

## A Novel Prediction Model for Improving Quality of Learning Using 4QS Machine Learning Approach

Ms. Ruchita A. Kale <sup>1</sup>

*Department of Computer Science &  
Engineering,  
SAGE University Indore, Madhya Pradesh,  
India,  
kaleruchita11@gmail.com*

Dr. Manoj K. Rawat<sup>2</sup>

*Department of Computer Science &  
Engineering  
SAGE University Indore, Madhya Pradesh,  
India,  
profrawat.sage@gmail.com*

**Abstract** - To improve their teaching skills, teachers must anticipate the performance tendencies of their students. Learning entails maximizing performance while avoiding problems in order to provide customers with more value with fewer resources. By utilizing the 4QS Model, the current study seeks to highlight the significance of implementing Lean concepts in educational institutions. Removing waste in arranging, preparing and performing teaching process in the teaching & resultant environment by providing value to student learning Process by juggling their performance with suitable predication May results in improvements in student result. In order to make research and educational work more efficient and effective in student results, researchers who are eager to improve their activities within the classroom, college, or university as well as their teaching process can simply follow the Lean-based 4QS Model presented in this paper, i.e. (Intelligence, Adversity, Spiritual, Stress). By basing their view of learning & thinking so can improve students' performance by focusing on their predicted weakness. Using the planned 4QS to learn within the educational sector can be advantageous for both the faculty and staff at colleges and universities. the steps were taken by students to study in order to achieve success.

**Keywords:** Education, Students, Prediction, Data sets, 4QS Model, Education.

### I. INTRODUCTION

The moment has arrived for individuals who were born in this millennium to enrol in colleges, thus it is essential to reconsider and reinterpret how the educational system should alter. The curriculum and methodology of the institutes are being revised in response to numerous issues in order to change the educational system.

The previous system, which is becoming out of date, placed more emphasis on what was taught than on who was taught it to or how it was taught. The previous ten years have seen a shift in students' preferred learning methods toward internet-based instruction and the use of machine learning to anticipate the answer as a result of technological improvement. Since educational institutions have not kept up with the advancement of technology, this has led to issues. Their curriculum is not appealing enough because tech-savvy, intelligent pupils have already created new ways to learn through the internet.

By connecting with other students for collaborative learning, students can help each other understand concepts that they are having trouble with. For them, the curriculum is insufficiently effective [1]. To increase the effectiveness of the system, instructors

must be aware of new technology and more conversant with changes in teaching techniques using the predictive method. Students will have more opportunities to solve problems as ML is used more creatively in the curriculum, and it will become more interactive. As rapidly as feasible, these new approaches will alter and evolve in order to keep up with the learners [2].

Thus, a paper should concentrate on the following ideas:

- Focusing on the issues that both students and businesses confront while creating a plan for the course;
- Uniformity and cohesion among students from various universities.
- The curriculum is consistent throughout all educational streams;
- The students are at the heart of the learning process.
- The development of the pupils' abilities and skills.
- The pupils' performance is evaluated rather than what they have learned from their textbooks [3].
- A focus on the learning process rather than the outcomes of their exam.
- Less number of instructors are sufficient for the instructional procedure.

This could enhance the effectiveness of the educational system as a whole.

## **II. METHODOLOGY**

This section provides an overview of the many teaching-learning models utilized to raise the system's overall effectiveness.

