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Local Wisdom (Loka Tua Mata Api) and Technology: A Health Tracking Application for Early Detection of Student Health

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Abstract

This study was motivated by the still-limited monitoring of student health, which is carried out manually, not systematically documented, and not yet supported by contextual, user-friendly digital media. This study aimed to develop an application that is valid, practical, and user-friendly to help students monitor their health conditions independently. The method used was Research and Development, using the ADDIE model through the stages of Analysis, Design, Development, Implementation, and Evaluation, while also applying a mixed-methods approach. The research subjects included needs analysis informants, three expert validators, and students involved in one-to-one testing, small-group testing, and field testing. The results showed that the application obtained an average Aiken's V validity score of 0.92, practicality levels of 84.67% in the small-group test and 88.40% in the field test, and a System Usability Scale score of 81.3. The average pretest score of 62.80 increased to 81.47 in the posttest, with a significant difference. Therefore, the developed application shows potential as a contextual, adaptive, and feasible medium for health recording, education, and early detection of student health, and warrants further development.

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Introduction

Student health is a strategic issue because the school years represent an important phase in shaping healthy behaviors, self-regulation skills, and help-seeking habits when students experience health problems. At this stage, schools are the closest setting for identifying changes in students' physical, emotional, and behavioral conditions before they develop into more serious problems; therefore, a more targeted, documented, and context-specific monitoring system is needed. This study

was motivated by the limited monitoring of student health conditions, which is still conducted manually, lacks systematic documentation, and is not yet supported by digital technology that aligns with school needs. International literature shows that digital approaches and school-based eHealth interventions have the potential to expand the detection of health needs, accelerate access to support, and improve several adolescent lifestyle behaviors, although their effectiveness remains influenced by design suitability, context of use, and the level of young users' engagement (Champion et al., 2019; Nishimura et al., 2024; Woodrow et al., 2022).

The development of mobile health has produced many applications for adolescents, but most studies still focus on chronic disease management, therapy adherence, or specific behavioral changes. Systematic reviews show that mobile applications and messages can support self-management and adherence among adolescents, although the evidence base remains limited, heterogeneous, and often derived from small-scale studies. Other reviews also indicate that the mHealth ecosystem for pediatric and adolescent populations is still dominated by themes such as reproductive health, chronic disease, and physical activity. This means that the development of health applications for school students has not fully moved toward a comprehensive, contextual, and preventive health monitoring system capable of identifying patterns, recording changes, and supporting structured follow-up. At this point, a research space remains open for health tracking applications specifically designed for students, rather than merely adapting general health applications (Badawy et al., 2017; Bond et al., 2022; Majeed-Ariss et al., 2015; Virella Pérez et al., 2019).

Nevertheless, the success of health applications for students is not determined only by technical features, but also by digital health literacy, perceived safety, ease of use, and perceived usefulness. Adolescents with low digital health literacy may find it more difficult to interpret information, assess the credibility of recommendations, and decide when they need to seek further help. Recent studies show that low perceived need, privacy concerns, impersonal design, and limited real social support often hinder young users' engagement. Conversely, engagement increases when applications are perceived as relevant, easy to use, emotionally connecting, and aligned with users' lived experiences. Therefore, health tracking applications for students need to be developed not merely as technological products, but as support systems that are feasible, acceptable, safe, and suitable for the school ecosystem (Bear et al., 2024; Borghouts et al., 2021; Creaser et al., 2022; Ho et al., 2025; Park & Kwon, 2021; Woodrow et al., 2022).

Another issue is that many digital health innovations still adopt a universal approach that is insufficiently sensitive to cultural contexts. Research on cultural adaptation emphasizes that values, language, symbols, social relations, and local norms influence how users understand health messages and decide whether to engage with an intervention. Recent literature suggests that digital interventions that are not responsive to cultural and socioeconomic contexts risk failing to reach target groups meaningfully. On the other hand, evidence on the effectiveness of cultural adaptation remains mixed, and adaptation processes in many studies are often conducted in a non-standardized and iterative manner, sometimes without a specific technological framework. Thus, integrating local wisdom into health tracking applications is not merely symbolic but a methodological necessity to translate technology into relevant, inclusive, and usable features, interaction language, reporting mechanisms, and feedback strategies for students (Balci et al., 2022; Malloy et al., 2023; Mancone et al., 2024; Marwaha & Kvedar, 2021; Naderbagi et al., 2024; Nittas et al., 2025).

