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Article

The Logic, Limitations, and Pathways of Using Large Language Models to Support Weight and Nutritional Health Management Among College Students

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Abstract: The "Healthy China" strategy and the "Year of Weight Management" initiative have elevated college students' weight and nutritional health from individual behavior to educational governance. Existing interventions (PE courses, campus runs, fitness tests) rely on periodic assessments, failing to sustain daily diet, exercise, and sleep interventions. Large language models (LLMs), with natural language understanding and multi-source data integration, can lower participation barriers and enhance intervention targeting and continuity. However, technological gains do not automatically yield health benefits, due to three challenges: data privacy, bodily discipline, and cost sustainability. Current research focuses on general digital tools or single scenarios, with insufficient discussion on LLMs' specific characteristics and governance limits. Building on a definition distinguishing LLMs from general health apps, this paper analyzes the logic and limitations of LLM empowerment in university weight/nutrition management. It proposes a framework centered on cafeteria nutrition data digitization, supported by incentives/constraints and health literacy development, and safeguarded by multi-stakeholder collaboration and ethical governance. The study argues that LLMs should serve as auxiliary tools for students' autonomous health management, and their effectiveness depends on coordinated development of data governance, educational mechanisms, and ethical boundaries.

Keywords: large-scale models; college students; weight management; nutritional health; data governance; health literacy

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1. Introduction

Weight and nutritional health issues among college students have long persisted,and both their manifestations and underlying mechanisms are complex.On the one hand,overweight and obesity,nutritional imbalances,and declining physical fitness are compounded by factors such as the convenience of takeout,flexible schedules,and academic pressure,making it difficult to address these issues through a single institutional measure[1].On the other hand,existing interventions in higher education institutions primarily focus on measurable outcomes.Physical education classes are time-limited,campus runs emphasize check-ins,and physical fitness tests are conducted only once a year;once students step outside these regulated settings,their diets,exercise routines,and daily schedules essentially revert to spontaneous patterns.Outcome-based management can indicate whether students meet standards but struggles to explain the process by which health risks emerge from everyday behaviors.

The“Healthy China”strategy and the“Year of Weight Management”initiative have further incorporated weight and nutritional health into the educational governance agenda.The“Healthy China 2030 Plan Outline”[2],the“State Council Opinions on Implementing the Healthy China Initiative”[3],and the“Implementation Plan for the Year of Weight Management Campaign”[4]all emphasize a shift from disease treatment to health promotion,and from periodic monitoring to process management.Under this policy logic,universities cannot treat physical fitness tests as the sole endpoint of management but should instead establish continuous support mechanisms covering daily diet,exercise,sleep,and mental well-being.

Large-scale model technology provides new tools to facilitate this transformation,but technological capabilities do not equate to governance solutions.Compared to general health applications,the distinction of large-scale models lies not in their superior computational power,but in the way they alter the interaction between students and health management systems.Whether this distinction can truly translate into improved health behaviors depends on whether data governance,institutional incentives,and ethical boundaries are established simultaneously.This article therefore analyzes the issue from three perspectives—logical foundations,practical limitations,and pathway development—focusing on why large language models are necessary,under what conditions they are effective,and how to prevent their technological advantages from being undermined by administrative logic.

2. The Logical Foundation for Large Language Models to Empower Weight and Nutritional Health Management in Higher Education

2.1. The Capability Leap from Rule-Based Systems to Generative Interaction

Traditional health applications are centered on rule-based systems,requiring users to convert food into grams and exercise into minutes and intensity levels,and providing fixed prompts based on preset thresholds.While this design theoretically enables quantitative management,it faces two insurmountable challenges in practice.First,the implementation cost of structured data entry is high;students often stop recording once their initial enthusiasm wanes,making data continuity difficult to guarantee.Second,fixed thresholds reduce individuals to a single variable,allowing only a determination of whether an indicator exceeds the limit but failing to understand the specific context in which the behavior occurred;consequently,the recommendations lack acceptability.

By leveraging natural language understanding,image recognition,and contextual reasoning,large language models can transform vague,unstructured daily information into computable data and generate context-adaptive recommendations based on students’physical condition,short-term goals,and real-time status.More importantly,large language models support dynamic adjustments based on feedback;when a plan deviates from reality,the system can reset the intensity of goals while preserving the student’s autonomy.This capability shifts health management from enforcing fixed standards to supporting self-regulation,and from one-time reminders to ongoing dialogue,thereby laying the foundation for long-term behavioral change.

2.2. Adapting Large Language Model Capabilities to University Health Management Scenarios

Health management in higher education is characterized by dispersed data sources, diverse behavioral contexts, and significant differences among intervention targets.Data from physical fitness tests, physical education courses, campus runs, cafeteria spending,

and health checkups at the university health center are stored in separate systems, making cross-system integration difficult for traditional tools. Under unified data standards, large language models can aggregate information from multiple sources to create student health profiles, identify various risks such as abnormal weight, nutritional imbalances, and physical inactivity, and push personalized exercise prescriptions and dietary recommendations based on risk levels [5,6].

