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# Developing effective student learning environment: Case study from Sharjah, United Arab Emirates

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The impact of COVID-19 on college education has been profound. At the same time, it has also provided an opportunity to test the effectiveness of new teaching approaches in challenging circumstances when the new delivery modes were introduced. In this case study, we have taken the project-based learning approach a little further by directly involving students as co-researchers in the ongoing research project in a higher education institution in Sharjah. This campus-based research project aimed at finding effective solutions to reduce plastic waste at the Sharjah campus. We enabled several groups of students to participate in the primary data collection for our project by aligning their course work projects with the aims of our own research. Hence, the students were directly involved in the ongoing community project, which raised their awareness about important sustainability issues. In addition, the students acquired essential research skills and were able to apply their knowledge to practical issue. This approach was effective: the difference between the final grades of students in the project and non-project groups was statistically significant in 2020 and in 2021. In 2020, the students in the project group scored 5.16% higher than the students in the non-project group. (95% confidence interval is  $[-0.9044, 11.2244]$ ,  $p = 0.047$ ). In 2021, this difference was 6.5% (95% confidence interval is  $[2.1176, 10.9026]$ ,  $p = 0.002$ ).

## KEYWORDS

students as co-researchers, student attainment, applied research by undergraduate students, research-based learning, active learning

## Introduction

One of the challenges of education is student engagement and developing effective learning environments (e.g., Taylor and Parsons, 2011; Fredricks et al., 2016). This challenge became even more acute during the recent COVID-19 pandemic, with the temporary introduction of 100% online teaching, which often had a detrimental effect on student learning (El-Sakran et al., 2022). However, this has also provided an opportunity to test the effectiveness of new teaching approaches in challenging circumstances, when the new delivery modes were introduced.

It has been widely accepted that active learning approach facilitates effective student learning *via* various collaborative activities, for example, group work, discussions, and projects (Prince, 2004). Research-based learning forms one of the ways for intellectual engagement of undergraduate students' in critical inquiry at university (e.g., Lambert, 2009). In this case study, we have taken the research-based active learning approach a little further by directly involving undergraduate students in the ongoing research project on during two spring semesters, in 2020 and 2021. Undergraduate students became "co-researchers" according to classification by Fielding (2001). This approach was applied in high schools (e.g., Messiou, 2014), colleges, and universities (e.g., Pilkington, 2010; Walkington, 2015) across Europe and North America. However, this is the first time when such pedagogical approach is being reported in the UAE although the effect of project-based learning on university students in the UAE was recently studied by Mohammed (2017).

The internally funded applied research project aimed at finding solutions to the reduction of plastic waste at the college campus. It is well established that petroleum-based plastic waste is one of the most urgent global sustainability issues of the 21st century. Due to its ubiquitous nature, persistence and huge production volumes plastic became a plague of modern time. A plastic bottle takes on average 500 years to biodegrade and every piece of plastic ever produced remains in the environment in one form or another (Orset et al., 2017). Plastic waste is especially harmful to marine life: it is estimated that plastic ingestion kills 1 million marine birds and 100,000 marine animals each year; some 33% of marine mammals and corals are threatened (Brondízio et al., 2019).

Although the college seeks initiatives to reduce plastic waste (TÜV Middle East, 2017), we have discovered that the amount of plastic waste at the Sharjah campus remained high.

Many students, especially the members of Sustainability Club, were concerned about the amount of plastic waste on campus, and this student interest and concern have given us the idea to directly involve the students into our applied research. In this approach, we pursued two goals: we used the primary data, collected by the students, in our ongoing research and at the same time, we created effective learning environment for the students, who were directly involved

in the project. By directly involving the students in the research process, we used "students as researchers" pedagogical approach (Walkington, 2015), which has a multitude of clear benefits for the students in terms of developing their higher thinking skills (e.g., Pilkington, 2010) and giving them first-hand practice of ongoing research (Healey and Jenkins, 2009).

Although the practice of involving undergraduate students into research process as co-researchers received substantial attention in pedagogy in the recent years (e.g., Pilkington, 2010; Walkington, 2015), to date there is no published record of quantitative analysis of the effect of such practice in the college setting in the UAE.