### **CURRENT STRATEGIES FOR LEARNING IMPLEMENTATION**

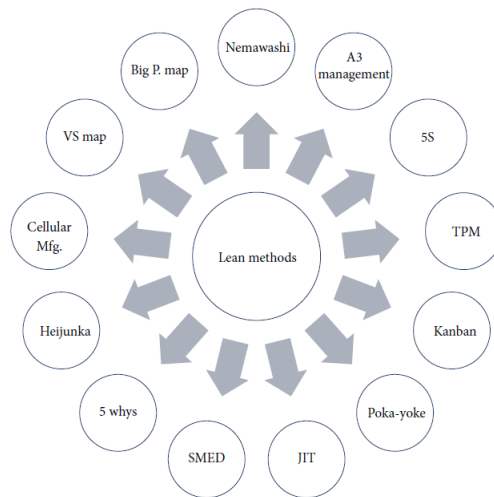
Implementing learning requires choosing the right tools from the learning toolbox to achieve process excellence [4]. However, there is a risk of concentrating too much on the tool's advantages and pursuing process excellence while ignoring the learning tool's durability within that particular work culture. An opportunity and a threat are both introduced to the company every time a new method is deployed. The technique has advantages, which are on the one side, and disadvantages, which are on the other. Relevant inquiries include [5]:

(1) How likely or challenging is it to achieve the benefit of the learning strategy under consideration?

(2) How does the application of the learning strategy and its advantages affect the longevity of the change intervention?

The situational applicability of learning tools, and more specifically the organizational decision-making that comes before the implementation of learning, are of particular interest to us in this article [6].

There are three concerns: how to evaluate the risks (opportunities and threats) associated with each candidate's learning tool in a fair and balanced manner; how organizational culture affects the success (or failure) of the change management implementation; and which of the many learning tools to use in a given situation [7].



**Figure 01: Lean methods or tools**

### III. USE OF MACHINE LEARNING IN THE EDUCATION SYSTEM

"Machine learning is described as a computer technical discipline that uses mathematical without being explicitly programmed for my readers who are new to the word (i.e., constantly rising performance on a given task. It is frequently overlooked to propose that machine learning would change education [8]. Some old school/college professors had a difficult time getting acclimated to machines that can think and understand.

Following are how machine learning will revolutionize the field of education-

1. *Increasing efficiency*- By integrating activities like classroom management, scheduling, etc., machine learning can make educators more effective in terms of artificial intelligence. Teachers should focus on tasks that AI does not do, which involve a human side.

2. *Learning analytics* - When it comes to learning analytics, machine learning can help teachers understand better the information that the usage of the human brain cannot glean. Systems will carry out in-depth dives into data in this role, sifting through millions of information pieces and drawing comparisons and assumptions that positively influence the learning and teaching process.

3. *Predictive analytics* - When it comes to predictive analytics, machine learning could draw answers about situations that may occur in the future. For example, "by using a statistical data set records of middle school students that are more likely to drop out due to academic failure or even their predicted success on a standardized exam, like the ACT or SAT, predictive analytics will notify us."

4. *Adaptive learning* - Machine learning could be used to remediate failing pupils or challenge gifted individuals in personalized learning. Adaptive learning is a technology-driven or online instructional framework that analyses a pupil's success in real-time and, based on the input, changes teaching methods and the curriculum. Think AI meets committed mentor for math meets customized dedication [9].

5. *Personalized learning* - ML in personalized learning may be used to give each pupil an individualized educational experience. Personalized learning is an instructional style in

which learners direct their learning, go at their speed, and make their own choices on what to learn in certain instances. Ideally, students pick what they are interested in in a classroom using customized instruction, to which the teachers adapt the expectations and curriculum to the needs of the students [10].

6. *Assessment* - In AI, ML can grade student assignments and reviews more accurately than a human might.

Some human interpretation may be needed, but the conclusions would have greater significance and reliability. Using the ML in the education sector, we can predict the student performance on their histological dataset to focus on their future to improve their stability with their growth [11].

The summation of this chapter gives a detailed overview of the learning system used in manufacturing industries for improvement and growth. Nowadays, the same method is used in the education system to improve the system's overall structure with curriculum development [9]. We are using the 4QS proposed scheme to improve the overall performance of learning education with a machine learning approach to predict the preventive measure we need to consider.

