DOI Link: https://doi.org/10.59671/ANVbO
Vol.408, Issue.6, Part.1, June 2025, PP. 2-27
Received April 2025 Accepted May 2025 Publihsed June 2025

# Optimizing Classroom Ecology through Learning Analytics to Improve Teaching and Student Engagement

**Xianghe Ren, Yuqian Zu, and Syed Zaheer Ud Din***

**International School for Optoelectronic Engineering, Qilu University of Technology (Shandong Academy of Sciences), Jinan 250353, China**

*Corresponding Author: zaheeruddin@yahoo.com (Syed Zaheer Ud Din)

## Abstract

Classroom teaching and students' learning have been widely concerned. To support the implementation of effective classroom teaching, this study examines the current state of instructional practices and student learning by surveying 541 college students. The questionnaire is divided into three main aspects, in which students are asked to assess their learning experience in college: motivations for choosing their major, their learning status, classroom performance, and feedback from teachers. Research results show that the motivation for choosing undergraduate majors positively affects students' learning. However, if teachers do not continue to provide the necessary guidance and high-quality courses to students, they will lose interest in their majors. For freshmen, teachers should be more concerned about their learning status, because they have the lowest adaptability to university learning. In addition, we also find that dumb classroom teaching, performing classroom teaching, still exists, and classroom teaching efficiency is low. Further analysis indicates that the teaching effectiveness of teachers, including teacher-student communication, positive motivation from teachers to students, and the content of their teaching, has a direct effect on students' learning. The low efficiency of classroom teaching is primarily attributed to an underdeveloped and ineffective classroom ecological environment. In the concluding section, this paper proposes a set of targeted strategies to rebuild and enhance the classroom teaching ecology, aiming to foster more effective teaching and meaningful student engagement.

*Keywords: Classroom teaching ecological environment, learning analytics, teacher-student communication, teaching effectiveness, extrinsic motivation, intrinsic motivation*

## Introduction

In recent decades, many countries have actively expanded higher education, with one of its primary objectives being the cultivation of high-quality talent to meet the evolving demands of economic and social development. In China, higher education has undergone several stages of development, and at every stage, China's higher education has achieved notable successes in talent training quality. In 2022, the gross enrollment rate in higher education in China was approximately 59.6%, indicating that the development of higher education in China has entered a stage of popularization. The shortage of hardware resources and the higher student-teacher ratio have a negative impact on the quality of higher education. Many researchers have believed that changing the teaching model is one of the effective ways to improve teaching quality. So, in the past few decades, several teaching models have been proposed. Jacqueline et al. (Jacqueline and Phillips, 2015) suggested that the flipped classroom teaching model has the potential to enable teachers to cultivate critical and independent thinking among students, building the capacity for lifelong learning and thus preparing future graduates for their workplace contexts. Luis R. Murillo-Zamorano et al. (Luis et al., 2019) have verified that the flipped classroom has positive effects on students' knowledge, skills, and engagement. Keiler (Keiler, 2018) has reported that the participating teachers described multiple benefits of teaching in a student-centered classroom and differences from traditional classrooms. With the development and popularization of network technology, a teaching model called Small Private Online Course (SPOC) (Jiang and Liang, 2023; Lin, 2021), which integrates offline classrooms and online platforms, has been widely used.

Although many ways have been used to transform traditional classroom teaching models and to improve the quality of classroom teaching, the current engagement in the learning of college students is not optimistic. Today, mobile phone ownership in universities is so common among students that these gadgets have become an indispensable part of their daily lives. When students utilize mobile phones as a learning tool during class time, these devices are likely to facilitate and enhance the

learning process. But they have already been controlled by mobile phones. During class time, they often use their mobile phone to play e-games, chat on WeChat/QQ, or browse web pages. Many college students do not focus their energy on listening to the teacher's lectures. So, in the classroom, the students do not care about the content taught by teachers and have zero communication with teachers, which results in the classroom teaching efficiency being poor. We think there are four main reasons for these phenomena. First, the teachers do not fully understand the growth process of modern college students. The post-2000 college students have grown up accompanied by the internet, exposing them to pluralistic content and knowledge. The ways and channels for obtaining information are also diversified. However, they lack self-discipline and initiative in learning. After entering university, some students concentrate their energy and time on the rich and diverse campus life and mobile content. They lack the recognition of professional learning goals and initiative in learning. Second, the teaching content is outdated and cannot meet the needs of modern scientific and technological development. Some teachers have not changed their teaching content for many years, which results in the teaching content being outdated. During classroom teaching, teachers profoundly rely on pre-prepared courseware and textbooks, minimizing interaction with students. Teachers have neglected to stimulate students' enthusiasm for learning, which leads to students losing interest in classroom teaching. Third, the ineffective academic evaluation mechanism makes teachers blindly pursue the examination passing rates, and students also pay more attention to their scores. Under this academic evaluation mechanism, the cultivation of students' abilities and comprehensive qualities is neglected. Fourth, some college students do not understand their majors and do not know their future development prospects. After entering university, some students lose their interest in their majors, and then they do not manage to learn when they encounter learning barriers.

In order to pull students back into learning, many universities have implemented classroom teaching reforms for a period of time. The core of these reforms is mainly focused on innovative teaching methodologies, such as case-based learning (CBL), problem-based learning (PBL), project-based exploration, group cooperation, and

various other approaches. The purpose of the teaching reform is to stimulate students' internal motivation for learning and carry out student-centered classroom teaching. Teachers, however, often face the uncomfortable reality that many students do not actively or deeply engage in classroom learning, but instead participate superficially or avoid it altogether. Many universities have invested a lot of effort in teaching, such as student attendance rate, teacher attendance rate, and supervision group listening to lectures. The classroom teaching efficiency has also been significantly improved. However, these efforts have not substantially benefited students. The key reason is that the classroom teaching ecological environment has not been improved, and the students' learning motivation has not been activated. This paper aims to explore how learning analytics can be used to establish an effective classroom teaching ecology and improve the overall efficiency of classroom instruction.

## Research design and methodology

### *What is the teaching ecological environment?*

The definition of the classroom teaching ecological environment is comparatively fuzzy at first. In 1932, American scholar W. Waller put forward the concept of classroom ecological environment in his book *Sociology of Educatio*n. Waller believed that the composition of classroom space has a significant impact on interpersonal interaction in the classroom. In the 1970s, Doyle and Ponder clearly defined the connotation of classroom ecological environment as space formed by the interconnected processes and events that affect learning environments (Walter, 1977). Here, the classroom teaching ecological environment is investigated in this paper, which belongs to the classroom ecological category, and has a direct impact on the efficiency of classroom teaching and students' learning. The classroom teaching ecological environment is a micro and macro coexisting ecological environment, and is the most basic ecological environment for students and teachers to participate in common activities. The constituent factors of the classroom teaching ecological environment include students, teachers, and the teaching methods and contents.