This article aims to quantitatively analyze the effect of undergraduate student participation in the ongoing applied research project on the student attainment rates in the Research Methods course.

## Methodology

The applied research project on plastic waste was integrated into the Research Methods course, which was taught by the members of the research team. We used voluntary sampling method, i.e., the students volunteered for the project groups. It was not possible to recruit the entire student cohort in the study. The students on this course were offered several topics directly related to the plastic-waste project during two spring semesters, in 2020 and 2021. The members of the research team liaised with all the students on the course, who chose to participate in the project: the aims of the research project were clearly communicated to the project students and the project students were given a task of collecting primary data through survey. The project students were given two questions from the research team in addition to the questions, which they developed themselves. Students then analyzed their primary data, drew conclusion, and produced research presentations within the framework of the Research Methods course. Typically, the student-led surveys included about 10 closed-ended questions, and 1–2 open-ended questions, please see **Supplementary Appendix**.

All the projects (plastic and non-plastic) were graded using the same assessment tool across all campuses to ensure compatibility of grades.

The course was taught across all the campuses as this is one of the mandatory courses for students studying for majors in Business, Applied Media, Education, and Health Science. Usually, about 3,000 of first- or second-year undergraduate students take this course each semester (please see **Table 1** in the Results for the exact number of the students, who were involved in the course during the study period).

Target population for this research was 281 students in 2020 and 250 students in 2021 in the sections taught by contributing authors. Estimated sample size was calculated at as 90 at 95% confidence level. The actual sample size is approximately 50% of the estimated sample size. As the participation in the project group was kept voluntary, researchers did not wait to reach the desired sample size.

The scope of participation and support offered by teachers was explained to students at the start of their course work project. No extra credit or support from teachers was offered to participating students. This led to unbiased selection of project group participants.

The results of the student-led surveys were also integrated into the database of the applied research project and analyzed by the research team. By this means, the undergraduate students, who participated in the project, became co-researchers. Overall, the students engagement in the research project was at level 2 “Students are consulted and informed” according to classification by Walkington (2015, p 10). In the informal discussions with the project students, the teachers investigated the reasons behind student’s interest in the applied research project.

In this article, the students, who participated in the applied research project as co-researchers are referred to as “project students” and other students from the same study section are referred to as “non-project students.”

In order to quantitatively assess the effect of student involvement in research on student attainment, the following variables were used: final grades, coursework (CW) grades, final exam (FEG) grades, and the difference between the final exam grades and course work.

Attainment of the project students was compared with the attainment of non-project students in the same study section using the means of the aforementioned variables.

The following Null Hypothesis was tested. There was no difference between attainment of students in the two groups. We used independent samples *t*-test to examine the null hypothesis. All the analyses were conducted in MS Excel.

## Results

**Table 1** shows background information about “project” and “non-project” students together with the student participation rate in the project.

The number of participating students doubled in spring 2021 compared with spring 2020, however, the number of student sections, where students participated in research, decreased.

The project students gave informal feedback about the reasons for participating in the applied research project on

**TABLE 1** Participation rate in the applied project in 2020 and 2021.

	2020	2021
Number of project students	24	48
% project students	1.4%	1.7%
Total number of students in project groups	281 students	250 students
Total number of the students in the course	1,682	2,704

plastic waste. The main reasons cited by the students include the following:

- a. General interest in sustainability issues;
- b. Desire to improve campus environment;
- c. Interest in reducing plastic waste and good understanding of issues associated with plastic waste, for instance, why plastic waste is harmful to the environment.

**Figure 1** later inter-compares GPAs of project and non-project students.

Mean GPA of the project students was higher by 0.4 compared with non-project students in 2020 and 2021 (**Figure 1**).

In 2020 and 2021, the attainment of project students was higher compared with the non-project students (**Figure 2**).

**Figure 2** clearly shows that the project students scored higher than non-project students, i.e., attainment of project students in 2020 and 2021 was higher compared to non-project students in all the parameters. The difference between course work and final exam grade was lower in the project students’ groups compared with the non-project student group. However, while the difference between project and non-project student attainment in 2021 was statistically significant at  $p \leq 0.05$  in 2020 only final grades of the project group were higher than final grades of non-project students at  $p \leq 0.05 \geq 95\%$  (see **Table 2**).