Within this framework, the local wisdom of Loka Tua Mata Api provides an important conceptual foundation, as it offers a source of values, perspectives, and daily practices that are close to students' lives. However, the literature shows that digital health research among adolescents has mostly focused on application effectiveness, user engagement, or general health behavior promotion. At the same time, very few studies have connected health tracking with local wisdom. Even fewer studies position schools as early detection ecosystems that integrate health monitoring, self-

reporting, risk identification, and culturally based follow-up. This gap indicates that existing innovations tend to follow two separate pathways: technologically strong systems that lack cultural context, and local wisdom rich in values but not yet translated into operational digital systems. This is where the main research gap lies: the limited availability of local-wisdom-based health-tracking models for early detection of student health in school contexts (Champion et al., 2019; Malloy et al., 2023; Naderbagi et al., 2024; Nishimura et al., 2024; Woodrow et al., 2022).

Therefore, research on the synergy between Loka Tua Mata Api local wisdom and technology through a health tracking application is scientifically and practically relevant. Scientifically, this study fills a gap at the intersection of three fields that are rarely integrated comprehensively: digital health for adolescents, school-based early health detection, and cultural adaptation based on local wisdom. In practice, the developed application has the potential to help students regularly record their health conditions, support schools in identifying symptoms or risk patterns earlier, and assist teachers or support staff in making faster follow-up decisions. This approach may also strengthen students' health literacy because the messages, indicators, and recommendations are grounded in cultural references close to their experiences. Based on this gap, the development of a Loka Tua Mata Api-based health tracking application can be positioned as a strategic effort to improve early detection of student health in a more adaptive, contextual, preventive, and sustainable manner (He et al., 2021; Mancone et al., 2024; Nittas et al., 2025; Wang et al., 2024).

Materials and Methods

Research Method

This study employed the Research and Development (R&D) method using the ADDIE model, which comprises five stages: Analysis, Design, Development, Implementation, and Evaluation. This model was selected because it provides a systematic, iterative development process and can be used to design and evaluate a product in stages. In this study, the product developed was a health-tracking application based on the local wisdom of Loka Tua Mata Api to support early detection of student health conditions. The study used a mixed-methods approach, involving qualitative data at the needs analysis stage and during the evaluation of user feedback, as well as quantitative data at the stages of expert validation, practicality testing, and initial product effectiveness testing (Branch, 2009; Creswell & Plano Clark, 2018; Molenda, 2003).

Research Site and Subjects

This research was conducted at SMPN 2 Bajawa, located in Ngada Regency, East Nusa Tenggara Province. The site was selected purposively because the school needed early detection of student health conditions, had school health service mechanisms such as the UKS or other forms of health monitoring, and had a socio-cultural context that allowed the integration of the local wisdom values of Loka Tua Mata Api into the application development. The research subjects consisted of three groups: needs analysis informants, expert validators, and student users of the application. The needs analysis informants included 1 principal or vice principal, 1 UKS officer, 2 teachers, and 6 students. The expert validators consisted of 3 individuals: 1 health expert, 1 media/application expert, and 1 local culture expert. This composition is consistent with development research, which places needs analysis and expert validation as initial stages before user testing is conducted gradually.

The number of student samples in this study was not determined using a population survey formula. However, it was adjusted to the characteristics of the ADDIE-based Research and Development model, which uses staged product evaluation. In the one-to-one trial stage, 3 students were involved to assess readability, clarity of instructions, and ease of initial use of the application. In the small-group trial stage, 6 students were involved to assess initial practicality and identify problems that had not appeared in the individual trials. In the field test or implementation stage, 30 students from one class were involved as the main sample to assess the practicality, usability, and

initial effectiveness of the application. Thus, the total number of students involved in the product testing stages was 39, with different participants at each stage in order to make the evaluation results more objective. This 3, 6, and 30 pattern aligns with the gradual formative evaluation practices commonly used in ADDIE-based development studies.

