

# Building Effective Academic Early Warning Mechanisms: Theoretical Framework and Practical Strategies

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**Abstract:** The academic early warning mechanism plays an important role in modern educational management, by identifying and intervening in students' academic problems early on to help them complete their studies successfully. This paper explores how to build an effective academic warning mechanism from both theoretical frameworks and practical strategies, with the aim of providing reference and guidance for educational managers and teachers.

**Keywords:** Academic Early Warning; Theoretical Framework; Practical Strategies.

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## 1. Introduction

Many universities have established Academic Early Warning Mechanisms to monitor students' academic performance and provide timely assistance to those who may be facing academic difficulties [1]. This system typically involves regular assessment of students' academic performance and issuing warnings to students when problems are identified, along with providing appropriate support and guidance. As educational reform deepens and educational quality improves, the standards for students' academic success are also constantly being raised[2][3]. However, due to various reasons, some students may encounter difficulties during their academic journey. Effective Academic Early Warning Mechanisms can identify these issues in a timely manner and help students overcome academic obstacles through scientific intervention measures, thereby achieving their educational goals [4].

This paper starts from the basic theoretical framework of Academic Early Warning and delves into the practical strategies of Academic Early Warning. Firstly, the paper provides a clear theoretical foundation by elaborating on the definition, purpose, and basic principles of Academic Early Warning. Then, it analyzes the specific strategies for implementing Academic Early Warning in practice, including the identification of warning signals, the transmission of warning information, and intervention measures after the warning. By combining theory and practice, this paper aims to provide a systematic and scientific implementation plan for Academic Early Warning to improve students' academic performance and overall quality.

## 2. Theoretical Framework

Academic Early Warning refers to the educational institutions, especially higher education institutions, taking a preventive and interventional management measure to timely discover and address the difficulties and problems students encounter in their learning process, ensuring their successful completion of studies [5][6]. This system monitors and evaluates students' academic performance, attitude towards learning, and learning behavior, and issues warnings to

students, teachers, and parents once it detects that a student is at risk of academic underachievement or failure. It then takes appropriate support measures to promote the student's academic progress and personal development[7][8].

The theoretical framework of Academic Early Warning typically includes the following key components:

### 2.1. The Purpose and Guiding Principles of Early Warning.

Academic Early Warning is aimed at implementing the educational philosophy of "people-oriented," strengthening the management of students' learning process, timely discovering and intervening in students' academic difficulties, in order to improve educational quality and students' academic performance. It emphasizes the fundamental task of cultivating moral character and puts students at the center, aiming to stimulate students' learning interest and potential, and providing comprehensive academic support.

### 2.2. Types of Early Warning and Evaluation System.

Academic Early Warning is usually divided into different levels, such as Blue Warning, Yellow Warning, Red Warning, or Level 1 Warning, Level 2 Warning, and Level 3 Warning. Level 1 Warning may be related to a student's failing course credits reaching a certain number, Level 2 Warning may be related to more failing course credits, while Level 3 Warning may be the most serious academic issue that could result in a student being expelled [9]. These warning types are based on multiple indicators such as academic performance, credit accumulation, and failing grades of students. The scientificity and systematic nature of the evaluation system are crucial to ensuring the effectiveness of the warning.

### 2.3. Information Collection and Data Analysis.

An effective Academic Early Warning system requires the establishment of a comprehensive information collection system before the warning, including student admission information, daily learning information, examination information, and graduation information. These data provide data support for the full-process warning of students [10].

## 2.4. Support Mechanisms and Implementation Strategies.

The ultimate goal of Academic Early Warning is to provide academic support. This includes establishing support organizations, clarifying the support subjects, adopting diverse support measures, and building a long-term support mechanism. The support work should be customized according to the specific situation and warning level of the student [11]. Meanwhile, Academic Early Warning Mechanisms should provide targeted support and intervention based on the characteristics of different grades and semesters. For example, the period of freshmen's adaptation to college life, the graduation pressure period for senior students, etc., all require different implementation strategies.

## 2.5. Practical Approaches and Continuous Improvement.

The implementation of Academic Early Warning requires a combination of the school's actual situation and targeted practical approaches. This may include optimizing the types of warnings, improving the evaluation system, and implementing supporting measures. Meanwhile, the effectiveness of Academic Early Warning needs to be evaluated regularly and continuous improvement needs to be made based on feedback.