Cafeterias serve as the primary source of daily nutrition for college students and represent the setting with the highest data density and most observable behaviors in weight and nutritional health management.Most university cafeterias have not yet established systematic nutritional labeling,leaving students without a basis for assessing the calorie content and nutritional composition of dishes.Additionally,cafeteria offerings are often guided by taste preferences,further reinforcing the selection of high-fat,high-sugar foods[7,8].Large language models can perform functions such as information presentation,meal recommendations,and long-term dietary behavior tracking in cafeteria settings,transforming nutrition management from abstract advocacy into concrete,actionable steps.This scenario-specific adaptability distinguishes large language models from general health applications and dictates that their empowerment strategy should be anchored in the digitization of cafeteria operations[9,10].

3. Practical Limitations of Large-Scale Model Empowerment

3.1. The Tension Between Data Privacy and Accuracy

The accuracy of large language models is directly proportional to the completeness of the data;however,records of weight,diet,exercise,and health are highly sensitive,and cross-analysis could reveal students'daily routines,financial circumstances,and psychological states.Current regulations in higher education institutions regarding data authorization,usage boundaries,and algorithmic transparency remain inadequate,making it difficult for students to assess how their information will be used[6].If data collection prioritizes maximizing model performance while disregarding the principle of data minimization,increased accuracy may come at the expense of students'data sovereignty.

Resolving this tension cannot rely solely on technical measures.Encrypted storage and anonymization can reduce the risk of leaks,but they do not address the legitimacy of data collection boundaries and usage permissions.Universities need to embed rights such as informed consent,the right to opt out,the right to correction,and the right to deletion into system processes,enabling students to retain substantive control over their own health data.Only by clearly defining the ownership of data rights at the institutional level can technological precision secure a sustainable data source and the fundamental trust of students.

3.2. The Conflict Between Instrumental Rationality and Bodily Autonomy

Large language models enable health management to be embedded in daily life,but they also make it easier for such management to evolve into continuous surveillance.When weight,step count,and calories are set as default,visible performance metrics,health management may shift from improving one's condition to meeting predetermined standards.Students eat and exercise for the sake of the data,and the body gradually transforms from a subject of perception and action into an object requiring

optimization.This form of discipline does not rely on coercive commands but rather generates internal pressure through continuous feedback and self-comparison[11].

Whether technological tools can avoid alienation depends not on the gentleness of their recommendations,but on whether the system allows space for refusal,interpretation,and privacy.If students can only accept the system's suggestions without voicing dissent,or if health data is used for public rankings and rewards or punishments,even the most advanced models are merely more sophisticated tools of control.Therefore,bodily agency should serve as the yardstick for evaluating the effectiveness of large-scale model applications;health management must serve students'autonomous choices and long-term growth,rather than mechanical compliance with metrics.

3.3. Constraints Between Development Costs and Governance Sustainability

Cafeteria nutrition databases,multi-system interfaces,model deployment,and ongoing maintenance all require resource investment,yet universities still have relatively weak foundations in data standards and interdepartmental coordination.If the goal from the outset is to build a complete and precise menu database,the development cycle and labor costs will rapidly escalate,making it likely that the project will remain stuck in the pilot phase for an extended period.Conversely,if only coarse-grained labeling is performed,the system's credibility may be undermined due to insufficient information.

This constraint illustrates that leveraging large language models should not aim for a one-time build but rather adopt an incremental,iterative approach that integrates data accumulation with usage feedback into a single process.Universities should start with the minimum viable scenario,first addressing data standards and access boundaries,and then gradually enriching functional modules.Only by maintaining a dynamic balance between technical costs and governance benefits can the system transition from a pilot phase to routine operation.

4. Building a Pathway for Large-Scale Models to Empower Weight and Nutritional Health Management in Higher Education Institutions

4.1. Building a Closed-Loop Data System Through the Digitization of Cafeteria Nutrition Data

Digitizing cafeteria nutrition data is the key to resolving issues related to data foundations and scenario adaptation.Universities can begin by establishing a three-tiered system of calorie classifications with fuzzy annotations for key nutritional characteristics.They can then gradually refine these labels through student post-meal feedback and the model's semantic understanding,thereby achieving the rolling accumulation of data assets through use[7][8].This cold-start approach not only lowers the initial implementation threshold but also engages students in data calibration through the feedback process,thereby enhancing acceptance of the system.

Building on this foundation,universities should comprehensively integrate data from physical fitness tests,physical education courses,campus runs,cafeteria spending,and health checkups at the university health center to form a closed-loop system that links health profiling,risk identification,intervention recommendations,and outcome feedback.Standardized data formats and clearly defined update cycles are prerequisites for cross-departmental data sharing.Only by establishing a continuous,traceable data flow

can large language models transition from static evaluations to trend analysis,providing a reliable basis for targeted interventions.