***What is learning analytics?***

Learning Analytics (LA) is commonly defined as "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Long and Siemens, 2011). It is expected that learning analytics can enhance understanding of learning behaviors like why a student fails to focus on classroom learning, or why a student is often absent from a class, or why the teachers' lectures do not arouse students' interest (Teo Susnjak, 2022). Now, learning analytics have been widely investigated and used in higher education institutions (Carolina et al., 2021; Mohammad et al., 2023). For example, Dirk Ifenthaler and co-workers have put forward that learning analytics can be used to inform and influence decisions on different levels of the educational system (e.g., micro, meso, macro) to improve individual and organizational learning and performance (Dirk et al., 2021).

***Why do we carry out learning analytics?***

The use of big data and analytics in higher education is a relatively new area, and the value of analytics and big data in higher education is in reform activities and improving the teaching and learning processes (Shaza et al., 2023; Tulas, 2013). Institutions of higher education are facing newly emerging challenges, which are affecting the reliance on traditional teaching and advising methods to improve learning motivation and student success (Attaran, Stark and Stotler, 2018; Menon and Suresh, 2020). Big data and analytics can help higher education leaders, administrators, and senior managers deal with newly emerging challenges and plan the strategic direction of their institutions (Ghazwan, 2023). In this work, based on big data and analytics, we carry out learning analytics to provide an overview of students' learning experiences and feedback. We provide analytics data to teachers, who can use this data to develop their courses, and let teachers know what they should keep doing and what they need to change.

### *Population, sample, and questionnaire*

In this paper, we have collected 541 questionnaires, among which girls account for 23% and boys account for 77%. 232, 132, 118, and 59 questionnaires were from freshmen, sophomores, juniors, and seniors, respectively. The questionnaire is divided into three main sections (RQ1-RQ3), in which students were asked to assess their learning experience under several aspects: motivations for choosing majors (RQ1); learning Status (RQ2); classroom performance, and feedback from teachers (RQ3).

## Results and analysis

### *Motivations for choosing majors (RQ1)*

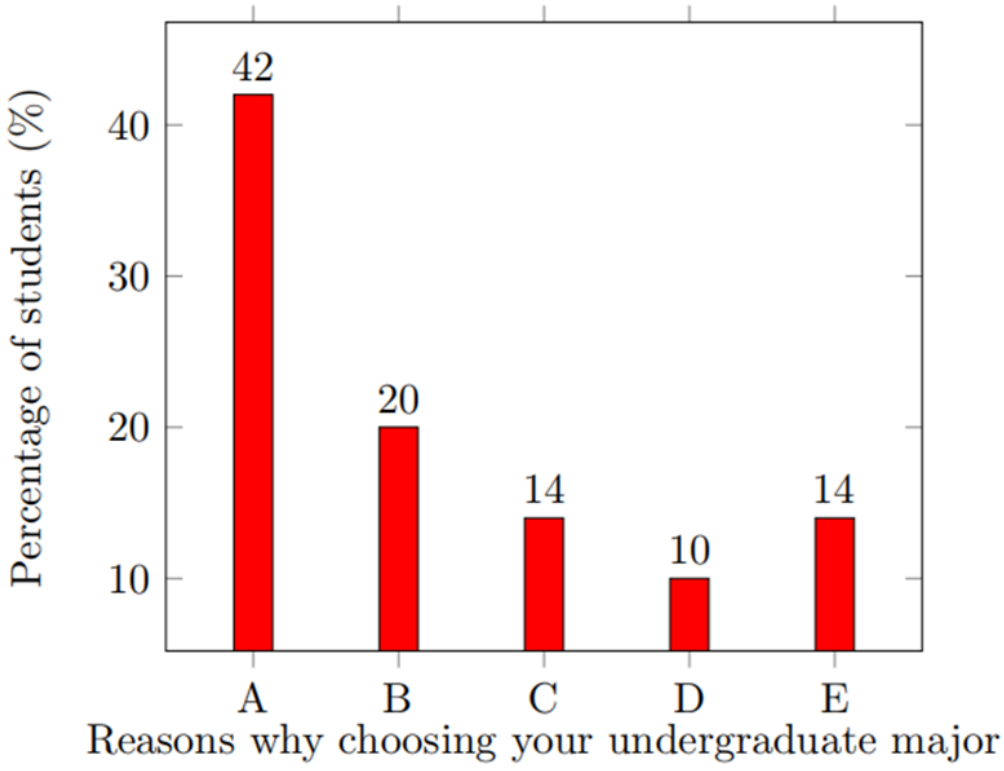


**Figure 1.** Results of reasons for choosing an undergraduate major. A: Very familiar with this major, good job opportunities; B: Personal interest and meaningful learning; C: Parents' decisions; D: Not caring about the major, only entering university; E: Other.

The choice of college major can be one of the most important decisions a student can make. The major choice directly determines where students will take most of

their courses within a university, thus, in turn, affecting much of their interactions with teachers and peers, as well as their future learning motivations (Pink, 2006; Porter and Umbach, 2006). The influence of motivation for choosing majors could also influence students' achievement motivation, or more specifically, their achievement goal striving and grade point average (GPA) at university (Stefan Janke, 2020). The choice of major influences their career trajectory, which may seem a good idea to choose a major that will pay off in hard cash in the future (Myrian et al., 2022). In our questionnaire, we find that 62% of students are familiar with or interested in the majors, which is an intrinsic motivation for choosing (shown by A and B bars in Figure 1). Accounting for 38% of students who passively or randomly choose their majors, which is the extrinsic motivation for choosing (shown by C, D, and E bars in Figure 1). We also investigated whether college students maintain interest in their majors after enrollment. From Figure 2, it can be found that although students who actively choose their major tend to show higher learning engagement, their sustained interest may diminish if they do not receive continuous guidance and access to high-quality instruction after entering university. 12% of students, who were interested in their majors before enrollment, have lost interest in their major marked by a B bar in Figure 2. 32% of students, who were originally not interested in their major before enrollment, have an interest in their majors after learning. This means that the development of well-being and achievement motivation during the transition period to university for freshmen is very important. Therefore, it is necessary to keep students' interest in their majors by improving intrinsic motivation for learning.

***Learning status (RQ2)***

*Adaptation level to university learning*

This part of the questionnaire uses a five-point adaptation scale to assess students' adjustment levels: Completely adapted (A), Adapted (B), Generally adapted (C), Inadaptable (D), and Fully inadaptable (E). From Figure 3 (L), it can be seen that 51% of the participants are adapted to university learning, and only 4% of them claim that they have not been inadaptable or fully inadaptable to university learning.