#### **IV. PROPOSED WORK**

Teachers and practitioners choose efficient learning strategies based on the shifting needs of the students as they pick up new abilities using the four-quadrant model of supported learning (4QS). The 4QS offers a way to comprehend, plan, and organise the application of learning strategies when occupational therapists employ skill acquisition as an intervention strategy. The objective is to improve performance in the selected occupation by obtaining occupational performance components [12]. The tactics in the first quadrant involve giving the learner clear instructions from the facilitator on the objective, specifications, and nature of the assignment. Explicit instructions and explanations, examples, physical patterning, and/or lower-level inquiries to learners with clear prompts are examples of strategies. Less direct tactics that involve the learner in the decision-making process are found in the second quadrant. Higher order questions, feedback, physical cues, nonverbal cues, and think-aloud modelling are some examples of hints at recommendations. External strategies are those that the learner uses to remind or prompt themselves using observable techniques are included in the third quadrant. These techniques include verbal self-instructions, mnemonics, visual clues, and kinaesthetic self-promptings. For autonomous performance, internalized self-monitoring and self-evaluation techniques are included in quadrant 4. Self-instruction, self-questioning, and self-monitoring are a few examples. The learner requests the facilitator at quadrant one to describe the task's nature and/or the performance traits that signify dysfunction. The child can function in quadrant 4, where their performance was successfully accomplished using automatic internalized procedures.

I suggested 4QS model, in which the following 4 quotients shall be accessed:

- [1] **Intelligence quotient (IQ)**
- [2] **Adversity quotient (AQ)**
- [3] **Emotional quotient (EQ)**
- [4] **Spiritual quotient (SQ)**

**[5] Stress Analysis****V. RESULT AND DISCUSSION**

The following section provides a detailed overview of the proposed 4QS model with education and curriculum development based on various quotients. By combining brain activity observation with the proposed 4QS method, we are able to predict student performance and stress levels based on predicted results for their first semester using results from the 10th and 12th grades and the provided 4QS test quotient. The next picture displays the student's predicted outcome using the 4QS model together with their degree of stress during quotient-solving [13].

**1. Intelligence quotient (IQ):**

We will employ 1 to 30 questions for 30 marks and a 60-minute time limit in this portion. By observing the students' likelihood of answering correctly, we may forecast their results based on their score, such as,

**Scores between:**

27–30 Very highly exceptional

24–26 High expert

21–23 Expert

19–20 Very high average

17–18 High average

13–16 Middle average

10–12 Low average

6–9 Borderline low

3–5 Low

0–2 Very low

**Table 01: A sample test was administered to college students, and the results were tracked using the Intelligence Quotient.**

Scores between	Rating	C1	C2	C3	C4	Sample
27–30	Very highly exceptional	0	0	0	0	0
24–26	High expert	2	1	0	0	1
21–23	Expert	13	4	1	0	3
19–20	Very high average	49	31	33	5	4
17–18	High average	69	45	29	11	13

13-16	Middle average	45	33	20	29	29
10-12	Low average	30	12	11	43	7
6-9	Borderline low	7	3	5	17	1
3-5	Low	0	0	0	7	0
0-2	Very low	0	0	0	2	0

We can predict the student's intelligence level using the above score from the table, together with the remaining 3 quotients, and train them accordingly to attain the desired results [14].

## 2. Adversity quotient (AQ):

As discussed in the last session, we will utilise 1 to 20 questions for a 5-point Likert-type scale in this portion, with a time limit of 30 minutes, and min and max criteria that vary depending on the situation described in the question. By observing the student answering probability, we are able to forecast their outcome within the range they have been given,

### AQ Range:

High	AQ (178-200)
Moderately High	AQ (161-177)
Moderate	AQ (135-160)
Moderately Low	AQ (118-134)
Low	AQ(117and below)

Below table show the sample question & answer with some predication,

**Table 02: A sample exam was administered to college students, and the results were tracked using the Adversity Quotient.**

