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Constructing Autonomous Exercise Programs for College Students Guided by Physical Fitness Monitoring Data

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Abstract: Physical fitness data collected from college students are often reported but seldom used to guide exercise outside class. Drawing on a review of related research, this study identifies five obstacles to building data-guided autonomous exercise programs: broken feedback loops, homogeneous program supply, weak motivation transfer, imprecise support for underconditioned students, and the absence of ongoing adjustment. Five corresponding strategies are proposed: an integrated data service covering monitoring, feedback, and interpretation; a stratified program library matched to individual profiles; quantified goals with progressive tasks; digitally delivered targeted support; and dynamic adjustment driven by movement-quality monitoring and periodic retesting. Together these strategies form a closed loop of monitoring, feedback, programming, and retesting, and offer a practical reference for universities that intend to turn fitness data into guidance for students' independent exercise.

Keywords: Physical Fitness Monitoring; College Students; Autonomous Exercise; Exercise Program; Digital Health Intervention

1. Introduction

The Healthy China initiative and the continuing integration of sport and education have turned college students' physical fitness from a peripheral concern into a hard performance target. As testing under the National Student Physical Fitness Standard has become institutionalized and routine across universities, fitness data now accumulate over consecutive academic years, creating a considerable resource for guiding exercise beyond the classroom. This resource, however, has not translated automatically into healthier behavior. Extracurricular autonomous exercise remains the main arena of students' physical activity, yet it has long been marked by fashionable choices of activity, training loads set by feel, and persistence that depends on enthusiasm. Behind these patterns lie both a shortage of program supply and a deficit of psychological drive: previous studies show that self-monitoring of physical fitness can positively influence college students' exercise motivation [1], and that self-efficacy mediates the relationship between physical literacy and autonomous exercise behavior [2]. Fitness data, in other words, can enter students' exercise decisions only when they perceive, understand, and use them to monitor themselves. In practice, though, a connecting mechanism between monitoring data and autonomous exercise is still missing: the data lie dormant in reports, programs are absent outside class, and behavior breaks off where cognition ends. This study therefore takes as its central question how physical fitness monitoring data can guide the construction of autonomous exercise programs for college students. Following the logic of defining concepts, reviewing research, diagnosing difficulties, and proposing strategies, it attempts to offer an operable path for extracurricular exercise guidance in universities.

2. Concept Definitions and a Review of Related Research

This section first defines the core concepts, then reviews related research along the data–program–behavior chain, and finally clarifies how monitoring data correspond to guidance for autonomous exercise, laying the ground for the diagnosis of difficulties and the design of strategies that follow.

2.1 Core Concept Definitions

Physical fitness monitoring data refer to test results based on the National Student Physical Fitness Standard, covering body morphology, physical function, and physical fitness in three dimensions. They serve both as a quantitative basis for evaluating an individual student's

condition and as an intermediary variable linking evaluation and intervention [3]. Autonomous exercise denotes physical activity that college students organize, manage, and monitor on their own outside class hours, as distinct from organized teaching and training within physical education curricula; its behavioral basis is autonomous exercise behavior [2]. An autonomous exercise program is an executable exercise plan that, on the basis of individual fitness data, specifies the frequency, intensity, time, and type of exercise together with progression rules, and is in essence the application of exercise prescription thinking to the extracurricular context [4]. The three concepts form a transmission chain of data, cognition, and behavior: monitoring data answer the question of who a student is, the exercise program answers how the student should train, and autonomous exercise is the final destination. This definition also sets the boundaries of the present study.