## 2.6. Full Participation and Coordination Mechanism.

The Academic Early Warning system requires the participation of schools, teachers, students, and parents, among others, to form a coordinated mechanism. This helps ensure the accurate transmission of warning information and the effective implementation of support measures. [12]

## 2.7. Policy Support and Institutional Guarantees.

The implementation of Academic Early Warning requires support from school policies and institutional guarantees. This includes formulating clear guidelines for Academic Early Warning management, providing necessary resources and conditions, and establishing corresponding incentive and evaluation mechanisms.

These components together form the theoretical framework of Academic Early Warning, aiming to help students overcome academic difficulties and promote their comprehensive development through systematic methods.

# 3. Practical Strategies

Effective Academic Early Warning Mechanisms need to be combined with theoretical frameworks and practical strategies to ensure that students can achieve academic success and identify and resolve potential learning problems in a timely manner. Here are some key theoretical frameworks and practical strategies for building effective Academic Early Warning Mechanisms:

**Data-driven strategies:** Utilizing data analysis tools, regularly monitor students' academic performance, such as exam scores, attendance rates, and homework completion. Through data mining and predictive analysis, identify students who may be facing academic difficulties and take timely intervention measures [13].

**Multi-level Early Warning System:** Establish a

hierarchical early warning system, classifying students based on their academic risk level. For example, classify Level 1, Level 2, and Level 3 warnings as general, targeted, and crisis warnings respectively. Take corresponding intervention measures for different warning levels to ensure the effectiveness and targetedness of the early warning signals.

**Individualized Intervention Plan:** A personalized intervention plan is developed based on the specific needs of the student. This may include training in learning strategies, counseling, time management guidance, and academic tutoring. Through personalized intervention measures, students' academic abilities and self-management skills can be improved.

**Teacher and Parent Participation:** Strengthen the roles of teachers and parents in Academic Early Warning Mechanisms. Teachers should provide timely feedback on students' academic performance, and parents can learn about their children's academic progress through the school-home communication platform and provide necessary support and assistance [14].

**Technical Support:** Utilizing modern information technologies such as academic management systems, mobile apps, and data analysis platforms to enhance the efficiency and accuracy of Academic Early Warning Mechanisms [15]. These tools can help monitor students' learning status in real-time and issue warning signals in a timely manner to ensure the timeliness of intervention measures.

**Continuous evaluation and improvement:** Regularly assess the effectiveness of Academic Early Warning Mechanisms and make adjustments and improvements based on the evaluation results. Through a feedback loop, continuously optimize the warning system to ensure its effectiveness and sustainability.

In summary, effective Academic Early Warning Mechanisms require a combination of theory and practice. Data-driven decision-making can be used to monitor students' academic performance using data analysis tools to identify problems and intervene. A multi-level early warning system can be established, such as tiered or multi-level warning systems, with different warning levels corresponding to different levels of academic difficulties, and taking appropriate measures accordingly. Individualized intervention plans can be developed, covering learning skills training and other content. The involvement of teachers and parents can be strengthened, with teachers providing feedback on student performance and parents providing support through the school-home platform. The efficiency and accuracy of the mechanism can be improved through the use of modern information technology. And continuous evaluation and improvement should be carried out, optimizing the early warning system based on evaluation results to ensure its effectiveness and sustainability.

## 4. Specific Implementation Steps

According to the theoretical framework and implementation strategy of Academic Early Warning, schools develop detailed implementation steps based on their specific circumstances. The implementation steps include the following.

### 4.1. Establish an Early Warning Indicator System.

Determine a set of Academic Early Warning indicators,

such as exam grades, attendance rate, completion of assignments, and level of classroom participation.

In terms of examination scores, different warning levels are assigned to different score ranges. For example, the grades can be divided into five levels, including excellent, good, average, passing, and failing. When a student's grades consistently hover around the passing line or slip into the failing range, an alert can be triggered accordingly. At the same time, the trend of the student's scores in each subject can be analyzed, and the subjects with a significant decline in scores should be given special attention. For example, if a subject's score drops by more than a certain percentage in two consecutive exams, an alert will be issued.