		Rating	Score Range	Sample Count
Min	92	High	AQ (178-200)	0
Max	160	Moderately High	AQ (161-177)	0
		Moderate	AQ (135-160)	15
		Moderately Low	AQ (118-134)	20
Average	121.828	Low	AQ (117 and below)	23

Rating	Score Range	C1	C2	C3	C4
High	AQ (178–200)	0	0	0	0
Moderately High	AQ (161-177)	2	1	1	1
Moderate	AQ (135-160)	72	40	43	24
Moderately Low	AQ (118–134)	76	51	31	37
Low	AQ (117 and below)	65	37	24	52

### 3. Emotional quotient (EQ):

Your ability to properly manage your own emotions is referred to as emotional intelligence (EQ). As part of our task, we had to guess the answers to some sample questions.

This will take into account the 15 Questions for 15 Minutes with 1 point awarded for each "a" response,

There are two points for every "b," zero points for every "c," and

To forecast the outcome, take into account the following score:

25 to 30 overall, very emotional

19 to 24 overall, somewhat emotional

13 to 18 overall average

Total 8–12 Rather emotionless

Total score under 7 Extremely emotionless

**Table 03: A sample test was administered to college students, and the results were tracked using the emotional quotient (EQ)**

Range	Rating	C1	C2	C3	C4	Sample
25–30	Excessively emotional	16	8	3	10	5
19–24	Fairly emotional	116	69	52	51	43
13–18	Average	56	52	43	50	10
8–12	Fairly unemotional	0	0	1	3	0
below 7	Excessively unemotional	0	0	0	0	0

### 4. Spiritual quotient (SQ):

SQ is going beyond your cognitive and emotional skills. It entails accepting your mortality and considering what you might be able to contribute to humanity. It involves living modestly and realising how small you are in the grand scheme of things. In this,

we use a 15-question, 15-minute format with a 1-strongly-disagree to 7-strongly-agree Likert-type scale.

based on the upcoming point in SQ question prediction,

the purpose of studies (07)

Individual Responsibilities (02)

Positive Relationship with

people in general (01)

Community Requirements (01)

Private Life (02)

Organization and Individual (02)

We can provide a basis for some sample data using the table below.

**Table 04: College students underwent a sample test, and the results were evaluated using the Spiritual Quotient (SQ)**

Question No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Minimum	4	3	2	1	6	1	3	5	6	5	3	2	1	3	3
Maximum	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Mean	5.86	6.24	5.67	5.40	6.52	5.03	4.91	5.83	6.53	6.14	5.29	5.67	4.14	5.83	5.71
Standard Deviation	0.84	0.97	1.25	1.50	0.50	1.63	1.26	0.83	0.50	0.75	1.31	1.04	1.91	1.19	1.19

## 5. Stress analysis

As the final factor we'll take into account when using the 4QS is stress, the 4QS model will change as a result. With this result, the stress analysis will be taken into account and will provide an accurate prediction of the student's thinking level, allowing us to focus on their areas of weakness in order to improve their performance. Each question has several options from which we can determine the stress level of the student. In this section, we will take into account 1 to 10 questions with a 15-minute time limit and award the marks based on their thinking and prompt responses.

The following table displays the student's stress level after careful observation of a few questions and their correct responses using the aforesaid 4QS model.