2.2 A Review of Related Research

Around the data–program–behavior chain, existing research has developed along five broad directions. In evaluation and prescription research, Cui et al. constructed an evaluation system for college students' physical fitness and developed accompanying exercise prescriptions [3], laying a methodological foundation for converting data into programs; Huang et al. further examined the practical value of AI-supported personalized prescriptions for guiding extracurricular exercise in universities [4]. In digital intervention research, Qiu et al. confirmed that digital health interventions produce significant health-promoting effects among physically underconditioned college students [5], offering a technical route for data-guided extracurricular intervention. In fitness training research, Cui et al. found that functional fitness training improves both movement quality and physical fitness test performance [6], which suggests that autonomous exercise programs must attend to the science of what and how students train. In health management research, Liu noted the tendency in current college fitness management to prioritize testing over application [7], pinpointing the weakness at the data-application stage. In behavioral quantification research, Yuan et al. established an isotemporal substitution model of physical behaviors, providing a quantitative tool for substituting and combining different activities [8]. Taken together, these studies have accumulated deeply at individual points such as evaluation tools, prescription design, intervention technology, and training methods, yet few have connected fitness monitoring data with the construction of autonomous exercise programs [7]. This gap is precisely where the present study begins.

2.3 Correspondence Between Monitoring Data and Guidance

Guiding programs with data presupposes knowing which data correspond to which kind of guidance. The test indicators of the National Student Physical Fitness Standard fall into three dimensions—body morphology, physical function, and physical fitness—and the core indicators under each dimension carry distinct data features that directly shape the orientation of program design. Students who exceed norms in morphology should rely mainly on moderate-to-low-intensity aerobic work with strict control of frequency and duration; those weak in function need interval running, rope skipping, and ball games to improve cardiorespiratory capacity gradually; those deficient in strength are advised to combine resistance training with functional fitness work, with priority given to movement quality; those poor in flexibility should embed dynamic and static stretching into the warm-up and cool-down phases; and those low in speed and agility may work on reaction, change of direction, and coordination. These correspondences follow the principles of remedying weaknesses first, attending to overall development, and progressing step by step. They constitute the basis for the diagnosis of difficulties and the design of strategies in what follows. The details are shown in Table 1.

Table 1. Design of Exercise Guidance Schemes Based on Characteristics of Physiological Monitoring Data

Monitoring dimension	Core indicators	Data features	Guidance for the program
Body morphology	Height and weight (BMI)	Overweight / obese	Moderate-to-low-intensity aerobic work as the mainstay, with strict control of frequency and duration, complemented by lifestyle guidance

Physical function	Vital capacity; 800/1000 m run	Low score rate	Interval running, rope skipping, and ball games, with intensity progressing from low to high
Muscular strength	Pull-ups (male) / 1-minute sit-ups (female)	Failed test	Resistance training combined with functional fitness work, with priority on movement quality
Flexibility	Sit-and-reach	Below standard	Dynamic and static stretching combined, embedded in the warm-up and cool-down phases
Speed and agility	50 m run	Low score rate	Reaction speed, change-of-direction movement, and agility-coordination work

3. Five Difficulties in Constructing Data-Guided Autonomous Exercise Programs

Viewed against the correspondences above, the construction of data-guided autonomous exercise programs in universities currently faces five difficulties.

3.1 The Feedback Chain for Monitoring Data is Broken, and "Tested but Not Used" Has Become the Norm

University fitness monitoring relies mainly on centralized testing, score reporting, and ranking incentives. Once testing ends, students are usually left with a single aggregate score: they can see neither the structural gaps among sub-items nor obtain targeted interpretation [7]. Without feedback, self-monitoring of fitness loses its premise—students have no way to monitor themselves, and the motivating effect of data on exercise cannot occur [1]. Data and autonomous exercise thus become two separate matters. At a deeper level, the diagnostic, warning, and guiding functions of monitoring data should run through the entire process of extracurricular exercise; yet under the operational inertia of testing, reporting, and archiving, the data stop at the administrative stage and are never converted into health information that students can understand and use. This is the primary obstacle that leaves autonomous exercise programs with nothing to build on.

3.2 Program Supply is Homogeneous and Disconnected from Individual Fitness Data

Guidance for extracurricular exercise mostly takes the form of uniform calls to action, such as collective running check-ins and step-count rankings, without classifying students on the basis of monitoring data, so that exercise intensity and activity selection are mismatched with students' actual levels. The exercise students engage in does not suit them, while what would suit them goes unguided—this has become a common experience. Technology for generating personalized exercise prescriptions has entered practical view [4], but it mostly serves classroom teaching or small special populations and has yet to cover large-scale extracurricular autonomous exercise; mature evaluation and prescription systems [3] also have limited reach in extracurricular guidance because of their operational thresholds. Homogeneous supply not only dilutes the guiding value of monitoring data but also deprives students of any sense of gain from the program, indirectly dampening their willingness to participate and persist.