Generally, students have a high adaptation level to university learning, which is beneficial for improving classroom teaching efficiency. Different grades of students, who are adapted or generally adapted to university learning, have different adaptation levels to university learning.

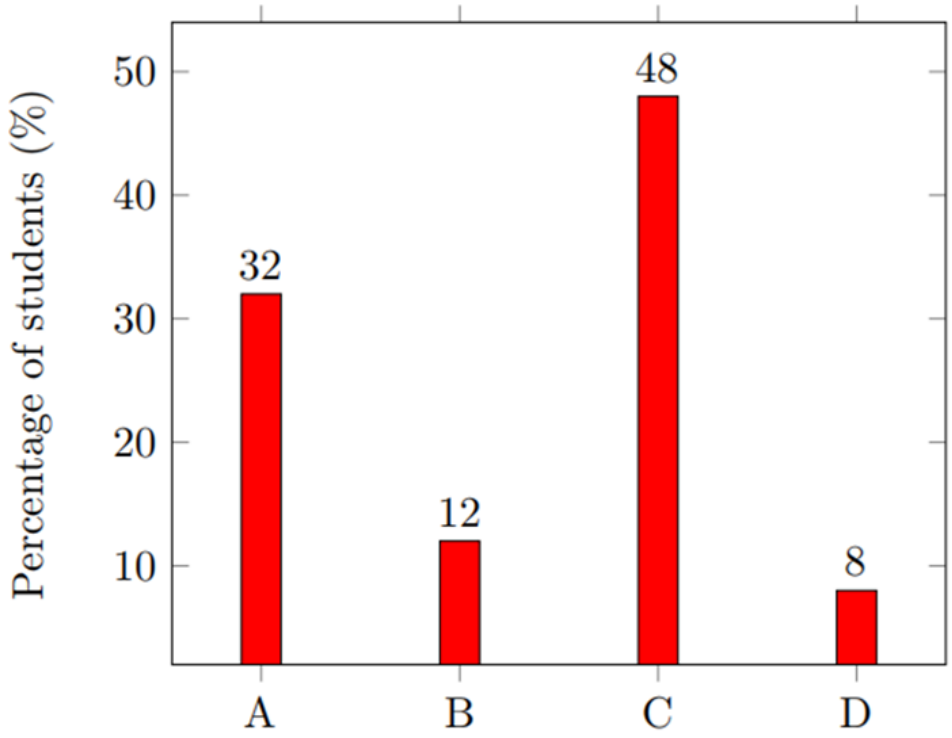


**Figure 2.** Percentages of students who are whether or not interested in their undergraduate major after learning. A: Not interesting at the time of enrollment, but interesting after learning; B: Interesting at the time of enrollment, but losing interest; C: Generally interesting; D: Other

From Figure 3 (R), we can find that freshmen have the lowest adaptability to university learning, which accounts for 53% of freshmen, while 67% of juniors are adaptable to university learning, which is the highest. It is easy to understand this tendency. For freshmen, they have just entered university and have not yet finished the learning method transition from high school to university. But after a period of time, they gradually adapted to university studies. However, from Figure 3 (R), we can find an abnormal phenomenon, that is that for seniors, the proportion of adapting to university learning has decreased. The seniors are very busy in their last

year. They face graduation, employment, further education, and academic learning in the final academic year. As a result, they exhibit a lack of adaptation to university learning.

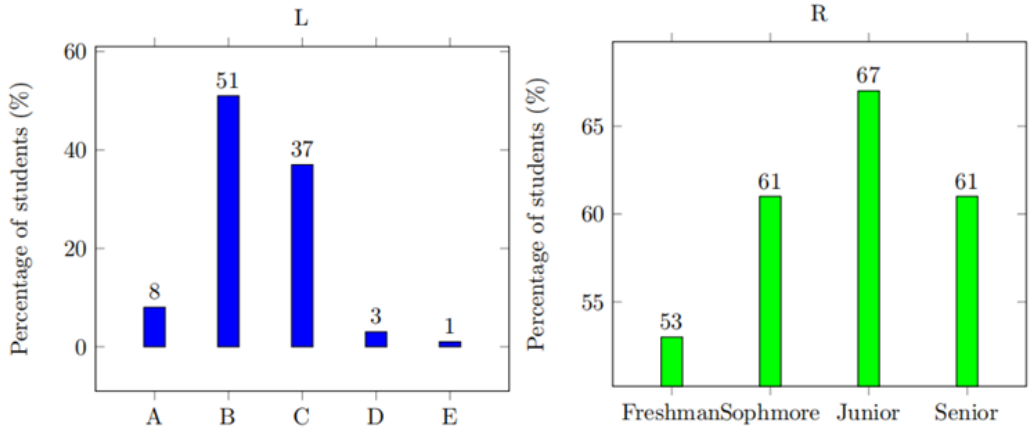


**Figure 3.** L) Adaptation levels to university learning. Here, the five levels are: Completely adapted (A), Adapted (B), Generally adapted (C), Inadaptable (D), and Fully inadaptable (E). R) Percentage for different grade students, who are completely adapted adaptable (A) or adaptable (B) to university learning.

*Is there any psychological anxiety?*

Concerning this questionnaire prompt, we defined three levels of anxiety (A-C): No anxiety (A), Mild anxiety (B), and Serious anxiety (C). In Figure 4, we show the anxiety level distributions. It can be seen that 86% of students display psychological anxiety, which amazes us. In order to explore whether students' anxiety levels differ for different grades, we have investigated the anxiety level distributions for Freshmen, Sophomores, Juniors, and Seniors, and the distributions are shown in Figure 5. From Figure 5, we can find that the percentage of students who are in an anxious state shows a clear decreasing trend with the increase in grades. Freshmen have the strongest anxiety, followed by sophomores. Based on the anxiety level distributions in Figure 5, an unignorable phenomenon is shown, no matter which grade, more than 60% of the students have experienced or are experiencing mild anxiety. Sun and co-workers (Sun et al., 2017) have claimed that anxiety has negative impacts on learners' intrinsic motivation, and their findings revealed that students with higher anxiety levels also have higher negative outcomes. So, during

classroom teaching, teachers should carry out some activities that can increase students' motivation and decrease their anxiety levels accordingly.