## Discussion and conclusion

The results show a clear increase in attainment in all variables in both 2020 and 2021 albeit not all difference in 2020 was statistically significant at  $p \leq 0.05\%$  (see **Table 2**). The reason for more robust statistical results in 2021 is the increase of the project students in relation to non-project students in the same study section (see **Table 2**). This implies that if this approach is expanded, i.e., more students are recruited as co-researchers, the student attainment rates in the project student group will increase.

There may be several reasons behind the higher attainment rates among project students.

First, the GPA of the project students was consistently higher by 0.4 in 2020 and in 2021 (see **Figure 1**) and this implies that more active and academically capable students

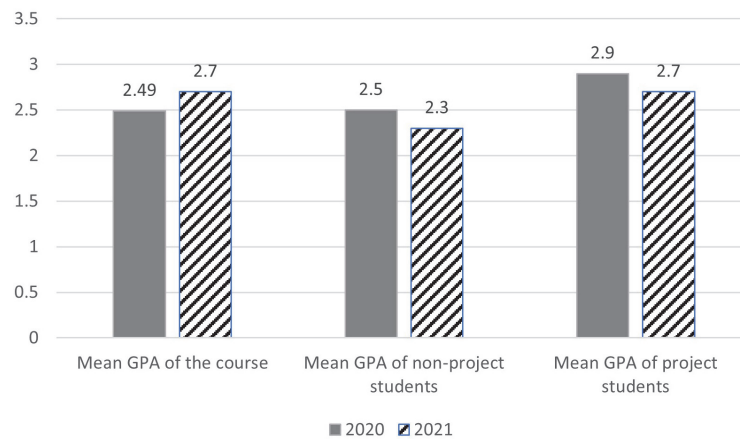


FIGURE 1 Student GPA: comparison between project and non-project students in 2020 and 2021.

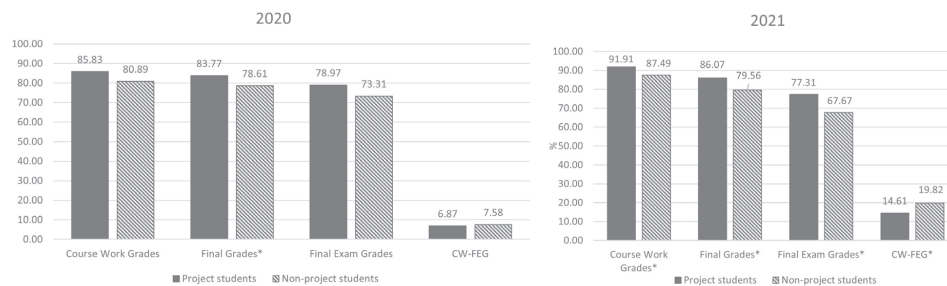


FIGURE 2 Attainment of project and non-project students in 2020 and 2021. CW-FEG is the difference between the mean final exam grades and the mean course work grades. \* denotes significant value at  $p \leq 0.05$ . For other  $p$ -values please see Table 2.

TABLE 2 Student attainment variables and the results of t-test.

Variable	2020				2021			
	Project students	Non-project students	P-values	95% CI	Project students	Non-project students	P-values	95% CI
Course Work	Mean	85.83	80.89		91.91	87.49		[0.2959, 8.5441]
	S.D.	9.15	15.14	0.058	6.74	14.2	0.018*	
Final Exam Grade	Mean	78.97	73.31		77.31	67.67	0.001*	[3.5171, 15.7629]
	S.D.	15.08	16.76	0.055	14.45	20.59		
CW-FEG**	Mean	6.87	7.58		14.61	16.26		[-2.874, 6.174]
	S.D.	9.70	11.18	0.38	14.52	14.60	0.020*	
Final Grade	Mean	83.77	78.61		86.07	79.56		[2.1174, 10.9026]
	S.D.	10.35	14.78	0.047*	7.76	15.07	0.002	

\*Significant at  $p \leq 0.05$ .

\*\*CW-FEG is a mean difference between course work grades and final exam grades.

chose to participate in the project. Clearly, this may have in turn impacted the attainment of the project students.