3.3 The Conversion from Data to Behavior Lacks Psychological Design, Leaving Exercise Motivation and Persistence Weak

Converting monitoring data into autonomous exercise behavior requires an intermediary process of motivation arousal and efficacy cultivation, in which self-efficacy is the central hub [2]. Existing program design attends to the body but neglects the mind: it lacks goal-setting and feedback mechanisms that render progress in the data visible, so students cannot see the causal chain from exercising to improved data, and a virtuous cycle of data improvement, stronger motivation, and sustained behavior is hard to form [1]. Because extracurricular exercise lacks organizational constraint, motivation that decays even slightly tends to interrupt the behavior, and the interruption in turn confirms the judgment that exercise is useless, further depressing the sense of efficacy. When data stay on paper and behavior cannot follow, the problem lies precisely in the absence of psychological design at the conversion stage.

3.4 Support for Underconditioned Groups Lacks Precision, and Digital Enablement Has Yet to Take Root

Students who fail fitness tests or are overweight

need scientific guidance most, yet current support relies mainly on centralized remedial sessions and uniform training, with limited individualization, and mismatches between intervention intensity and students' capacity occur from time to time. The promoting effect of digital health interventions on underconditioned groups has been verified [5], and isotemporal substitution models provide a quantitative tool for combining and replacing activities [8]; yet neither has been systematically incorporated into the everyday supply of autonomous exercise programs. Some remain at the pilot stage of research projects, others stop at simple step counting, and data collection, program delivery, and effect re-evaluation remain disconnected. Underconditioned groups thus stay in a state of being supervised but not guided.

3.5 Process Monitoring and Dynamic Adjustment are Missing, and Programs are Prescribed Once and Left Unchanged

Autonomous exercise takes place outside class, where movement quality and load intensity lack real-time monitoring; blind increases in volume easily lead to injury and excessive fatigue, and the fact that functional fitness training improves movement quality underscores the necessity of process monitoring [6]. Meanwhile, programs are seldom revised against periodic retest data and cannot respond to changes in students' fitness [3]. The value of monitoring data lies in continuous comparison; without a closed loop of retesting, comparison, and revision, a program degenerates into static text, its guidance of exercise loses timeliness, and the gains from the first four difficulties cannot be consolidated.

4. Strategies for Addressing the Difficulties

In response to the difficulties above, and on the principle of one-to-one correspondence, five strategies are proposed.

4.1 Establish an Integrated Data Service Mechanism of Monitoring, Feedback, and Interpretation

This mechanism addresses the absence of data feedback directly. After fitness testing, students should receive individualized reports that convert raw scores into grades, percentiles, and gap analyses of sub-items, so that they can make sense of their own data; supporting micro-lectures on data interpretation and fitness consultation services should translate the language of scores into the language of health, explaining what each gap means and where improvement is possible. Taking data feedback as the starting point of self-monitoring can activate its motivating effect on exercise [1]; at the same time, data sharing between physical education departments and student affairs systems should be promoted in order to open a channel through which monitoring data reach extracurricular exercise contexts [7]. The essence of data service lies not in how much is provided but in whether it can be understood and used. This is the first kilometer of data-guided programming.

4.2 Build a Stratified and Classified Library of Autonomous Exercise Programs Based on Monitoring Data

This mechanism responds to the homogeneity of program supply. Students may be classified by test results into types such as weak cardiorespiratory function, weak strength, insufficient flexibility, overweight intervention, and standard maintenance, with programs designed for each type. Every program should specify the four FITT elements, progression rules, and alternative activities, so that students can take their seat according to their ticket. The compilation of the library can refer directly to the indicator–guidance correspondences in Table 1, and can borrow the generation logic of AI-assisted personalized prescriptions to improve the efficiency and targeting of supply [3][4]. The library should also leave room for choice, allowing students to select among activities of the same type, so that scientific rigor and autonomy are both respected. A program should be at once a prescription and a menu, for only then will students be willing to follow it.

