of the respondents agreed that PC^2 had enabled them to get prompt feedback, whether their answer was correct or not. "Runtime Error" was the least understood feedback for incorrect answers; it was also not meaningful or helpful. Most of the time, the runtime error happens because the respondents did not test the program using the same type of input or same input data set that the judges used to check the respondents' answer. On another note, the scoreboard proved to be a hit with the respondents, as most agreed they had benefited from the ranking it displayed, motivating them to keep on trying and competing with their friends.

More than half of the respondents stated that they would discuss the possible solutions and read the questions before lab sessions, but they were not able to solve the questions on time due to failing to write down the program solution beforehand. Most of the students asked for more time to answer the question before the lab's two-hour session ended, and only 24.1% of the respondents were able to solve all problems correctly within that time. Additionally, 76.5% of the respondents said that they would always make sure that the program solutions successfully produced the correct outputs while 69.7% of the respondents said that they always made sure they submitted error-free solutions, proving that PC^2 has successfully pushed students always to output their best and most correct solution. This is because the students must strive for the Accepted ('Yes') feedback from PC^2 but until then must repeatedly correct and submit their solutions.

IV. CONCLUSION

This paper presents a model for a Programming course that was designed using the integrated course design approach. Using the approach, it was shown that we could systematically consider the important and pertinent factors that must be incorporated into a first-year Programming course. In the case of the Faculty of Information Science and Technology, UKM, due to the identified situational factors, the course was designed such that it allows immediate feedback, presents a competitive atmosphere, and also allows adequate opportunities for students to prepare for their lab sessions. The immediate feedback element was addressed via the utilization of PC^2, which also provided the competitive atmosphere required. The three-tier structure, a hierarchical structure of lectures, and tutorials and lab sessions provided the necessary structure that enables students to follow through the content in a structured manner; thus, providing them with an adequate amount of time for discussions and self-study. The results from the evaluation in this study indicate that these design objectives were satisfactorily achieved.

ACKNOWLEDGMENT

REFERENCES

[1] Yang, T.-C., Hwang, G.-J., Yang, S. J. H., & Hwang, G.-H. (2015). "A Two-Tier Test-based Approach to Improving Students' Computer- Programming Skills in a Web-Based Learning Environment," *Educational Technology & Society*, 18(1), pp. 198–210.

[2] Brame CJ and Biel R (2015). "Test-enhanced learning: The potential for testing to promote greater learning in undergraduate science courses," *CBE—Life Sciences Education* 14, pp. 1-12.

[3] Kani, U. M., Sa'ad, T. U. (2015), "Drill as a Process of Education," *European Journal of Business and Management*, Vol.7 (21), pp. 175-178.

[4] H. Mohamad Judi, S. Mohd Salleh, N. Hussin, S. Idris (2010), "The Use of Assignment Programming Activity Log to Study Novice Programmers' Behavior Between Non-Plagiarized and Plagiarized Groups," *Journal Information Technology*, 9(1), pp. 98-106. DOI: 10.3923/itj.2010.98.106

[5] N. F. A. Zainal, S. Shahrani, N. F. M. Yatim, R. A. Rahman, M. Rahmat, and R. Latih (2012), "Students' Perception and Motivation towards Programming," *Procedia - Soc. Behav. Sci.*, vol. 59, pp. 277-286. https://doi.org/10.1016/j.sbspro.2012.09.276

[6] Sun, W. and Sun, X. (2011). "Teaching Computer Programming Skills To Engineering And Technology Students With A Modular Programming Strategy." Technical Report (AC 2011-308), Oregon Institute of Technology.

[7] Krpan, D., Mladenović, S. and Rosić, M. (2015). "Undergraduate Programming Courses, Students' Perception and Success", *Procedia - Social and Behavioral Sciences,* vol. 174(2015), pp. 3868 – 3872.

[8] Fink, L. D. (2007). "The Power of Course Design to Increase Student Engagement and Learning." *Peer Review*, *Winter 200*, pp. 13–18.

[9] M. Mukhtar, Y. Yahya, S. Abdullah, A. R. Hamdan, N. Jailani, & Z. Abdullah (2009). "Employability and service science: Facing the challenges via curriculum design and restructuring," *Proceedings of the 2009 International Conference on Electrical Engineering and Informatics* (ICEEI 2009), pp. 357-361. DOI: 10.1109/ICEEI.2009.5254712

[10] Kleinschmidt, M. (2015). "Generation Z characteristics: 5 infographics on the Gen Z lifestyle", [Online]. Available: https://www.visioncritical.com/generation-z-infographics/.

[11] Mohr, Kathleen A. J., and Mohr, Eric S. (2017). "Understanding Generation Z Students to Promote a Contemporary Learning Environment." *Journal on Empowering Teaching Excellence*: vol. 1(1), Article 9. http://doi.org/10.15142/T3M05T

[12] Singh A. (2014), "Challenges and issues of Generation Z," *IOSR Journal of Business and Management*, vol. 6(7), pp. 59-63.

[13] (2016) Gen Z in the Classroom: Creating the Future. [Online]. Available: http://www.adobeeducate.com/genz/adobe-education-genz.

[14] Gupta, S. and Gupta, A. (2018). "E-Assessment Tools for Programming Languages: A Review." *Proceedings of the First International Conference on Information Technology and Knowledge Management*, vol. 14, pp. 65-70. DOI: 10.15439/2018KM31.

[15] White, G. and Kiegaldie, D. (2011). "Gen Y Learners: Just How Concerned Should We Be?," *Clin. Teach.*, vol. 8(4), pp. 263–266.

[16] M. Rahmat, S. Shahrani, R. Latih, N. F. M. Yatim, N. F. A. Zainal, and R. A. Rahman, (2012). "Major Problems in Basic Programming that Influence Student Performance," *Procedia - Soc. Behav. Sci.*, vol. 59, pp. 287–296. https://doi.org/10.1016/j.sbspro.2012.09.277

[17] S.A. Sukiman, H. Yusop, R. Mokhtar, and N.H. Jaafar (2016). "Competition-Based Learning: Determining the Strongest Skill that Can Be Achieved Among Higher Education Learners," *Regional Conference on Science, Technology, and Social Sciences: Business and Social Sciences*, pp. 505-516.

[18] I. Supriana, RD. Agustin, M. A. Bakar, & N.A.M. Zin, (2017). "Serious games for effective learning," *6th International Conference on Electrical Engineering and Informatics* (ICEEI'2017).

[19] (2017) "Welcome to the PC2 Home Page". [Online]. Available: https://pc2.ecs.csus.edu/

[20] Keuning, H., Jeuring, J., & Heeren, B. (2016). "Towards a Systematic Review of Automated Feedback Generation for Programming Exercises." *Proceedings of the 2016 ACM Conference on Innovation and Technology in Computer Science Education (ITiCSE'16)*, pp. 41–46. http://doi.org/10.1145/2899415.2899422