

Evaluation of Assessment Tools for High-care Student Groups in Vocational High Schools

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Abstract. Student dropout problems are a continuous concern in the educational world. According to relevant statistics, dropouts are responsible for a large proportion of the crimes committed by young people. Thus, students are a potential threat to public order after dropping out of school. Researchers are diligently developing efficient and effective assessment tools in the name of “prevention over treatment.” This paper employs group decision making for professional counselors and uses questionnaires to select a series of key criteria for high-care group assessment tools that can be adopted in school counseling units. In addition, the analysis hierarchy process (AHP) is used to establish a model for selecting assessment tools for high-care students groups in vocational high schools. We hope that this model can offer counseling units in vocational high schools in Taiwan an objective and effective method for selecting optimal assessment tools.

Keywords: High-care students, assessment tools, analysis hierarchy process (AHP)

1 Introductions

Dropping out of school and defiant behaviors are closely associated with criminal behavior. A study of education dropouts and juvenile criminals reported that among 218 juvenile delinquents, 65% had dropped out of education. In other words, more than three-fifths of the juvenile offenders were education dropouts [1].

According to domestic and foreign literature, dropping out of school can increase the crime rate [2], increase government expenditure on social welfare, and increase feelings of alienation among dropouts. Statistical analysis of juvenile delinquency conducted in 2001 by the Criminal Research Center of the Ministry of Justice stated that the total number of criminals was 14,727 [3], of which, 35.14% were high school dropouts and 52.54% were between 16 and 18 years of age. These data demonstrate that dropping out of school can be a significant concern for personal development and social stability.

Using information technology, this study analyzes and compares four assessment

tools, namely, a checklist, a self-report questionnaire for predicting dropout probability, a statistical prediction model, and teachers as predictors to identify the appropriate assessment tools for predicting potential dropouts. The objective of this study is to determine the most suitable assessment tool for identifying which students of higher vocational schools are at risk of dropping out.

2 Literature Review

Multiple factors influence students to leave school. Most previous studies concerning dropouts mention both the conceptual model for dropouts developed by Tinto [5] and that developed by Miller [6] subsequently; these two models are essentially the same. Both models emphasize that the academic and social performance of students with different background characteristics can influence their perceptions at the psychological level.

The analytic hierarchy process (AHP) is a decision-making strategy developed by Saaty in 1971. With constant modifications and verifications, by 1978, the AHP method had matured. AHP has a wide range of theoretical applications; the amount of literature on AHP is substantial. The research methods of AHP theory were proposed and explained in [7].

The methods frequently used by domestic and foreign education units to predict student dropouts include checklists, self-report questionnaires for dropout probability, statistical prediction models, and teacher assessments [5]. These four methods use different subjects, approaches, durations, and data presentation; the appropriate sample size for these methods also differs. The four prediction tools are described below.

A. Checklist

Teachers who have direct contact with students are instructed to select the items that apply to the students to assist in determining how likely the students are to leave education and related phenomena, and related research was completed by Ginaras and Careage [8].

B. Self-report questionnaire for dropout probability

The targets of self-report questionnaires for assessing dropout probability are students. Examples of these scales include the Student At-Risk Identification Scale (SARIS) developed by McKee et al. [8].

C. Statistical prediction model

A statistical prediction model is used to determine the factors associated with dropping out and potential indices [9].

D. Teacher assessments

Teachers should identify at-risk students based on their daily contact and interaction with the students. Wells et al. [10] conducted relevant research and discussions using this method.

3 Methodology

Research procedures that support the study theme were formulated as shown in Fig. 1. The targets of this study were first-year students of higher vocational schools. The assessment tools included a checklist, a self-report questionnaire for dropout probability, a statistical prediction model, and teacher assessments. Other assessment tools were not included in this study.

3.1 Description of hierarchical factors

We adopted AHP in this study and structured various evaluation factors in hierarchical order using a top-down inductive method. Four main criteria are summarized and described below.

A. Accuracy

Accurate predictions rely on screening rate, teacher-student relationship, and student factors. Because the counseling units of educational institutions are responsible for an excessive amount of tasks, the counselors hope that the lists they receive actually contain at-risk students who genuinely require counseling. For assessment tools in which subjects are teachers, teachers' personal subjective evaluations rely on teacher-student relationships and whether teachers can objectively evaluate students. For assessment tools in which subjects are students, the evaluation may be invalid because students can refuse to answer or provide false answers because of psychological factors specifically for at-risk students.

B. Convenience

Regarding convenience, the factors considered are the ease of operation and workload. Checklists do not require extensive textual descriptions and the questions primarily concern phenomena that can be easily observed or understood by teachers and that exist in schools. Numerous students are screened using self-report inventories and statistical prediction models, which can be a burden to counseling staff.

C. Speed

Regarding speed, factors considered are the number of test participants and the operation duration.

D. Practicality

Regarding practicality, the factors considered are data analysis and transitional function. Personal information enables teachers to concretize their vague perceptions of students and understand the various risk factors faced by students. Counselors and mentors who are not directly involved in the assessment procedure should be able to take over assessed cases relatively rapidly after obtaining detailed assessment result.

3.2 Establishing and applying models

The establishment of a selection method in this study involves six steps [7]. We adopted AHP to determine the weights of selection criteria and construct a selection model. The results are described below.

A. Analysis and establishment of research architecture

- (1) **Problem description:** We first conducted problem analysis for the theme and goal of this study before collecting relevant information to fully understand objectives. Next, we differentiated the causal relationships among the secondary objectives to facilitate the partitioning of subsequent hierarchical structure.
- (2) **Establishment of hierarchical structure:** Several populations were defined by analyzing the study goal. Each population was further divided into several subpopulations; the hierarchical structure is shown in Fig. 2.