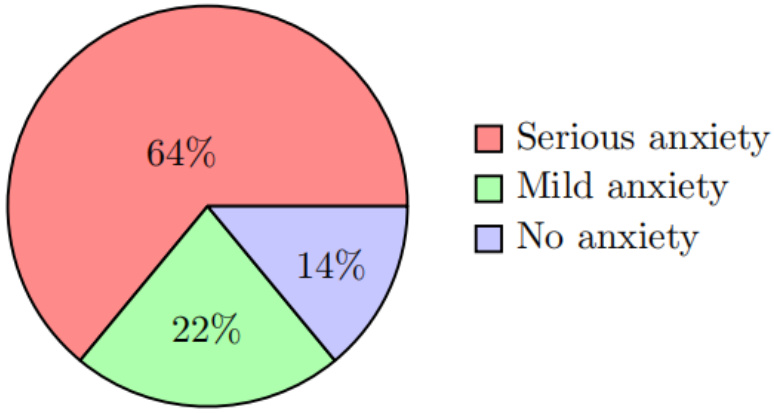


**Figure 4.** Percentage of students who are staying at different anxiety levels.

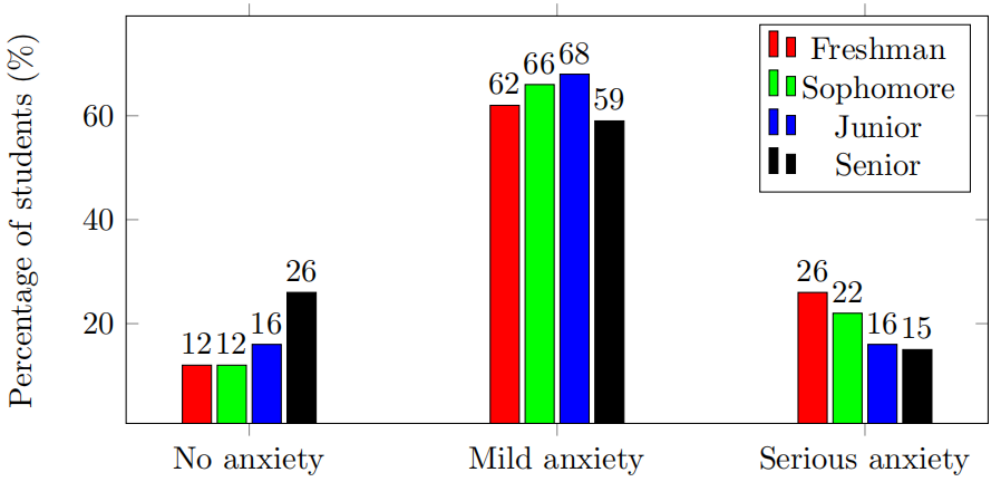


**Figure 5.** Percentage of different grades students, who are experiencing different anxiety levels.

*Do teachers communicate with students?*

The relationship between teachers and students is multifaceted. Usually, one of the important goals of the teacher-student relationship is to help students learning. Communication plays a critical role in establishing and supporting a healthy teacher-student relationship, which can promote learning by engaging students with the subject matter and with corresponding processes of thinking (Kinchin, 2003; Wubbels and Brekelmans, 2005). An open, honest communication between teacher

and student can even lead to pedagogical changes which, in turn, will improve learning (Amir Abd Elhay & Arnon Hershkovitz, 2019; Harfitt, 2014). In the introduction section, we have once mentioned that in the classroom, teachers have zero communication with students. To identify the underlying reasons, this section includes two questions designed to examine whether teachers actively engage in communication with students and whether they provide students with opportunities for such interaction. From Figure 6 (L), we can find that the frequency of teacher-student communication is notably low, and the teacher-student communication is mainly limited to the classroom. Approximately 66% of students have little communication with teachers in the classroom, and 12% of students have no chance or are not willing to communicate with teachers. Presently, most teachers work in one place and live in another place. After classes, teachers leave school and go home. So, teacher-student communication gradually disappears. If students encounter difficulties in their studies, only 9% of them seek help from teachers, and 61% of them depend on themselves, as shown in Figure 6 (R). One of the aims of our university education is to cultivate students' ability to learn independently. When they need help but fail, they will experience negative setbacks in their learning. Effective teacher-student communication should be reestablished, which can promote the establishment of a friendly teacher-student relationship, which then contributes to the classroom teaching ecological environment. In the classroom, teachers should try to avoid "indoctrination" teaching and leave more time for students to ask questions and communicate with each other. Out of the classroom, some measures should be adopted to rebuild student-teacher communication, such as adopting more flexible communication methods (Petillion and McNeil, 2020), going beyond the classroom and beyond school time (Amir Abd Elhay & Arnon Hershkovitz, 2019; Bovermann, Weidlich, and Bastiaens, 2018).

***Classroom performance and feedback from teachers (RQ3)***

*Can you adapt to teachers' teaching?*

This section aims to assess the extent to which students are able to adapt to their teachers' instructional approaches. We have set four adaptation levels (A-D):

Completely adaptable (A), Generally inadaptable (B), Inadaptable (C), and Fully inadaptable (D). The outcomes of these inquiries are shown in Figure 7. Only 24% of students said they are completely adaptable to the teachers' teaching, while 76% said they are inadaptable. Even 21% of students are fully inadaptable to the teachers' teaching. By further analysis, we find that 24% of students, who are inadaptable to the teachers' teaching, do not accept too much content taught by teachers.

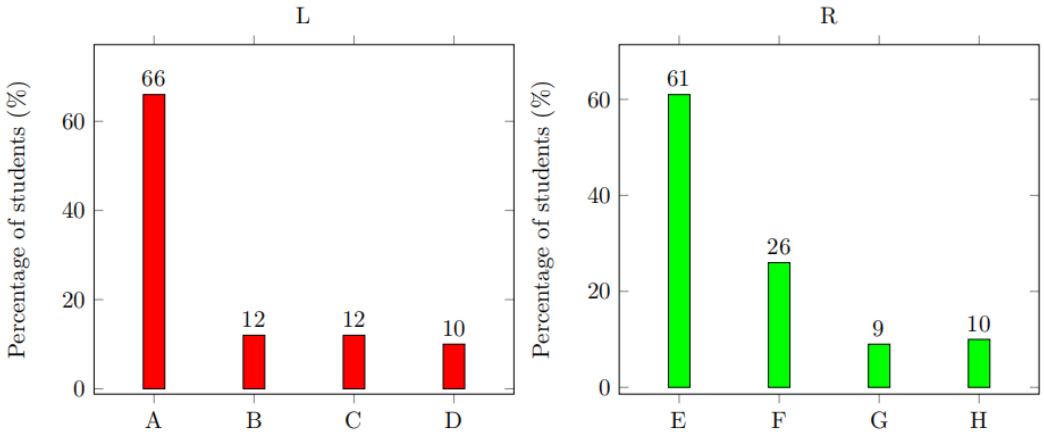


**Figure 6.** L) Results of communication between teachers and students. A: Only in the Classroom and not much; B: No chances; C: Not willing to communicate; D: Other. R) Percentage of students who know how to deal with learning barriers; E: Depending on themselves; F: Discussing with classmates; G: Seeking help from teachers; H: Plagiarizing.

