, the quantity of animation affects attention by reducing interaction time with the application's main functions (Almaral Martinez et al., 2023). Another study also stated that irrelevant animations can interfere with users' ability to complete the goals and functions of an application (particularly autistic users),

because they are more prone to distraction (Alzahrani et al., 2022). Based on considerations of the application's appearance and functionality, suggestions concerning additional images and animations were therefore not implemented further after the additions provided by the expert test subjects.

After considering various factors, the product was revised again to present a final product ready for use. The resulting product has the advantage of presenting and recording data entered by students for administrators, as well as providing interpretations, recommendations, and information efficiently. This study has theoretical and practical implications in the field of GC in higher education. Theoretically, this study strengthens the literature on the use of Android-based technology in needs assessment and data-driven assessment. Practically, the "Aca-Resilience Tracker" application helps counselor lecturers obtain students' academic resilience data more quickly and efficiently, while helping students increase their awareness of the importance of academic resilience and mental health.

3.2.3 Product Novelty and Limitations

The novelty of the developed application lies in its more comprehensive and follow-up-oriented presentation of academic resilience assessment results compared with previously available platforms. Platforms such as "Satu Persen" only display resilience level categories and general interpretations without providing total scores, self-care levels, or specific follow-up recommendations based on user needs. The recommendations provided are also general and focus only on users' independent efforts. Meanwhile, the "Vercel Resilience Test" platform does not yet present detailed assessment results because users are immediately directed to recommendations without an in-depth interpretation of their resilience condition. Unlike these two platforms, the application developed in this study not only displays academic resilience scores and categories but also provides more detailed result interpretations, self-care levels, and follow-up recommendations tailored to users' conditions as an implementation of data-driven assessment in GC services.

The media developed in this study uses a mobile application platform because it is considered better able to support effective, practical, and user-experience-oriented assessment than a website. Mobile applications have advantages in accessibility, ease of use, efficiency, and user engagement. Research shows that mobile applications are easier to learn and use and provide higher satisfaction than websites (Bhalla et al., 2026). In addition, applications can be accessed quickly through icons directly available on the phone screen, shortening the access process compared with websites that must be opened through a browser (Prastyo et al., 2021). In terms of user experience, websites also tend to be considered more complex and have less practical navigation (Xie et al., 2023).

The advantages of mobile applications are also evident in the contexts of guidance and counseling and education. Mobile application users have been shown to have higher usability and better engagement in completing programs than website users (Purkayastha et al., 2020). This finding is reinforced by Baumel & Kane (2018), who stated that application design quality, such as ease of use and visual appeal, has a stronger relationship with user engagement than websites. Based on these findings, the mobile application was selected as the development

platform for Aca-Resilience Tracker because it has greater potential to reach students broadly and optimally support needs assessment and recommendation delivery.

The selection of the Android platform for this application was based on the dominance of this operating system in the global smartphone market. Android is an open-source operating system, supported by various device manufacturers, and easy to develop and modify, providing high flexibility for application developers (Bhosale & Pawar, 2017). In addition, Android supports various features that facilitate users, such as the ability to run multiple applications simultaneously, use widgets on the home screen, and quickly access settings and notifications (Adekotujo et al., 2020). Various studies and operating system distribution data also show that Android has a larger market share than other operating systems, supported by the availability of devices across various price ranges, making them more accessible to the public (Sahani, 2017).

Android's dominance is also evident among university students, who are the primary target of this application. Research shows that students use Android as a communication medium, information source, and means of self-presentation, with its use driven by everyday needs, peer influence, and the features offered by the device (Yunita, 2015). The high level of Android use among students makes this platform more potential for supporting broad access to guidance and counseling services. Therefore, developing Aca-Resilience Tracker on Android is considered more appropriate for reaching the majority of students and facilitating assessment and recommendation delivery more easily and efficiently.

This study still has several limitations. The developed "Aca-Resilience Tracker" application focuses only on the academic resilience variable and is intended for students as user subjects, particularly students at the State University of Malang. In addition, testing was conducted on a limited group at the State University of Malang, so the development results cannot yet be broadly generalized and may not be representative when used with students from other higher education institutions. Further research and development are also needed to develop application features so that they not only support needs assessment but can also provide curative services.

One limitation of the Aca-Resilience Tracker application is that the assessment results provided still focus on identifying the overall level of academic resilience along with scores for each indicator. Although the application can display the user's academic resilience level, individuals with the same total score or resilience category may not necessarily be in identical conditions because they may have different score patterns across academic resilience indicators. In other words, two students who are both in the moderate category may have different development needs because their strengths and weaknesses lie in different indicators. In addition, the application is not yet able to provide specific categorization or interpretation for each indicator, so the recommendations provided are still based on overall academic resilience results.

This limitation opens opportunities for further development through latent class analysis (LCA). Latent class analysis is a statistical method used to identify groups of individuals that cannot be directly observed (latent) based on their response patterns or characteristics (Weller et al., 2020). This approach allows individuals to be grouped into particular classes with similar characteristic profiles even when they obtain the same total score. In the context of academic resilience, latent class analysis can help identify student

profiles based on combinations of scores across academic resilience indicators, making the interpretation of assessment results and follow-up recommendations more specific, personal, and aligned with the needs of each user group.

Another limitation of the Aca-Resilience Tracker application lies in the platform used, which can only be downloaded and operated on devices with the Android operating system. This condition means that students using other operating systems cannot yet use the application directly. Therefore, the application's reach remains limited to Android device users and requires cross-platform development so that it can be accessed by more users.

In addition, the Aca-Resilience Tracker application has open access, allowing users to log in using email addresses outside the State University of Malang domain. Consequently, the application can be used by students from other higher education institutions as well as individuals outside the intended target of product development. Nevertheless, the assessment results obtained need to be interpreted carefully because the norms and categorization used in the application were developed based on empirical data from students at the State University of Malang. Thus, the displayed categorization results may not be representative of academic resilience levels in populations outside the State University of Malang student population with different characteristics.

4. Conclusion

Based on the results of the research and development conducted, it can be concluded that this study successfully developed an Android-based medium, the Aca-Resilience Tracker application, which applies data-driven assessment procedures to measure the academic resilience level of students at the State University of Malang and produces assessment interpretations and follow-up recommendations appropriate to users' needs. The validation results show that the Aca-Resilience Tracker application and administrator guidebook have a high level of acceptability based on accuracy, usefulness, ease of use, and attractiveness according to expert and prospective user assessments. These findings indicate that the developed product is suitable for use as an assessment medium and decision-making support in guidance and counseling services in higher education. Nevertheless, product use remains limited because the norms and data were developed based on the characteristics of students at the State University of Malang, so application to students from other higher education institutions should be carried out carefully to ensure that the results remain representative. Therefore, future research is recommended to conduct testing with broader groups to determine the effectiveness of the product in improving guidance and counseling services and supporting the development of students' academic resilience. In addition, constraints related to Android device ownership and internet access can be addressed through assistance from lecturers, counselors, or peer counselors who help students access and optimally utilize the application.

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