Development Model

The development model used in this study was the ADDIE model. In the analysis stage, the researcher identified student health issues, school needs, readiness for technology use, and the potential integration of Loka Tua Mata Api's values into the application. In the design stage, the researcher defined the application objectives, feature structure, usage flow, health-tracking indicators, interface display, and forms of local cultural integration into the language, icons, and system feedback. During the development stage, the researcher created an application prototype, prepared the research instruments, and then requested expert evaluations. During implementation, the application was tested with the target students on a limited scale. In the evaluation stage, the researcher assessed the validity, practicality, usability, and initial effectiveness of the application to determine the final product revision (Branch, 2009; Molenda, 2003).

Theoretical Foundation

This study was based on three theoretical foundations. First, the ADDIE instructional design theory served as the primary procedural framework for developing the product. Second, the perspective of cultural adaptation in digital health was applied, namely that digital health applications need to be adjusted to users' cultural values, language, communication style, and social context to be more relevant and acceptable. Third, the perspective of adolescent digital health literacy was used, meaning that the application design needs to consider students' ability to access, understand, evaluate, and use digital health information safely. Thus, the application developed is not only technically functional but also culturally appropriate and highly usable for students (Marwaha & Kvedar, 2021; Naderbagi et al., 2024; Park & Kwon, 2021).

Data Collection Techniques

Data were collected through five techniques. First, semi-structured interviews were conducted to explore students' frequently experienced health problems, health reporting patterns, barriers to early detection, and users' expectations of the application. Second, observations were conducted to document the school's existing health monitoring procedures. Third, documentation studies were conducted on UKS records, school health programs, and other relevant documents. Fourth, expert validation questionnaires were used to assess the application's content, design, functionality, and integration of local cultural elements. Fifth, user response questionnaires and the System Usability Scale (SUS) were used to measure the practicality and usability of the application. The use of SUS in this study was based on its wide use as a concise instrument for evaluating the usability of digital systems (Brooke, 1996; Bangor et al., 2008).

Research Instruments

The research instruments included: (1) interview guidelines for the principal, teachers, UKS officers, students, and parents/guardians; (2) observation sheets; (3) expert validation sheets; (4) student response questionnaires; (5) the SUS questionnaire; and (6) pretest and posttest instruments to measure the improvement of students' ability in self-monitoring and early health detection. The content validity of the instruments and product was assessed using Aiken's V, because this coefficient is designed to evaluate validity based on expert judgments. Meanwhile, SUS was used to assess the ease of use of the application from the end users' perspective (Aiken, 1985; Brooke, 1996; Bangor et al., 2008).

Research Procedure

1. Analysis Stage

This stage was conducted to identify needs through interviews, observation, and document analysis. The researcher mapped students' health problems, existing monitoring practices, early-detection needs, digital infrastructure readiness, and elements of Loka Tua Mata Api local wisdom that could be integrated into the application. The results of this Analysis served as the basis for preparing product specifications that fit the user context (Branch, 2009; Molenda, 2003).

2. Design Stage

At this stage, the researcher designed the development objectives, menu structure, navigation flow, health tracking indicators, user interface, and the integration of Loka Tua Mata Api values into the application's language, symbols, and health messages. The researcher also prepared the blueprint, flowchart, storyboard, and research instruments. The design was directed to ensure that the application is functional, easy to use, and relevant to students' characteristics and local cultural context (Branch, 2009; Marwaha & Kvedar, 2021).

3. Development Stage

This stage involved developing the application prototype based on the prepared design. The prototype was validated by three experts, namely a health expert, a media/application expert, and a local culture expert. After revision, a one-to-one trial was conducted with three students to assess readability, menu clarity, and initial ease of use.

4. Implementation Stage

The revised application was tested gradually with the target students. The trial was conducted as a small-group trial with six students and a field test with 30 students from one class. The collected data included pretest and posttest scores, user response questionnaires, SUS scores, observation notes, and application usage logs to assess practicality, usability, and initial effectiveness (Park & Kwon, 2021).

5. Evaluation Stage

Evaluation was conducted both formatively and summatively. Formative evaluation was carried out through revisions at each stage, while summative evaluation was conducted at the end of implementation to assess the application's validity, practicality, usability, and initial effectiveness. In the ADDIE model, evaluation is a continuous process to ensure product quality before wider use (Branch, 2009; Molenda, 2003).