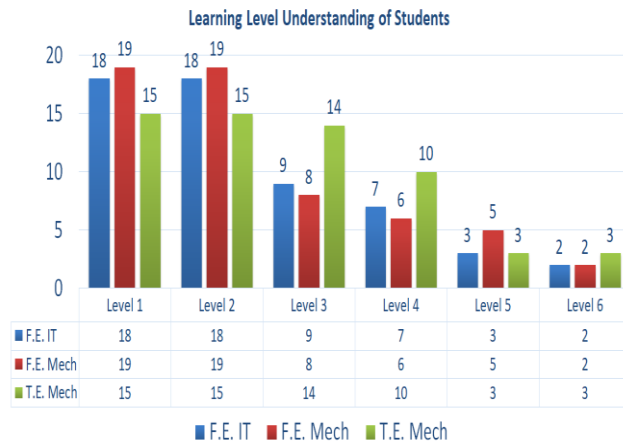


Sr No.	Head ache	Awar eness	Academic Pressure	Vocal Expressi on	Unhealthy Influence	Ass. load	Physical Health	Relationsh ip atcolg	Digital Distractio n	Sleep Hours	Time Pressur e	Financial Pressure	Tech Obligatio ns	Res ult	Level
0	3	1	5	5	3	5	3	5	5	1	4	5	5	3.4 4	High Stress
1	5	3	1	1	5	3	5	5	5	4	5	5	3	3.2	Medium Stress
2	3	2	2	3	3	3	4	2	3	4	4	3	2	2.8 4	Medium Stress
3	2	3	4	5	1	4	3	4	3	3	4	3	4	3.2 8	Medium Stress
4	4	2	3	4	3	3	3	4	5	5	3	4	1	3.2 8	Medium Stress
5	3	1	5	5	3	1	5	4	4	5	4	4	5	3.0 8	Medium Stress
6	3	3	3	4	4	4	4	4	5	5	5	4	3	3.6 4	High Stress
7	5	2	3	5	5	3	4	4	3	5	3	3	4	3.5 2	High Stress
8	3	1	3	2	1	3	4	5	3	5	2	1	3	2.2	Medium Stress
9	3	3	3	4	4	3	3	4	5	2	4	4	5	3.2	Medium Stress
10	5	1	2	4	3	4	3	5	5	5	3	4	5	3.4 4	High Stress
11	2	3	3	5	3	4	4	1	5	4	3	4	4	3.2 4	Medium Stress
12	5	1	2	5	5	3	1	5	3	5	5	5	5	3.7 6	High Stress
13	4	3	3	2	2	3	4	4	5	1	5	5	4	3	Medium Stress
14	4	3	5	5	1	3	1	3	5	5	4	2	1	3.0 8	Medium Stress
15	2	3	3	3	1	2	1	1	5	1	4	4	5	2.4	Medium Stress

Table 05: Analyzing stress using the 4Q model

From above figure show the predication of stress by above observation.

Learning levels understanding of a student



**Figure 02: Learning level Understanding of Students**

### Findings from the test:

The majority of F.E. students experienced medium to high levels of stress. Students with medium to high adversity quotients had less stress. High-emotional students experienced moderate to high levels of stress. HSC marks and IQ did not correlate. High-spiritual students experienced less stress.

The suggested course outcomes for the upcoming semester were determined by the results. assuming the level of education will remain the same in the following class. After results from three or more semesters are achieved, this can be adjusted. Figure 4 provides a summary of the 4QS model's result analysis with student prediction.

```

Object key Object value
  fail      23.877866320088152
  fail      28.513154858766505
  pass      3.128098463923408
  pass      16.98275890425346
print array
23.877866320088152
fail
28.513154858766505
fail
3.128098463923408
pass
16.98275890425346
pass|
3.128098463923408-->pass
16.98275890425346-->pass
23.877866320088152-->fail
28.513154858766505-->fail
pass
pass
fail
2
1
Student will probably pass the engineering all exams
You need to focus on Q1 module

```

**Figure 03: Analysis of the results using the 4QS model and student prediction**

## VI. CONCLUSION

In conclusion, there is numerous potentials for development that support the application of the suggested model employing 4QS and stress analysis in colleges and universities. Since people are generally resistant to change, there may be difficulties in understanding the need for 4QS, but solid follow-up examples like the ones given above aid in establishing an effective strategy that can help with the successful implementation of the 4QS model for raising student performance.