In terms of attendance, a clear limit on the number of acceptable absences is set. For example, when the number of absences exceeds a certain percentage (e.g. 10%) of the total number of courses in a semester, the student enters a warning state. Distinguish between unexcused absences and legitimate absences, and give higher-level warnings to students with more unexcused absences.

In terms of homework completion, the on-time submission rate of homework will be examined. If a student fails to submit homework on time repeatedly or the number of times of not submitting homework on time reaches a certain value within a semester, an alert will be triggered. The quality of homework completion can be evaluated by indicators such as teacher's evaluation and error rate of homework. An alert will be issued when the quality of homework completion persistently remains low.

In terms of classroom participation, observe the number of times a student speaks in class, their level of engagement in group discussions, etc. For example, students who speak less than a certain number of times or rarely participate in group discussions in a semester are flagged. Teachers evaluate students' classroom performance, including their level of focus, interaction with the teacher, etc. Students with lower ratings trigger the warning.

## 4.2. Data Collection and Analysis

Using information systems and data analysis tools, regular collection and analysis of students' academic data can identify potential risk signals. By collecting and analyzing data scientifically, potential academic risk signals can be identified in a timely and accurate manner, providing strong support for Academic Early Warning Mechanisms and helping students complete their studies successfully.

### 4.2.1. Collecting Data

#### (1) Collect data using an information system.

**Teaching Management System:** Can record students' course grades, course selection, learning progress, etc. Regularly extract students' examination scores data from the teaching management system, including midterm and final examination scores, as well as scores from regular quizzes. At the same time, pay attention to students' course selection, and if there are unreasonable course combinations or excessive course selection that cannot be balanced, it should also be recorded as a potential risk signal.

**The attendance system collects data:** it accurately records the attendance of students, including attendance at classes and laboratory classes. For students who have a high number of unexcused absences, the system automatically marks them and includes them in the warning data range.

**The assignment submission platform collects data:** it collects information on students' completion of assignments,

including the rate of timely submission and the quality score of assignments. Through the platform, it is possible to have a clear understanding of students' performance in each course, and students who frequently submit assignments late or with low quality can be given special attention.

#### (2) Collects Data by Teacher Feedback.

Teachers have direct observation of students' classroom behavior and attitudes during the teaching process. Establish channels for teacher feedback, so that teachers can submit regular evaluations of students' classroom participation and learning motivation, etc. For example, teachers can evaluate students at the midpoint and end of each semester, and the evaluation content includes the number of times students speak in class, their participation in group activities, and whether they ask questions proactively. For special cases, such as when a student experiences obvious learning difficulties or abnormal behavior in a certain stage, teachers can provide feedback to the Academic Early Warning management department in a timely manner so that appropriate measures can be taken.

#### (3) Students collect data through self-evaluation and peer evaluation.

Develop a self-evaluation questionnaire for students, allowing them to evaluate their own learning state, learning methods, and time management. For example, students can conduct a self-evaluation once a month to reflect on their strengths and weaknesses in the learning process, as well as whether they need help. Conduct peer evaluation activities, where students evaluate each other's learning attitudes and cooperative abilities. The peer evaluation results can serve as supplementary data to help identify potential problems among students.

### 4.2.2. Data Analysis

#### (1) Develop a warning model.

Taking into account multiple academic indicators such as exam scores, attendance rates, completion of assignments, and classroom participation, an Academic Early Warning model can be established. Statistical analysis methods can be used to determine the weight of each indicator and the warning threshold. For example, by analyzing historical data, a warning signal can be issued when a student's exam score falls below a certain score, the number of absences exceeds a certain proportion, or the number of assignments not submitted on time reaches a certain value, etc.

Using machine learning algorithms, students' academic data can be trained and predicted. By analyzing a large amount of students' academic data, the model can automatically identify potential risk signals and predict in advance the academic difficulties that students may face.

#### (2) Trend Analysis.

Conduct longitudinal analysis of students' academic data to observe changes in their performance over a period of time. For example, analyze whether a student's exam scores are declining, whether their attendance is gradually decreasing, and whether their homework quality is consistently deteriorating. If any negative trends are identified, promptly issue a warning and take intervention measures.