Data Analysis Techniques

Qualitative data from interviews, observations, documentation, and open-ended suggestions were analyzed using thematic Analysis through the processes of data reduction, coding, theme grouping, interpretation, and conclusion drawing. Thematic Analysis was chosen because it is flexible and suitable for identifying patterns of needs, user experiences, and feedback on the application development. Quantitative data were analyzed using: (1) Aiken's V for the content validity of the instruments and product; (2) percentage scores for practicality; (3) SUS score calculation for usability; and (4) a pretest-posttest difference test using a paired-samples t-test if the data were normally distributed, or the Wilcoxon signed-rank test if the data were not normally distributed. This combination of analyses enabled the researcher to assess product quality in terms of content, use, and initial user changes (Aiken, 1985; Bangor et al., 2008; Braun & Clarke, 2006).

Research Ethics

Because the research subjects were students, this study paid attention to school permission, participant consent, parental or guardian consent when necessary, data confidentiality, and restrictions on access to personal health information. All data were used solely for research and application development, and students' identities were coded during data processing and reporting. These ethical considerations are especially important in the use of digital technology involving health data and school-age users (Marwaha & Kvedar, 2021; Naderbagi et al., 2024).

Results and Discussions

1. Needs Analysis

The results of interviews with the principal, school health unit staff, teachers, and students showed that student health monitoring at school was still carried out manually and had not been systematically documented. Health complaints were generally reported verbally to teachers or school health unit staff, so data on students' health conditions were not systematically collected. As a result, early symptoms such as recurring headaches, fatigue, sleep disturbances, and other minor complaints were often not monitored continuously. Observations at the school also showed that basic health services facilities were already available, but were not yet supported by digital media to assist with regular recording and monitoring. On the other hand, most students already had access to smartphones, so the school could implement a health-tracking application to detect early health issues.

These findings indicate that the school's main need is not merely a health recording tool but a system that helps students report their health conditions independently, quickly, and in a structured manner. An important point from these findings is that the application developed must be simple, easy to understand, and relevant to students' daily lives. The integration of Loka Tua Mata Api's local wisdom is also important because it can make the application feel more closely aligned with students' context in Ngada Regency. Thus, the results of the analysis stage confirm that the application's development does not merely address technical needs but also the contextual and cultural needs of its users.

2. Results of Product Design and Development

Based on the results of the needs analysis, the researcher designed a health-tracking application with several main features: a user login page, a daily health condition recording menu, early symptom indicators, simple notifications, a health condition summary, and initial follow-up recommendations. The integration of Loka Tua Mata Api's values was achieved through the selection of terms familiar to students, the use of icon designs that reflect the local context, and the presentation of communicative health messages. The results of the design stage were then translated into the application blueprint, flowchart, and storyboard.

At the development stage, the initial prototype was successfully created and then validated by three expert validators, namely a health expert, a media/application expert, and a local culture expert. In general, all three validators stated that the application was already aligned with the research objectives. However, minor revisions were still needed in terminology, display colors, and the clarity of several menus. Revisions were made by simplifying the language, clarifying navigation buttons, adjusting the icons, and strengthening the integration of local messages to make them more meaningful.

These results show that product quality is not determined solely by the completeness of its features, but also by the user experience when interacting with the application. The validators' suggested revisions indicate that student applications must prioritize readability, simplicity, and

contextual relevance. This means that the product's success lies not only in its digital features but also in its ability to provide a user-friendly system for young users.

3. Results of Expert Validation

The results of expert validation showed that the Loka Tua Mata Api-based health tracking application fell into the very valid category. The validity scores from the health expert were 0.92, from the media/application expert were 0.89, and from the local culture expert were 0.94. The overall average Aiken's V score was 0.92, indicating that the application was feasible for student testing.

Table 1. Results of Expert Validation

Aspect Assessed	Aiken's V Score	Category
Health content suitability	0.92	Very valid
Media design and application function	0.89	Very valid
Local cultural integration	0.94	Very valid
Average	0.92	Very valid

Although the validation results indicated a very valid category, the experts still provided several suggestions for improvement. The health expert emphasized the importance of simplifying symptom-related terms to make them more appropriate for students' level of understanding. The media expert suggested increasing font size and ensuring consistent menu placement. The local culture expert considered integrating local wisdom to be beneficial, but noted that it should be more prominently featured in health reminder messages. These findings imply that high validity does not mean the product is complete without revision; rather, it indicates that the product already has a strong quality foundation to proceed to user testing.