Additionally, 21% of students, who are fully inadaptable to the teachers' teaching, have no interest in the content taught by teachers. What factors contribute to these phenomena? We believe that the lack of teacher-student communication is the most significant factor. Many teachers focus primarily on delivering content without adequately understanding or responding to students' learning needs and progress. Traditionally, teachers have dominated the classroom with teacher speaking. Recently, emphasis is shifting to helping learners become responsible for their learning, and teachers must be student-centered and demonstrate respect for their background, ideologies, beliefs, and learning styles (Allison, 2015).

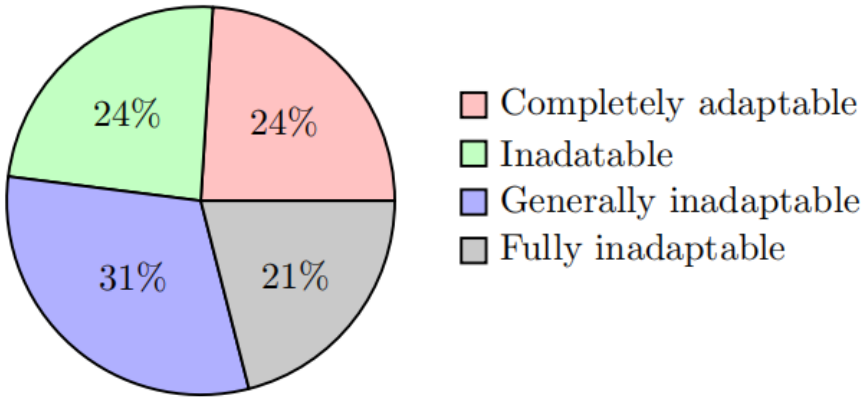


**Figure 7.** Percentage of students who stay at different adaptation levels to teachers' teaching.

*Praise from of teacher in the classroom*

This section is focused on the praise from teachers within the classroom and the frequency of teachers' praise. The use of teachers' praise in the classroom has been the subject of empirical research since the 1970s (Brophy, 1981; White, 1975). The praise refers to "explicit verbal positive evaluations of other persons, products, actions or traits, where the evaluations are based on the evaluator's subjective standards" (Brummelman et al, 2016). Praise is usually stressed in a particular way, which teachers should use to reinforce both students' behavior and students' learning (Sofia et al., 2021). Praise comments are positive evaluations of students' performance or behavior, they are thought to be an encouraging, motivating, and affirming tool for reinforcement (Moore et al., 2019; Xue and Li, 2021). Although praise is an important and effective tool to encourage students' learning, we find that teachers did not give necessary praise to students based on our questionnaires. In Figure 8, we show the frequency of students being praised. It can be seen that only 7% of students have often been praised, and 61% of students have been occasionally praised. Even 32% of students have never been praised. In fact, the more often teachers give praise statements to students, the more actively these students engage in the classroom instructions. In Figure 9, we display the relationship between being praised and participating in classroom teaching. Through analysis, it is found that there is a clear correlation between the frequency

of praise received by students in the classroom and their level of enthusiasm for taking part in classroom teaching. Students who actively answer teachers' questions are more praised, while conversely, students who frequently receive praise from the teachers are more proactive in answering questions in the classroom. The findings revealed that students with higher achievement levels also have higher motivational levels.

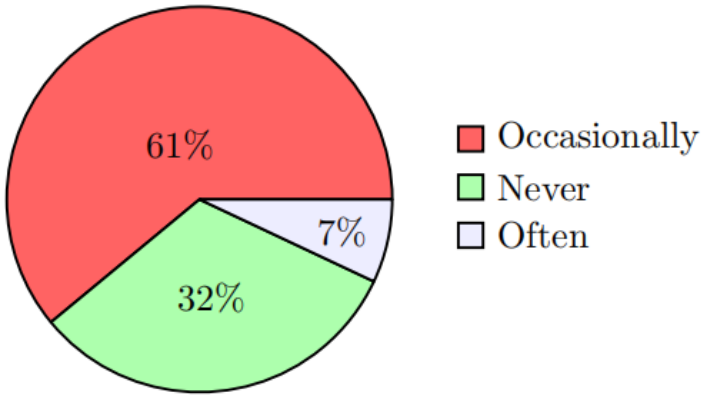


**Figure 8.** How often are students praised by teachers?

**Recommendations**

Classroom teaching is the fundamental approach to teaching and is also the main channel for students to obtain knowledge and exercise their ability to improve and develop various concepts. Classroom teaching is multidimensional in the sense that it serves a variety of purposes and contains a variety of events and processes. Therefore, the classroom teaching ecological environment is the guarantee of the teaching objectives and teaching process. The success of education depends on the trust teacher-student relationship, which relies on a harmonious and open classroom teaching ecological environment. It was revealed that an active classroom teaching an ecological environment promotes inclusivity and improves academic performance. Based on our investigations, however, we can find that the classroom teaching ecological environment is not fine, which results in a "Dumb" classroom, a performing classroom. The reason is that the open, student-centered classroom teaching ecological environment has not been set. The following sections offer

ideas and strategies on how to rebuild an efficient classroom teaching ecological environment.

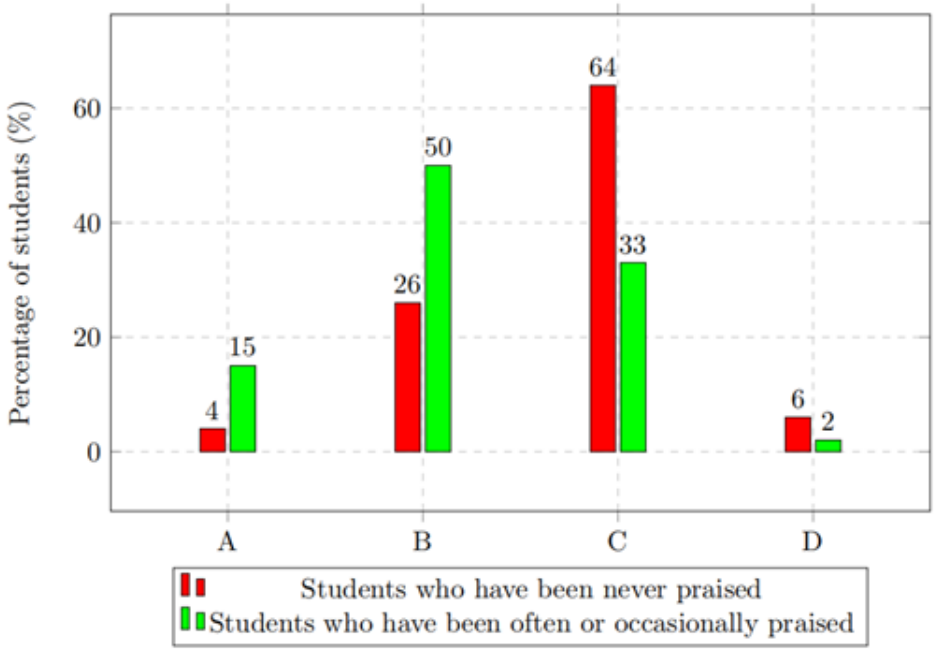


**Figure 9.** The relationship between being praised and participating in classroom teaching (answering the teacher's questions in the classroom). A: Actively participating; B: Only with full confidence in answering, then participating; C: Passive participation; D: Waiting to see.