By utilizing the suggested 4QS approach, college/university teaching staff might plan their lessons quickly and simply, follow well-defined procedures, and easily enhance student performance without wasting time on planning or setting up remedial classes or special workspaces for failing students. Since the majority of students did not show interest in backlog activities, those students may experience depressive symptoms. However, using our suggested model, teachers can enhance student performance without incurring additional costs by focusing only on the predicted areas of weakness from the 4QS model. In addition to educating about Lean concepts and its tools, college/university educators' duty is to integrate the Lean 4QS model mindset into their instruction in order to enhance student learning and performance. The lectures and exercises should also be planned in a way that would enhance student learning, save time, and encourage relentless quest of excellence with accumulated predation using our suggested system to achieve the best results.

## REFERENCES

1. Zhang, Y., An, R., Cui, J., and Shang, X. (2021a). "Undergraduate grade prediction in Chinese higher education using convolutional neural networks," in LAK21: 11th International Learning Analytics and Knowledge Conference, 462–468.
2. Zhang, Y., Lei, Y., Lin, M., Curran, W., Liu, T., and Yang, X. (2021b). "Region of interest discovery using discriminative concrete autoencoder for covid-19 lung ct images," in Medical Imaging 2021: Computer-Aided Diagnosis, Vol. 11597 (International Society for Optics and Photonics), 115970U.
3. Zhang, Y., Dai, H., Yun, Y., Liu, S., Lan, A., and Shang, X. (2020a). Meta-knowledge dictionary learning on 1-bit response data for student knowledge diagnosis. *Knowl. Based Syst.* 205:106290. DOI: 10.1145/3448139.3448184
4. Zhang, Y., Yun, Y., Dai, H., Cui, J., and Shang, X. (2020c). Graphs regularized robust matrix factorization and its application on student grade prediction. *Appl. Sci.* 10:1755. DOI: 10.3390/app10051755
5. Zhang, Y., He, X., Tian, Z., Jeong, J. J., Lei, Y., Wang, T., et al. (2020b). Multi-needle detection in 3d ultrasound images using unsupervised order-graph regularized sparse dictionary learning. *IEEE Trans. Med. Imaging* 39, 2302–2315. DOI: 10.1016/j.knosys.2020.106290
6. Fan Y, Liu Y, Chen H, Ma J. Data mining-based design and implementation of college physical education performance management and analysis system. *International Journal of Emerging Technologies in Learning.* 2019;14(06):87-97

7. Anand, M.. (2019). "Advances in EDM: state of the art," in *Software Engineering* (Lviv: Springer), 193–201.
8. Sunny Nanade, Sachin Lal, "Applying Lean for Effective Implementation and Governance of Education in Future Cities", *International Journal of Innovative Technology and Exploring Engineering (IJITEE)* ISSN: 2278-3075, Volume-8, Issue-7S, May 2019.
9. Sunny Nanade, Sachin Lal, " Developing Engineering Curriculum: The Lean Way", *International Journal of Innovative Technology and Exploring Engineering (IJITEE)* ISSN: 2278-3075, Volume-8 Issue-8S3, June 2019
10. Alves, A. C., Flumerfelt, S., & Kahlen, F. J. (2017). *Lean Education: An Overview of Current Issues*. Switzerland: Springer International Publishing.
11. Juhaňák, L., Zounek, J., and Rohlíková, L. (2019). Using process mining to analyze students' quiz-taking behavior patterns in a learning management system. *Comput. Hum. Behav.* 92, 496–506. DOI: 10.1016/j.chb.2017.12.015
12. Kim, B.-H., Vizitei, E., and Ganapathi, V. (2018). Gritnet: Student performance prediction with deep learning. arXiv preprint arXiv:1804.07405.
13. Kushwaha, R. C., Singhal, A., and Swain, S. (2019). "Learning pattern analysis: a case study of moodle learning management system," in *Recent Trends in Communication, Computing, and Electronics* (Langkawi: Springer), 471–479.
14. Liu, Q., Tong, S., Liu, C., Zhao, H., Chen, E., Ma, H., et al. (2019). "Exploiting cognitive structure for adaptive learning," in *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining* (Anchorage, AK), 627–635.