4. Results of the One-to-One and Small Group Trials

The one-to-one trial was conducted with 3 students. The results showed that the students understood the application flow, though they still experienced slight confusion about certain terms and the function of one icon. After revisions were made, the application was tested again in a small-group trial involving 6 students. The results of the small group trial showed an average practicality percentage of 84.67%, which falls into the very practical category.

Table 2. Results of the One-to-One and Small Group Trials

Testing Stage	Number of Students	Result	Category
One-to-one trial	3	Minor revisions were identified in terminology, icons, and instructions	Initial revision
Small group trial	6	84.67%	Very practical

From the results of the small-group trial, students reported that the application was easy to understand, attractive, and helped them record their health conditions regularly. Some students also mentioned that the application interface felt familiar because it used language and symbols that were not overly formal. The important implication of these findings is that integrating local wisdom not only enriches the product's identity but also enhances user comfort. In other words, the application becomes more easily accepted because it does not feel unfamiliar to the users.

5. Results of the Field Trial

The field trial was conducted with 30 students from one class at the research site school. The results of the user response questionnaire showed that the application received a practicality score of 88.40%, placing it in the very practical category. The System Usability Scale score was 81.3, which is considered good and indicates that users found the application easy to use.

Table 3. Results of Practicality and Usability in the Field Trial

Indicator	Result	Category
User practicality	88.40%	Very practical
SUS score	81.3	Good

These results indicate that the application can be used well by students in daily health monitoring activities. The students did not experience significant obstacles when accessing the menus, entering data, or understanding the available features. This shows that the developed product meets the criteria for good usability and is sufficiently ready for implementation in the school context.

6. Results of the Initial Effectiveness of the Application

The initial effectiveness of the application was measured by comparing the pretest and posttest scores of 30 students. The results showed that the average pretest score of 62.80 increased to 81.47 on the posttest. The average increase was 18.67 points. The paired-samples t-test showed a p-value of 0.000 (< 0.05), indicating a significant difference between the scores before and after using the application.

Table 4. Pretest and Posttest Results

Variable	N	Mean	SD	Sig.	Description
Pretest	30	62.80	8.21	-	-
Posttest	30	81.47	6.74	0.000	Significant

The improvement in these results indicates that the application has the potential to help students better understand the importance of health monitoring and to recognize early symptoms more effectively. The significance of these findings lies not only in the increase in scores but also in the indication that using the application encourages an initial change in students' awareness of their own health conditions. This means that the application functions not only as a recording tool but also as an educational medium that supports early health detection. However, these results should still be interpreted proportionally. The effectiveness found in this study is still preliminary because the testing was conducted in only one class at one school and over a limited implementation period. Therefore, these findings are more appropriately interpreted as initial evidence that the application is feasible and has the potential to be further developed on a wider scale. The results of the Health Tracking Loka Tua Mata Api application are shown in the figure below.

Figure 1. Health Tracking Loka Tua Mata Api Application

Based on the needs analysis, the use of a health-tracking application is important because schools still rely on verbal reporting and manual record-keeping, which makes it difficult to monitor recurrent mild symptoms continuously. This condition indicates that the main problem is not only the absence of data but also the lack of an early detection mechanism that enables students to conduct self-monitoring quickly and systematically. In the international literature, mHealth interventions for children and adolescents have been reported to have a positive impact on health outcomes, suggesting that digital tools are worth considering as supportive media for behavior change and health monitoring (Fedele et al., 2017). Hetrick et al. (2018) also emphasized that self-monitoring features in applications can bridge the gap between the need for routine monitoring and the limitations of face-to-face service practices. Thus, the findings of this study are meaningful because the developed application does not merely digitize record-keeping, but also opens opportunities for the formation of health reflection habits among students from an early age. Future research should examine whether longer-term use of the application actually improves the consistency of symptom reporting and accelerates school follow-up for students' health complaints.