B. Calculation of factor weights for each hierarchy level

The weights for evaluating assessment tools for at-risk populations at higher vocational schools were established by calculating the geometric means and summarizing the composite score determined by expert groups according to weights defined by experts.

C. Calculation of eigenvectors and eigenvalues

The weights for factors in each hierarchy level were obtained from a pairwise comparison matrix of the primary and secondary criteria using eigenvector equations.

D. Consistency test

Saaty suggested verifying the consistency of a pairwise comparison matrix using a consistency index (*CI*) and consistency ratio (*CR*) [7].

E. Calculation of the relative weights in each hierarchy level

After calculating the weights of factors in each hierarchy level, the weights of the overall hierarchy were calculated, and then, calculations for the overall hierarchy were conducted.

F. Calculation of weights for the overall hierarchy and selection of the optimal assessment tool

The most appropriate alternative for the research goal can be determined by calculating the weights of factors in each hierarchy level.

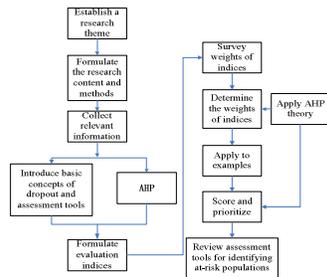


Figure 1. Research procedure.

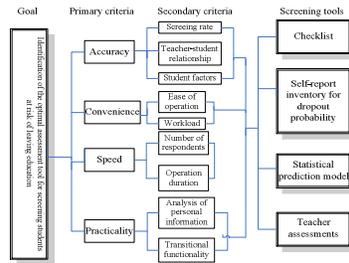


Figure 2. Hierarchical structure.

4 Results and Discussion

To evaluate the assessment tools selected by counseling units for identifying at-risk populations, we drafted an index set after reviewing literature and conducting a questionnaire. We also developed the indices required for this study by conducting interviews and mentor meetings, inviting students, mentor teachers, and counseling units to adjust the index set. The weights of various factors were assessed using AHP

to explore the alternatives and strategies that should be used for selecting assessment tools.

A. Weights of the factors in each hierarchy level

First, the results of expert questionnaires regarding the primary criteria were analyzed. The experts' judgments on the primary criteria of alternative assessment tools were compared in pairs.

The weights of criteria in each hierarchy level can be calculated from the pairwise comparison matrix of the primary and secondary criteria using eigenvector formulae; the results are shown in Table 1.

Table 1. Weights of eigenvectors for primary and secondary criteria.

Primary Criteria	Weights of criteria	Secondary criteria	Weights of secondary criteria	The two weights multiplied
Accuracy	0.5986	Screening rate	0.6483	0.3880
		Teacher-student relationship	0.1220	0.0730
		Student factors	0.2297	0.1374
Convenience	0.1300	Ease of operation	0.7500	0.0975
		Workload	0.2500	0.0325
Speed	0.0570	Number of respondents	0.3333	0.0189
		Operation duration	0.6667	0.0380
Practicality	0.2144	Analysis of personal information	0.7500	0.1608
		Transitional functionality	0.2500	0.0536

Regarding the single factors judged by experts, the screening rate was the most important factor of accuracy, ease of operation of convenience, operation duration of speed, and analysis of personal information of practicality. As shown in Table 1, among the four criteria, the screening rate of the accuracy criterion was the most important factor and has a combined weight of 0.3880. The respondents attached relatively minimal importance to the factor number of participants in the speed criterion; the combined weight of this factor was only 0.0189. This result indicates that experts consider the most important factor to be the screening rate. The primary purpose of assessment tools is to identify or screen for the students at high risk of leaving education. Therefore, the screening rate is the most critical index of an assessment tool.

B. Selection of the optimal assessment tool

The composite score for the four assessment tools was obtained by organizing the weights of various criteria obtained from questionnaires completed by counseling personnel. The composite score of the factors that influence the respondents' choice of assessment tool for identifying at-risk populations are shown in Table 2.

Table 2. Selection of assessment tools for counseling units.

Decision factors	Primary criteria	Secondary criteria	Combined weight	Priority
Checklist	0.32429	1.30762	0.3286	1
Self-report questionnaire	for 0.28409	0.874815	0.2516	3

dropout probability				
Statistical prediction model	0.09732	0.73678	0.1351	4
Teacher assessments	0.2943	1.080785	0.2846	2

In summary, under various influences, the assessment tool most preferred by counseling personnel, according to AHP analysis, was, from most to least preferred, checklists, teacher assessments, self-report questionnaires of dropout probability, and statistical analysis models. The primary criteria for checklists scored 0.32429, which was higher than scores for the three other assessment tools. This result indicates that counseling personnel value test outcomes when selecting assessment tools. Additionally, they consider whether assessment outcomes can be transferred for use in counseling, which is the practical aim of this study.

5 Conclusions

Education units are concerned with students' school attendance and have proposed multiple measures to reduce the number of dropouts. However, specific actions that evaluate assessment tools for identifying at-risk students at higher vocational schools have not been conducted. Therefore, this study proposed methods for selecting assessment tools that can effectively identify the students who are likely to leave education. We created indices to evaluate assessment tools for identifying at-risk populations at higher vocational schools based on the properties of the assessment tools and also calculated the weights of the indices according to performance evaluating questions using AHP to determine the relative importance of each index.

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