### *Improving intrinsic motivation for learning*

Intrinsic motivation can be defined as "a desire to engage in an activity for its own sake, that is, just because of the satisfaction it provides" (Kohn, 1999). When students engage not for external reward but because they find the activity itself interesting and gratifying, they become more likely to attach meaning to their work, explore new topics, and persist in the face of learning challenges. Students are intrinsically motivated when they can act independently, feel that their efforts matter, and gain satisfaction from enhancing their skills.

### *Nurturing extrinsic motivation for learning*

Unlike intrinsic motivation, which arises from within the individual, extrinsic motivation is the use of external rewards (outside the individual) to encourage a

certain behavior. These can be tangible, such as a scholarship or a desired GPA, or intangible, like receiving praise or attaining fame. In classrooms, praise from teachers is a useful way to nurture a students' extrinsic motivation for learning. Teachers acknowledge and affirm the effort students put into classroom learning. Praise should be focused on the process, but not on the outcome. Shifting praise from achievement to effort helps students understand the value of the learning process and the time they spend doing it (Brummelman et al, 2014). External motivation can also involve punishment. Students might fear the punishment associated with their GPA or bonuses. Extrinsic motivation is induced by rewards or punishments dependent upon success or failure in the task. Sometimes, though, punishments are necessary; as a rule, teachers should always try a reward first (Steel et al., 2016). The success of learning depends on whether or not the learners are motivated. Both intrinsic and extrinsic motivation are important because they stimulate and energize the learners to think, concentrate, and learn effectively.

***Broadening teacher-student communications***

Effective communication, which includes both in-classroom and out-of-classroom interactions, is the basis of good educational outcomes. Open, honest teacher-student communication can even lead to pedagogical changes which, in turn, will improve learning (Harfitt, 2014). Effective teacher-student communication can help in filling the gap between teachers and disadvantaged students (Ann Bainbridge Frymier, 2005). Alamgir Khan and co-workers (Alamgir Khan et al, 2017) have confirmed that teachers who communicate better lead classes to better grades and retention rates, while poor classroom communication leads to low learning motivation. Our findings, however, indicate that the teacher-student communication is insufficient, and the communication is still limited in classrooms. Therefore, the teacher-student communication should be broadened beyond the classroom boundaries. Today, mobile phone ownership is so prevalent among college students that these gadgets have become an indispensable part of their daily lives. Wireless and mobile technologies can help teachers and students improve teacher-student communication. Both communication via new media and

traditional communication in the classroom are associated with better relationships with students and with a better classroom environment. By communicating, the teachers let students feel a wish to keep the initiative of learning.

***Offering courses addressing a current need of students and society***

In a dynamic world, courses are implemented within the shortest possible time frame, or some course contents are changed to meet the needs of students and society. One of the purposes of higher education is to acquire new knowledge for preparing for the workforce and to aid students in finding a more successful future or more opportunities in life through a liberal education (Chan, 2016). If the courses or some course contents are outdated or unable to keep up with the development of society, students will think they are learning useless knowledge, and then lose their interest and motivation for learning. Based on our questionnaire, we can find that students have not actively participated in classroom teaching, and have shown disinterest in the teaching content. Research has shown that students put less effort into difficult courses compared to less rigorous courses, find them to be less meaningful, and are less confident that they can do well in the class (Lynch, 2008). For this case, as teachers, it is necessary to tap the course's fun factor fully to let students learn well, learn lively, and learn interestingly, so that the students are interested in learning. Once the students are interested in learning, they will be willing to quickly accept the knowledge taught in the classroom, transitioning from weariness to a state of happy learning.

***Reforming the academic evaluation mechanism for students***

In recent years, undergraduate students have had a GPA-oriented academic achievement perspective. In this learning environment, undergraduate students often exhibit low intrinsic motivation, with a growing tendency toward utilitarian attitudes and goal-oriented thinking in their approach to learning. For example, in order to pursue higher scores, students are immersing themselves in exercises before the examination. This is not only detrimental to their comprehensive growth but also undermines the intrinsic value and quality of university education. Conducting effective assessments to evaluate student learning outcomes (SLO) is a

difficult and complex process for all higher education professionals. Cohen (Cohen, 2016) and Uttl (Uttl, 2017) pointed out that students' achievement is highly dependent on many factors such as intelligence, learning abilities, gender, and prior achievement, and that to fully control these factors. The academic evaluation of undergraduate students is the establishment of evaluation standards based on professional training objectives and graduation requirements, and the use of evaluation techniques and methods to analyze, judge, and evaluate the learning outcomes of undergraduate students. The international community is increasingly emphasizing the evaluation of advanced abilities such as learning literacy, innovation literacy, higher-order thinking, critical thinking, and analytical and problem-solving abilities. Therefore, it is necessary to upgrade the current academic evaluation method. Students are the main body of the learning process. It is essential to establish student-centered academic evaluation criteria, content, and methods, and to form diverse evaluation subjects and an emphasis on learning process evaluation.

***Enhancing the teaching effectiveness of teachers***

The effectiveness of teaching is often defined as teachers' ability to improve students' learning and is concerned with the attributes of teachers, classroom environment, teaching processes, and their effects on the students (Olivia M Little, L. Goe, Courtney A. Bell, 2009). The high teaching effectiveness of teachers makes learning more meaningful, fruitful, and understandable (Dash and Barma, 2016). Students who enter into classroom with different learning ability levels have different minds in the classroom, apart from academics, which effective teachers should care about during classroom teaching. For students who have low learning ability, teachers should care about them in particular and should not negate the students' efforts. Teachers should do their best to find a way to help the students build up learning confidence. Our findings reveal that 61% of students deal with the learning barriers individually, which is not conducive to classroom teaching. So, during teaching processes, teachers need to identify the learning barriers as quickly as possible. It is more effective for teachers to support students in

addressing these challenges through guidance and intervention, rather than relying on warnings or expressions of dissatisfaction.