Analyze academic data trends across different student groups to identify common issues. For example, if there is a general decline in the grades of a particular course for a group of students studying a particular major, it may indicate a problem with the course's teaching and warrant adjustments.

#### (3) Correlation Analysis.

Analyze the correlation between academic indicators. For

example, if research has found that student attendance is positively correlated with exam scores, then students with lower attendance may also experience a negative impact on their exam scores, and early warning and intervention should be implemented.

Explore the relationships between academic data and other factors such as extracurricular activities participation and family background. If certain factors are found to be significantly related to academic performance, targeted measures can be taken, such as guiding students who are over-involved in extracurricular activities or providing more learning support for students from economically disadvantaged families.

### 4.3. Warning Signal Issuance.

When the system detects a student's academic risk, it will issue a warning signal to relevant personnel (such as the student himself/herself, the tutor, the counselor, and the parents) in a timely manner. The warning signal can be sent to the warning student through paper notices, emails, text messages, or system pop-up windows.

(1) Paper notices are a traditional and effective way that has the characteristics of formality and permanence. Schools can prepare special Academic Early Warning notices, detailing the student's academic problems, potential risks, and recommended improvement measures. The notices can be delivered to the students by the counselors in person, and the students can read and sign a copy to ensure that they have read and taken the contents seriously. At the same time, the paper notices can also be sent to the tutors and parents, so that they can understand the student's academic situation and work together to provide support and assistance to the student.

(2) Email is also a common way to release early warning signals. Send emails to the student himself/herself, the tutor, the counselor, and the parents, detailing the academic risks the student is facing. The email content should include the student's specific academic problems, such as poor exam scores, excessive absences, and uncompleted assignments, as well as the potential consequences and recommended measures. Make sure the email subject is eye-catching and can draw the recipient's attention. For example, you can use titles such as "[Academic Early Warning] Urgent Notice". Meanwhile, the email body should be concise and to the point, highlighting the key points and avoiding lengthy and complex statements.

(3) SMS has the characteristics of immediacy and convenience, which can convey warning signals to relevant personnel in the first place. The content of the SMS should be brief and to the point, including key information such as the student's name, academic problem, and urgency. An automatic SMS sending function can be set up, where the system sends an SMS immediately to relevant personnel when it detects specific academic risks. At the same time, to ensure that recipients can view the SMS in time, it can be resent as a reminder SMS at important time points (such as before exams, before assignment deadlines, etc.).

(4) Pop-up alerts are a common warning method used in school teaching management systems. By setting pop-up alerts in the school's teaching management system, student information platform, and other related systems, students can see their Academic Early Warning information immediately when logging into the system. The pop-up content should include a brief explanation of the academic problem and suggested action steps. For tutors and counselors, pop-up

alerts can be set in their work management system, so they can promptly learn about the academic status of the students they are responsible for. Meanwhile, the system can provide a one-click function to view detailed information, making it convenient for them to learn about the specific problems of the students and take appropriate measures.

### 4.4. Implementation of Intervention Measures

The key to Academic Early Warning Mechanisms is to implement intervention measures in a timely and effective manner to help students overcome academic difficulties and ensure their successful completion of studies. After receiving Academic Early Warning signals, appropriate intervention measures should be carefully developed and implemented based on the level and specifics of the warning signals. Appropriate intervention measures, such as individual tutoring, study groups, psychological support, adjustment of study plans, and parent-school cooperation, should be developed and implemented based on the level and specifics of the warning signals.

**(1) Individual Tutoring:** For students who have obvious difficulties in certain subjects, professional teachers can be arranged for individual tutoring. Teachers can develop individualized tutoring plans based on the specific problems of the students. They can help students solve their learning difficulties by providing targeted assistance. Individual tutoring can take various forms, including face-to-face tutoring and online tutoring, to meet the needs of different students. During the tutoring process, teachers should focus on cultivating students' learning methods and thinking abilities, and improve their ability to learn independently.

**(2) Learning Groups:** Organize learning groups to enable students to learn from each other and help each other. Learning groups can be divided based on subjects, learning progress, etc. to allow students to discuss problems and share learning experiences in groups. Arrange a mentor teacher or outstanding student to serve as the group leader to organize and guide the group's learning activities. The school can provide special learning venues and resources for learning groups to encourage students to actively participate in group learning.