4.3 Embed Quantified Goals and Progressive Tasks, Using Self-Efficacy to Unblock the Conversion

This mechanism targets weak motivation and persistence. Program design should translate monitoring data into quantifiable stage goals—improving the 1000 m time by ten seconds in eight weeks, for example—so that progress becomes visible and can be fed back. Progressive task design allows students to accumulate experiences of success, cultivate self-efficacy, and thereby convert physical literacy into stable autonomous exercise

behavior through this mediating variable [2]; regular follow-ups and motivation assessments help maintain exercise motivation over time [1]. Goal setting should follow the principle of a jump that is within reach: too easy and it fails to motivate, too hard and it damages efficacy. Data here serve as both a benchmark and a source of incentive.

4.4 Empower Precise Support for Underconditioned Groups with Digital Health Interventions

This mechanism addresses the coarseness of support for underconditioned groups. Digital health profiles should be established for these students, through which customized programs, exercise reminders, and data feedback are pushed via applications, improving the accessibility and adherence of intervention [5]. The idea of isotemporal substitution should be introduced, guiding students to replace sedentary periods with moderate-intensity activity so that health benefits accumulate [8]. A closed loop of screening, intervention, and re-evaluation should be built, with the degree of improvement in weak items serving as the basis for program revision. The significance of digital enablement lies in shifting support from centralized remediation to daily accompaniment, so that the students most in need of guidance can obtain guidance matched to their level at any time, and intervention moves from coarse to fine.

4.5 Insist on Movement-Quality Monitoring and Dynamic Adjustment Driven by Periodic Retesting

This mechanism solves the problems of uncontrolled process and lagging adjustment. Program implementation should give priority to movement quality, embedding basic movement screening and functional fitness training content so as to control exercise risk at its source [6]. Retesting should be organized on a semester or academic-year cycle, with comparisons of pre- and post-test data serving as the direct basis for revising the FITT elements, forming a closed operation of monitoring, programming, retesting, and reprogramming [3]. Movement monitoring and data retesting are two sides of the same process: the former safeguards the safety of the process, while the latter calibrates the direction of the program, and together they sustain the continuity of data-guided exercise. The correspondence between the difficulties and the strategies above is shown in Table 2.

Table 2. Correspondence Framework of Implementation Challenges and Strategies for Exercise Data-Driven Programs

Difficulty	Corresponding strategy	Key steps and data nodes
Absent data feedback; tested but not used	Integrated data service mechanism	Delivery of individual reports; guidance in data interpretation
Homogeneous program supply	Stratified and classified program library	Classification of fitness types; configuration of FITT elements
Weak motivation; broken transfer	Quantified goals and progressive tasks	Achievement of stage goals; maintenance of motivation
Coarse support for underconditioned groups	Precisely targeted digital intervention	Improvement of weak items; guidance on isotemporal substitution
Uncontrolled process; lagging adjustment	Movement-quality monitoring and periodic retesting	Movement screening; comparison of retest data

5. Conclusion

The value of physical fitness monitoring data is ultimately realized in their use. Following the logic of defining concepts, reviewing research, diagnosing difficulties, and proposing strategies, this study has argued for the feasibility of building a measurable, guideable, and adjustable system of autonomous exercise programs for college students, with stratified data classification as the warp and motivation arousal and process monitoring as the weft. The integrated data service solves the problem of data not reaching down, the stratified program library solves the mismatch of programs, quantified goal design solves the failure of behavior to follow, precise digital support solves the inaccessibility of underconditioned groups, and movement monitoring with periodic retesting solves the poor management of process. Interlocked with one another, the five form a complete closed loop of monitoring, feedback, programming, and retesting, and only then can fitness data truly become a navigator for college students' autonomous exercise. It should be noted that the framework proposed here remains

a path design, and its effects await further verification in the development of data platforms and in intervention experiments; this is also the direction of future research.

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