## Conclusion

Classroom teaching and student learning are inherently complex, involving more than just the delivery and reception of information. Effective teaching is a dynamic, interactive process shaped by multiple factors, including student motivation, instructional quality, and the broader learning environment. In order to implement effective classroom teaching, we investigated the current situation of classroom teaching and students' learning status by surveying 541 college students. In this study, the questionnaire was divided into three main aspects, where students were asked to assess their learning experience in college. The findings highlight that the motivation for choosing their majors positively affects students' learning. However, if teachers do not continue to provide the necessary guidance or high-quality courses to students, they will lose interest in their majors.

For freshmen, teachers should be more concerned about their learning status, because they have the lowest adaptability to university learning. In addition, we also found that dumb classroom teaching and performing classroom teaching still exist, and the classroom teaching efficiency is low. Further analysis indicates that the teaching effectiveness of teachers, such as teacher-student communication, positive motivation from teachers to students, and teaching content, has a direct effect on the students' learning. The reason why classroom teaching efficiency is low is that the classroom teaching ecological environment is not fine.

This study also put forward some corresponding strategies on how to build a classroom teaching ecological environment: 1) Improving intrinsic motivation for learning, 2) Nurturing extrinsic motivation for learning, 3) Broadening communication between teachers and students, 4) Enhancing teaching effectiveness of teachers, 5) Reforming academic evaluation mechanism to the students, and 6) Offering courses addressing a current need of students and the society.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

This work was supported by grants from Key Teaching and Research Projects of Shandong Province (No. Z2022062) and the Key Teaching and Research Projects of Qilu University of Technology (No. 2022dz13).

## References

Adam, S., Edward, H. S., Charlotte, J. S., & Chris I. B. (2016). The impact of reward and punishment on skill learning depends on task demands. *Scientific Report*s **6**, 36056. https://doi.org/10.1038/srep36056.

Alamgir, K., Salahuddin, K., Syed, Z., & Manzoor, K. (2017). Communication Skills of a Teacher and Its Role in the Development of the Students' Academic Success. *Journal of Education and Practice* **8** (1), 18-21. https://iiste.org/Journals/index.php/JEP/article/view/35059/36057.

Allison, P. (2015). Enhancing Teaching Effectiveness and Student Learning Outcomes. *The Journal of Effective Teaching* **15**(1), 20-33. https://eric.ed.gov/?id=EJ1060429.

Ann, B. F. (2005). Students' Classroom Communication Effectiveness. *Communication Quarterly* **53**(2), 197-212. DOI:10.1080/01463370500089896.

Amir, A. E., & Arnon, H. (2019). Teachers' perceptions of out-of-class communication, teacher-student relationship, and classroom environment. *Education and Information Technologies* **24**, 385–406. https://doi.org/10.1007/s10639-018-9782-7.

Attaran, M., Stark, J., & Stotler, D. (2018). Opportunities and Challenges for Big Data Analytics in US Higher Education: A Conceptual Model for Implementation. *Industry and Higher Education* **32** (3), 169–182. https://doi.org/10.1177/0950422218770937.

Bovermann, K., Weidlich, J., & Bastiaens, T. (2018). Online learning readiness and attitudes towards gaming in gamified online learning–a mixed methods case study. *International Journal of Educational Technology in Higher Education* **15**(1), 1–17. https://doi.org/10.1186/s41239-018-0107-0.

Brophy, J. (1981). Teacher praise: A functional analysis. *Review of Educational Research* **51**, 5-32. doi: 10.3102/00346543051001005.

Brummelman, E., Crocker, J., & Bushman, B. J. (2016). The praise paradox: When and why praise backfires in children with low self-esteem. *Child Development Perspectives* **10** (2), 111–115. https://doi.org/10.1111/cdep.12171.

Brummelman, E., Thomaes, S., Overbeek, G., Orobio de Castro, B., van den Hout, M. A., & Bushman, B. J. (2014). On feeding those hungry for praise: Person praise backfires in children with low self-esteem. *Journal of Experimental Psychology: General* **143** (1), 9–14. https://doi.org/10.1037/a0031917.

Carolina, G. V., Carolina, G. G., Andres, R. M. T. & Alejandro, L. V. (2021). Learning analytics in higher education: a preponderance of analytics but very little learning. *International Journal of Educational Technology in Higher Education* **18**(23), 1-19. https://doi.org/10.1186/s41239-021-00258-x.

Chan R. Y. (2016). Understanding the Purpose of Higher Education: An Analysis of the Economic and Social Benefits for Completing a College Degree. *Journal of Education Policy, Planning and Administration* **6**(5),1-40. https://scholar.harvard.edu/roychan/publications/understanding-purpose-higher-education-analysis-economic-and-social-benefits.

Cohen P. A. (1981). Student ratings of instruction and student achievement: a meta-analysis of multisection validity studies. *Review of Educational Research* **51**, 281–309. Doi: 10.3102/0034654305100328.

Dash, U. & Barman, P. (2016). Teaching effectiveness of secondary school teachers in the district of Purba Medinipur, West Bengal. *IOSR Journal of*

*Humanities and Social Sciences* **21**(7), 50-63. DOI:10.9790/0837-2107075063.

Dirk, I., David, G., & Doreen, P., Atsushi Shimada and Masanori Yamada. (2021). Putting learning back into learning analytics: actions for policy makers, researchers, and practitioners. *Educational Technology Research and Development* **69**, 2131–2150. https://doi.org/10.1007/s11423-020-09909-8.

Justine, F., Allison, R., Kerrie, S., Melissa, A. P., & Kia, K. (2022). Students' motivation and engagement in higher education: the importance of attitude to online learning. *Higher Education* **83**, 317–338. https://doi.org/10.1007/s10734-020-00657-5.

Ghazwan, H. (2023). Big Data and Analytics to transform higher education: a value chain perspective. *Perspectives: Policy and Practice in Higher Education* **27**(4), 160–168. https://doi.org/10.1080/13603108.2022.2099475.

Gupta, M., & Verma, G. (2021). Teaching effectiveness of school teachers: a theoretical perspective. *International Journal of Creative Research Thoughts (IJCRT)* 9(10) a173-a179. https://api.semanticscholar.org/CorpusID:239006329.

Harfitt, G. J. (2014). Brokering dialogue between secondary students and teachers to co-construct appropriate pedagogy in reduced-size classes. *Teachers and Teaching* **20**(2), 212–228. https://doi.org/10.1080/13540602.2013.848572.