**(3) Psychological support:** Providing psychological support is essential for students who are experiencing academic difficulties due to psychological issues. Schools can establish a psychological counseling center and hire professional psychological counselors to provide psychological counseling and guidance services to students. Psychological counselors can communicate and exchange ideas with students through face-to-face counseling, telephone counseling, and online counseling, helping students relieve stress, adjust their mindset, and improve their ability to cope with academic difficulties.

**(4) Adjustment of Study Plan:** Helping students adjust their study plans and rationally arrange their study time and tasks. Based on the students' actual situation, a personalized study plan is formulated, with clear learning goals and steps, to improve study efficiency. The tutor or tutor can communicate with the students regularly to understand their progress in learning and adjust the study plan in time to ensure that the students can complete their academic tasks on schedule.

**(5) Home-school cooperation:** Strengthen communication and cooperation with parents to jointly focus on the academic development of students. Schools can provide feedback on

students' academic performance through email, WeChat, phone communication, etc. in a timely manner, so that parents can understand their children's academic difficulties and needs. Parents can create a good learning environment for their children at home, pay attention to their children's learning progress and psychological state, and provide necessary support and encouragement. At the same time, parents can work with the school to develop educational plans and jointly help students overcome academic difficulties.

#### 4.5. Effect Evaluation and Feedback

In Academic Early Warning Mechanisms, regular evaluation of the effectiveness of intervention measures is needed, a scientific evaluation system should be established, and feedback information from students, teachers, counselors, and parents should be collected from multiple dimensions. Based on the evaluation results and feedback, the early warning system and intervention strategies should be improved in a timely manner, and a sustainable improvement mechanism should be established to make Academic Early Warning Mechanisms more perfect and effective, thus providing a guarantee for students' academic success.

It is crucial to establish a reasonable evaluation system, which should assess the effectiveness of interventions from multiple dimensions, such as academic performance improvement, changes in learning attitudes and methods, and psychological adjustment. The impact of interventions can be analyzed by comparing exam scores and classroom performance before and after the intervention. At the same time, students' feelings and suggestions can be collected through questionnaires and interviews to optimize strategies.

During the evaluation, extensive feedback should be collected. Student feedback is crucial, and regular satisfaction surveys should be conducted to evaluate the effectiveness of the intervention and provide suggestions. Teacher, counselor, and parent feedback should also be valued, as it provides insight into the intervention's effectiveness from different perspectives. Teachers can provide feedback on the teaching promotion and implementation issues, counselors can provide feedback on student behavior and psychological changes, and parents can provide feedback on home learning situations and their reaction to the intervention. This will provide a comprehensive understanding of the actual effectiveness of the intervention.

According to the evaluation and feedback, timely optimize the early warning system and intervention strategies. If the preliminary effects are not good, analyze the reasons, which may be design or implementation issues. Adjust the strategy, such as improving counseling methods and increasing interactivity. At the same time, improve the early warning system, enhance the accuracy of signals, optimize data collection and analysis. Adjust the warning level according to the student's situation to ensure that the system is scientific and reasonable.

By combining theoretical frameworks and practical strategies, effective Academic Early Warning Mechanisms can be established, which can significantly improve students' academic success rate, help students overcome academic difficulties, and achieve comprehensive development.

### 5. Conclusion

Building effective Academic Early Warning Mechanisms requires a combination of theoretical frameworks and practical strategies, through systematic management and

individualized intervention measures, to help students overcome academic difficulties and achieve comprehensive development. Academic Early Warning systems have significant effects on improving students' academic performance and mental health. By identifying and intervening early, Academic Early Warning helps students solve academic difficulties in a timely manner, improve their academic performance and graduation rates; by providing psychological support and intervention, Academic Early Warning helps students alleviate stress and anxiety, improve their mental health; by providing individualized support and intervention, Academic Early Warning helps students build self-confidence and self-management ability, improve their overall quality and competitiveness. Educational managers and teachers should continuously explore and improve Academic Early Warning Mechanisms to enhance their scientificity and effectiveness, providing a solid guarantee for students' academic success.

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