

# The Effect of the Choice of Hydration Strategy on Average Academic Performance

Some concerned fellow students

**Abstract**—We evaluate the relationship between hydration strategy and academic performance and project that by using the right button of the water dispenser to fill up their water bottles, students can potentially gain up to 4.14 s of study time per refill, which amounts to raising their grades by up to 0.0003 points.

**Index Terms**—KIT Library, Academic Performance, Hydration

## I. INTRODUCTION

THE concepts of hydration and study have always been tightly interwoven. As an example, an investigation was once conducted by Bell Labs into the productivity of their employees, that found that “workers with the most patents often shared lunch or breakfast with a Bell Labs electrical engineer named Harry Nyquist” [1], and we presume that they also paired their food with something to drink. We can see that intellectual achievement and fluid consumption are related even for the most prestigious research institutions.

In this work, we quantify this relationship in the context of studying at the KIT library and subsequently develop a novel and broadly applicable strategy to leverage it to improve the academic performance of KIT students.

## II. EXPERIMENTAL SETUP

Over a period of one week, we monitored the use of the water dispenser on the ground floor of the KIT library at random times during the day. The experiment comprised two parts: a system measurement to determine the flowrate of the water dispenser, and a behavioural measurement, i.e., a record of participants’ chosen hydration strategies:  $S_L$  denotes pressing the left button of the water dispenser,  $S_R$  the right one, and  $S_B$  pressing both buttons.

For the system measurement 10 datapoints were recorded for each strategy, for the behavioural measurement 113 in total.

## III. EXPERIMENTAL RESULTS

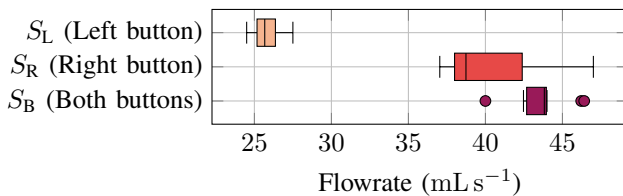


Fig. 1. Flow rate of the water dispenser depending on the hydration strategy.

Fig. 1 shows the results of the system measurement. To investigate the difference in flowrate between strategies, we used a Mann Whitney U test, because of its nonparametric nature. We found that  $S_L$  was slower than  $S_R$  with a significance of  $p < 0.01$ , while no statistically significant difference was found between  $S_R$  and  $S_B$ . The results of the behavioural measurement are shown in Fig. 2.

The authors would like to thank their hard-working peers as well as the staff of the KIT library for their unknowing - but vital - participation.

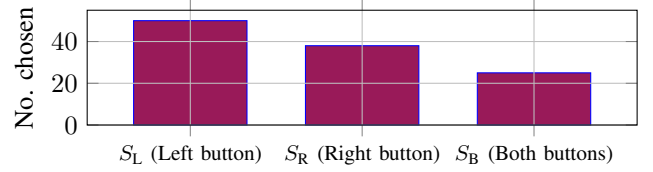


Fig. 2. Distribution of the choice of hydration strategy.

## IV. MODELLING THE GRADE IMPROVEMENT

We can consider the water dispenser and students as comprising a queueing system, specifically an M/G/1 queue [4]. The expected response time, i.e., the time spent waiting as well as the time dispensing water, is [4, Section 14.3]

$$W = E\{S\} + \frac{\lambda \cdot E\{S^2\}}{2(1 - \rho)},$$

where  $S$  denotes the service time (i.e., the time spent refilling a bottle),  $\lambda$  the mean arrival rate, and  $\rho = \lambda \cdot E\{S\}$  the system utilisation. Using our experimental data we can approximate all parameters and obtain  $W \approx 23.3$  s. The difference to always using the fastest strategy amounts to 4.14 s.

Strangely, it is the consensus of current research that there is only a weak relationship between academic performance and hours studied [2]. Observing Figure 1 in [3, p. 950] and performing a linear regression, we quantified the grade gain per additional hour studied as 0.054 points/hour. Using an estimate of 5 refills per day, we thus predict a possible gain of up to 0.0003 points.

## V. DISCUSSION AND CONCLUSION

Further research is needed, particularly on the modelling of the arrival process and the relationship between the response time and the grade gain. Nevertheless, we believe this work serves as a solid first step on the path towards achieving optimal study behaviour.

In this study, we investigated how the choice of hydration strategy affects average academic performance. We found that always choosing to press the right button leads to an average time gain of 4.14 s per refill, which translates into a grade improvement of up to 0.0003 points. We thus propose a novel and broadly applicable strategy to boost the average academic performance of KIT students: always using the right button.

## REFERENCES

- [1] J. Gertner, *The idea factory: Bell Labs and the great age of American innovation*. Penguin, 2012.
- [2] E. A. Plant, K. A. Ericsson, L. Hill, and K. Asberg, “Why study time does not predict grade point average across college students: Implications of deliberate practice for academic performance,” *Contemporary Educational Psychology*, vol. 30, no. 1, pp. 96–116, Jan. 2005.
- [3] H. Schuman, E. Walsh, C. Olson, and B. Etheridge, “Effort and Reward: The Assumption that College Grades Are Affected by Quantity of Study,” *Social Forces*, vol. 63, no. 4, pp. 945–966, Jun. 1985.
- [4] W. J. Stewart, *Probability, Markov Chains, Queues, and Simulation: The Mathematical Basis of Performance Modeling*. Princeton University Press, Jul. 2009.