4.2. Promoting Behavioral Change Through a Synergy of Incentives and Constraints

Behavioral change cannot rely solely on external constraints,nor can it depend entirely on individual self-discipline.On the constraint side,the large-scale model can use multidimensional data to verify the authenticity of exercise and dietary records,thereby reducing token check-ins and selective reporting.On the incentive side,consistent recording,balanced diets,and improvements in health metrics are linked to honors,evaluations,and progress-based rewards,ensuring that health efforts receive tangible feedback[12].These two approaches must be advanced in tandem:constraints set the baseline,while incentives spark motivation,jointly transforming external requirements into internal goals.

The key to mechanism design lies in having the large-scale model handle objective recording and feedback,while teachers and institutional policies provide interpretation and rewards.Data should serve as the foundation for fair judgment,not as the basis for punishment.If the system relies solely on the number of non-compliance cases as a management metric,students may circumvent oversight by falsifying data,thereby undermining the integrity of health management.Therefore,the ultimate goal of incentives and constraints is not to increase the recording rate,but to enhance students'autonomy and sustainability in participating in health management.

4.3. Upholding Student Autonomy Through Health Literacy and Digital Literacy

Large language models can only provide information and recommendations;the final decision-making authority regarding health behaviors remains with the students.Health literacy helps students understand the nonlinear relationship between weight,nutrition,and health,thereby preventing extreme weight loss or uncontrolled neglect of their health;digital literacy helps students identify the commercial logic and bodily biases in algorithmic recommendations and understand the limits of data and algorithmic uncertainty.The cultivation of these literacies must not be limited to the transmission of knowledge but should be embedded in real-life contexts such as dietary choices,exercise routines,and the setting of health goals.

Colleges and universities can incorporate knowledge about weight,nutrition,and health into physical education,health education,or general education courses,and guide students to reflect on the significance of health data through class discussions and practical activities.Only when students are able to voice differing opinions on the system's recommendations and justify their reasoning will large language models truly become tools that support self-management,rather than authorities that replace independent judgment.Whether faculty from different disciplinary backgrounds can teach health literacy depends on the institution's faculty structure and investment in training;this requires a gradual approach,particularly at institutions with limited resources.

4.4. Ensuring Operation Through Multi-Stakeholder Collaboration and Ethical Standards

Weight and nutritional health management involves multiple stakeholders,including physical education,student affairs,medical services,logistics,information technology,and families;it is difficult for any single department to establish a complete closed-loop system

on its own.Universities should clearly define the responsibilities of each department:the physical education department should be responsible for exercise interventions;student affairs and counselors should provide daily guidance;medical institutions should conduct professional assessments;and the IT department should oversee platform development and data security.At the same time,universities can collaborate with nutrition experts,market regulatory authorities,and local communities to provide referrals and ongoing support for high-risk students[10,13].

Ethical standards serve as the baseline for multi-stakeholder collaboration.Data collection must adhere to the principle of data minimization,and the usage process must remain transparent and explainable;ranking students based on health indicators or publicly disclosing such information is strictly prohibited.Large language models should only be used for assessment,reminders,and preliminary recommendations;in-depth guidance and crisis intervention must be carried out by professionals.Only by establishing a stable relationship among technology,institutional frameworks,values,and stakeholder collaboration can the empowerment of large language models evolve from localized efficiency improvements to the optimization of overall governance.It must be acknowledged that multi-stakeholder collaboration faces challenges such as blurred boundaries of authority and responsibility,as well as insufficient incentives for external stakeholders to participate;a gap still exists between ideal design and actual implementation.

4. Conclusions

The core value that large language models bring to weight and nutritional health management in higher education lies in transforming the modes of interaction and data collection in health management,enabling a shift from evaluating stage-specific outcomes to providing continuous process support.However,this transformation is not the result of natural technological evolution;rather,it depends on whether data governance,incentive mechanisms,competency development,and ethical standards can be established simultaneously.If universities continue to use technology with a control-oriented mindset,large language models may reinforce—rather than alleviate—the tendency toward instrumental rationality in health management.

This study primarily focuses on theoretical analysis and pathway design;the effectiveness of specific proposals has not yet been tested using empirical data.Future research could conduct controlled studies on the efficiency of the“cold start”for digitizing cafeteria nutrition data,the impact of different incentive mechanisms on student behavior change,and the long-term effects of large-model recommendations on health autonomy.The framework presented in this paper has not yet been validated through comparisons across universities of different tiers;the feasibility of this approach will vary significantly depending on institutional conditions.Only through continuous observation of the relationship between technology application and student agency can large language models truly serve the“Healthy China”initiative—rather than creating new forms of formalism.

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