The expert validation findings, with an average Aiken's V of 0.92, indicate that the product has met the standards of content feasibility, media quality, and cultural integration. However, the revision notes on terminology, icons, and local messages emphasize the importance of user-based refinement. The main meaning of this result is that the quality of a health education application is not determined by the number of features it has, but by the extent to which its design is readable, understandable, and aligned with the users' daily context. Co-design studies involving young people show that user involvement in the design process makes application features more relevant to real needs, including the need for personalization, comfortable language, and a non-intimidating appearance (Hetrick et al., 2018). In line with this, reviews on the cultural and contextual adaptation of digital interventions stress that cultural context must be seriously considered in the design and development process (Naderbagi et al., 2024). Therefore, the integration of Loka Tua Mata Api in this study is not merely decorative, but rather a pedagogical and cultural strategy to make the application feel familiar to Ngada students. Further research should involve more students, teachers, parents, and school health unit staff in the co-design cycle to refine cultural adaptation, language, and usage flows.

The practicality score of 84.67% in the small group trial, 88.40% in the field trial, and the SUS score of 81.3 demonstrate that the application has strong usability at the early stage of implementation. This result is significant because user acceptance is an important prerequisite before a health application can be more widely implemented in schools. Usability literature confirms that the System Usability Scale is a well-established instrument for evaluating user experience across digital products, so the high score in this study indicates that the interface, navigation, and core functions of the application are already on the right track (Bangor et al., 2008). On the other hand, systematic reviews of mHealth applications for adolescents show that application quality for younger users is strongly influenced by simplicity, readability, and the appropriateness of the design for their age-related needs (Jeminiwa et al., 2019; Liverpool et al., 2020). This explains why the use of familiar language and less formal symbols in the application contributed to students' sense of comfort when recording their health conditions. For future studies, the usability aspect should be complemented with usage analytics data, such as login frequency, duration of use, most frequently used features, and drop-off points, so that understanding practicality is based not only on perception but also on actual user behavior.

The increase in scores from an average pretest score of 62.80 to a posttest score of 81.47, with $p < 0.05$, indicates that the application has the potential to function not only as a recording tool but also as a health education medium. Substantively, this result means that students are not only better able to report their condition, but are also beginning to understand the importance of recognizing early symptoms and conducting regular monitoring. These findings are consistent with a meta-analysis showing that mHealth interventions in young populations can improve health outcomes. However, the magnitude of the effect varies across studies (Fedele et al., 2017). However, the findings of this study should still be interpreted with caution because the testing was limited to one class, one school, and a short implementation period. Therefore, future research should include quasi-experimental or experimental designs with control groups, larger sample sizes, longer follow-up periods, and broader outcome indicators such as behavioral change, reporting compliance, and the accuracy of early detection. In addition, future studies should also examine the possibility of integrating the application with school health unit services or school reporting systems so that its benefits can move beyond individual learning toward a more tangible strengthening of the school health system.

Overall, the study's results show that the health-tracking application based on the local wisdom of Loka Tua Mata Api was successfully developed to a high quality. This can be seen in its high validity, very good practicality, strong usability score, and improvement in pretest-posttest results. These findings indicate that the ADDIE model is effective for developing digital media that are not only functional but also aligned with user needs in the school environment.

Another important point of this study is the role of cultural context in increasing product acceptance. The integration of local wisdom makes the application feel closer to students' lived experiences, making its use more comfortable and less excessively formal or rigid. Thus, the technology in this study does not stand alone; it is integrated with users' sociocultural context. This is the key value of the developed product.

Nevertheless, this study still has several limitations. First, the number of students at the implementation stage was limited to 30. Second, the study was conducted in only one school in Ngada Regency. Third, the implementation was not long enough to assess the long-term impact on students' health behavior. Therefore, future research is recommended to test the application in more schools, involve larger samples, and add analytics features or integration with the school health unit system to optimize early detection further.

Conclusion

Based on the research findings, the development of a health-tracking application based on Loka Tua Mata Api local wisdom produced a valid, highly practical product with good usability and initial effectiveness in improving students' understanding of health monitoring and early symptom detection. These findings indicate that digital media designed contextually, user-friendly, and aligned with school needs can support more targeted student health monitoring. The integration of local wisdom adds value by making the application more closely aligned with students' experiences and more acceptable within the school environment. Therefore, this application has the potential to serve as a health recording medium and an adaptive tool for health education and early detection support. Future research is recommended to test the application with a larger sample and in more diverse school contexts.

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