As informal feedback showed, project students became directly involved in the real-life applied project, because they were concerned about sustainability and the plastic waste issue and were keen to find workable solutions. Participation in the

project has given them this opportunity and at the same time made them feel responsible for the outcomes of the research. This may have resulted in the higher attainment rates. Higher sense of responsibility of the students directly engaged in research process was also described by Lambert (2009) and Healey et al. (2013) in the UK and Mohammed (2017).

It is also likely that the project students were engaged in more frequent and detailed discussions with the teachers about the ongoing applied research project compared to their peers. Participation in the project gave more opportunities for discussions and interactions with the teachers (e.g., [Messiou, 2014](#); [Walkington, 2015](#); [Mohammed, 2017](#)) and, in many ways, more effective learning environment was created for the students through their direct integration and engagement with the applied research and this has resulted in the measurable increase in student attainment.

Most likely a combination of all three reasons discussed above led to the higher attainment rates among the project students. This case study clearly demonstrated the benefits of research-based learning and engaging undergraduate students as co-researchers. However, further research is needed to better quantify the effects and benefits of engaging undergraduate students as co-researchers at the UAE higher education institutions.

## Data availability statement

The original contributions presented in this study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author/s.

## Author contributions

NS, AD, PK, and ST designed the study. NS and AD analyzed the data. NS wrote the manuscript with support from all the authors. All authors participated in data collection, contributed to the article, and approved the submitted version.

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## References

- Brondizio, E. S., Settele, J., Díaz, S., and Ngo, H. T. (2019). "Global assessment report of the intergovernmental science-policy platform on biodiversity and ecosystem services," in *Debating nature's value*, eds E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (Bonn: IPBES).
- El-Sakran, A., Salman, R., and Alzaatreh, A. (2022). Impacts of emergency remote teaching on college students amid COVID-19 in the UAE. *Int. J. Environ. Res. Public Health* 19:2979. doi: 10.3390/ijerph19052979
- Fielding, M. (2001). Students as radical agents of change. *J. Educ. Change* 2, 123–141.
- Fredricks, J. A., Filsecker, M., and Lawson, M. A. (2016). Student engagement, context, and adjustment: Addressing definitional, measurement, and

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2022.955873/full#supplementary-material>

methodological issues. *Learn. Instr.* 43, 1–4. doi: 10.1016/j.learninstruc.2016.02.002

Healey, M., and Jenkins, A. (2009). *Developing undergraduate research inquiry*. New York, NY: Higher Education Academy, 152.

Healey, M., Lannin, L., Stibbe, A., and Derounian, J. (2013). *Developing and enhancing undergraduate final-year projects and dissertations a national teaching fellowship scheme project publication*. York: Higher Education Academy, 1–94.

Lambert, C. (2009). Pedagogies of participation in higher education: A case for researchbased learning. *Pedagogy Cult. Soc.* 17, 295–309. doi: 10.1080/14681360903194327

- Messiou, K. (2014). Working with students as co-researchers in schools: A matter of inclusion. *Int. J. Incl. Educ.* 18, 601–613. doi: 10.1080/13603116.2013.802028
- Mohammed, N. (2017). Project-based learning in higher education in the UAE: A case study of Arab students in emirati studies. *Learn. Teach. High. Educ.* 14, 73–86. doi: 10.18538/lthe.v14.n2.294
- Orset, C., Barret, N., and Lemaire, A. (2017). How consumers of plastic water bottles are responding to environmental policies? *Waste Manag.* 61, 13–27. doi: 10.1016/j.wasman.2016.12.034
- Pilkington, R. (2010). Developing undergraduate research and inquiry. *Innov. Educ. Teach. Int.* 47, 247–248. doi: 10.1080/14703291003718976
- Prince, M. (2004). Does active learning work? A review of the research. *J. Eng. Educ.* 93, 223–231. doi: 10.1002/j.2168-9830.2004.tb00809.x
- Taylor, L., and Parsons, J. (2011). Improving student engagement. *Curr. Issues Educ.* 14, 1–32.
- TÜV Middle East (2017). *Waste management report higher colleges of technology*. Hanover: TÜV Nord.
- Walkington, H. (2015). *Students as researchers: Supporting undergraduate research in the disciplines in higher education*. York: The Higher Education Academy.