Jacqueline, O. F., & Craig, P. (2015). The use of flipped classrooms in higher education: A scoping review. *Internet and Higher Education* **25**, 85–95. https://doi.org/10.1016/j.iheduc.2015.02.002.

Janke, S., & Dickhauser O. (2019). A Neglected Tenet of Achievement Goal Theory: Associations between Life Aspirations and Achievement Goal Orientations. *Personality and Individual Differences* **142**, 90–99. doi:10.1016/j.paid.2019.01.038.

Jiang, L., & Liang, X. (2023). Influencing factors of Chinese EFL students' continuance learning intention in SPOC-based blended learning environment. *Education and Information Technologies* **28**, 13379–13404. https://doi.org/10.1080/10494820.2022.2105901.

Keiler, L. S. (2018). Teachers' roles and identities in student-centered classrooms. *International Journal of STEM Education* **5**(34). DOI: 10.1186/s40594-018-0131-6.

Kinchin, I. M. 2003. Effective teacher student dialogue: A model from biological education. *Journal of Biological Education* **37**(3), 110–113. https://doi.org/10.1080/00219266.2003.9655864org/10.1080/00219266.2003.9655864.

Kohn, A. (1999). Punished by Rewards: The Trouble with Gold Stars, Incentive Plans, A'S, Praise, and Other Bribes. *Houghton Mifflin and Company*. https://api.semanticscholar.org/CorpusID:145388141.

Lynch, D. J. (2008). Confronting challenges: Motivational beliefs and learning strategies in difficult college courses. *College Student Journal* **42**, 416–421. https://api.semanticscholar.org/CorpusID:141214504.

Lin, Y. S. & Lai, Y. H. (2021). Analysis of AI Precision Education Strategy for Small Private Online Courses. *Frontiers in Psychology* **12**, 749629. DOI: 10.3389/fpsyg.2021.749629.

Long, P., & Siemens G. (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE Review* **46**(5), 31–40. DOI: 10.17471/2499-4324/195.

Luis, R. M. Z., Jose, A. L. S., & Ana, L. G. C. (2019). How the flipped classroom affects knowledge, skills, and engagement in higher education: Effects on students' satisfaction. *Computers and Education* **141**, 103608. DOI:10.1016/j.compedu.2019.103608.

Menon, S., & Suresh, M. (2020). Factors influencing organizational agility in higher education. *Benchmarking: an International Journal* **28**(1), 307–332. https://doi.org/10.1108/BIJ-04-2020-0151.

Moore, T. C., Maggin, D. M., Thompson K. M., Gordon J. R., Daniels S., & Lang L. E. (2019). Evidence Review for Teacher Praise to Improve Students' Classroom Behavior. *Journal of Positive Behavior Interventions* **21**(1), 3-18. https://doi.org/10.1177/1098300718766657.

Mohammad, K., Paul, P., & Sharon, S. (2023). The use and application of learning theory in learning analytics: a scoping review. *Journal of Computing in Higher Education 35*, 573–594. https://doi.org/10.1007/s12528-022-09340-3.

Myriam, A. V., Jose, D. A., Lucia, P. L., & Iago, P. P. (2022). Initial Motivations for Choosing Teaching as a Career. *Frontiers in Psychology* **13**, 842557. DOI: 10.3389/fpsyg.2022.842557.

Olivia, M. L., Laura, G., & Courtney, A. B. (2009). "A Practical Guide to Evaluating Teacher Effectiveness. https://api.semanticscholar.org/CorpusID:150525376.

Petillion, R. J., & McNeil, W. S. (2020). Student experiences of emergency remote teaching: impacts of instructor practice on student learning, engagement, and well-being. *Journal of Chemical Education* **97**(9), 2486–2493. https://doi.org/10.1021/acs.jchemed.0c00733.

Pink, D. H. D. (2012). The Surprising Truth about What Motivates Us. Reprint, paperbacked. Riverhead Books.

Porter, S.R., & Umbach, P.D. (2006). College major choice: An Analysis of Person–Environment Fit. *Research in Higher Education* **47**, 429–449. https://doi.org/10.1007/s11162-005-9002-3.

Shaza, A. S., Noraffandy, Y., & Hassan, A. (2023). Education big data and learning analytics: a bibliometric analysis. *Humanities and Social Sciences Communications* **10**, 709. https://doi.org/10.1057/s41599-023-02176-x.

Stefan, J. (2020). Prospective effects of motivation for enrollment on well-being and motivation at university. *Studies in Higher Education* **45**, 2413-2425. DOI: 10.1080/03075079.2019.1612353.

Sofia, B. G., & Karen, A. E. (2021). Praise in Education. Oxford University Press. https://doi.org/10.1093/acrefore/9780190264093.013.1645

Sun, J. C. Y., Syu, Y. R., & Lin, Y. Y. (2017). Effects of conformity and learning anxiety on intrinsic and extrinsic motivation: The case of Facebook course groups. *Universal Access in the Information Society* **16**(2), 273–288. https://doi.org/10.1007/s10209-016-0456-1.

Teo, S., Gomathy, S. R., & Anuradha, M. (2022). Learning analytics dashboard: a tool for providing actionable insights to learners. *International Journal of Educational Technology in Higher Education* **19**,12. https://doi.org/10.1186/s41239-021-00313-7.

Tulas, B. (2013). Significance of Big Data and Analytics in Higher Education. *International Journal of Computer Applications* **68**(14), 0975 – 8887. DOI:10.5120/11648-7142.

Xue, E., & Li, J. (2021). The Teachers' Teaching Ability Promotion Policy in China. In: Creating a High-Quality Education Policy System *[Exploring Education Policy in a Globalized World: Concepts, Contexts, and Practices.]* 27–38. Springer, Singapore. https://doi.org/10.1007/978-981-16-3276-1-3.

Uttl, B., White, C. A., & Gonzalez, D. W. (2017). Meta-analysis of faculty's teaching effectiveness: student evaluation of teaching ratings and student learning are not related. *Studies in Educational Evaluation* **54**, 22–42. doi: 10.1016/j.stueduc.2016.08.007.

Walter, D. (1977). "Learning the Classroom Environment: An Ecological Analysis of Induction Into Teaching." https://api.semanticscholar.org/CorpusID:141194087.

Wubbels, T., & Brekelmans, M. (2005). “Two decades of research on teacher-student relationship in class. *International Journal of Educational Research* **43**(1), 6–24. DOI:10.1016/j.ijer.2006.03.003.

White, M. A. (1975). Natural rates of teacher approval and disapproval in the classroom. *Journal of Applied Behavior Analysis* **8**(4), 367-372. doi: 10.1901/jaba.1975.8-367.