

Developing a framework for blended teaching and learning to enhance students' performance

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The implementation of the Covid-19 restrictions in South Africa in 2020 led to all universities worldwide, including the University of the Witwatersrand (Wits), to transition from face-to-face to online teaching and learning. During this period, considerable work was done by Wits to deliver effective online teaching and learning. With continued concerns of high infection rates, most teaching and learning activities remained online during 2020 and 2021. However, at the beginning of October 2021, the South African government eased Covid-19 regulations, and this resulted in universities allowing some contact teaching and learning to resume. Wits adopted a blended approach where teaching and learning takes place both online and on-campus. The objective of the paper is to draw from experiences and lessons from face-to-face and online teaching and learning to ensure effective delivery of blended teaching and learning. This is done by understanding the benefits and disadvantages of both modes of teaching and learning, and identifying critical areas to consider for blended teaching and learning.

INTRODUCTION

The global outbreak of the Coronavirus (Covid-19) first identified in December 2019 in Wuhan, China had a devastating impact on the economic and social activities of many countries around the world. In a quest to curb the spread of the virus, over 192 countries including South Africa implemented nationwide lockdowns and restrictions of economic and social activities including social distancing - measures to minimise the spread of the virus amongst the population. This, unfortunately, had devastating results not only on the economy but also on how Higher Education Institutions (HEIs) operate globally. According to du Plessis (2022) and Reddy *et al* (2020), the lockdown was the largest disruption of education systems in human history affecting about 99% of the world's student population.

In South Africa, the first case of Covid-19 was announced on 05 March 2020. After the announcement, cases rose rapidly to 402 in 18 days which led to a nationwide lockdown for 21 days by the government. Due to the failure to contain the virus within the initial lockdown period, the restrictions were extended. These extensions meant that HEI's remained closed for the duration of the lockdown if teaching and learning were to continue in the traditional way/maintain the face-to-face pedagogy.

South Africa has approximately 5 million students enrolled across its various public and private higher education institutions (Amoed, 2021). The outbreak of the pandemic generated uncertainty and permanently affected the way in which teaching and learning takes place at higher institutions of learning. According to Pokhrel and Chhetri (2021), the transitional period made it apparent that students and staff with a fixed mindset found it difficult to adapt and adjust, whereas the students and staff with an adaptable mindset quickly adapted to the new learning environment and subsequently succeeded.

However, this is not entirely the case when looking at the majority of South African students, where in addition to their mindset, most are affected by the socio-economic and structural issues inherent in the country. Due to financial issues that students already face in South Africa, few students had access to computers and data, hence online learning platforms at the onset of the pandemic was challenging to access without the assistance and support of the government and institutions (Gumede and Badriparsad, 2021).

Further, the emergency shift from contact learning to online learning exposed the dire digital literacy divide in South Africa (Gumede and Badriparsad, 2021). According to the chief financial officer of SEACOM, Steve Briggs, 36% of South Africans are not connected to the internet. Further, only 1.2% of South African households in rural areas have access to the internet; the majority struggle with poor connectivity owing to the location of their homes, usually in remote, rural areas. The other challenge was the recurrent power interruptions which constantly affected students' learning.

Given the impact of the pandemic on teaching and learning, and the risk of students losing the entire 2020 academic year, South African institutions had to innovate, adapt and implement online teaching and learning. The University of the Witwatersrand (Wits) implemented a fully online academic programme on 20 April 2020. In enforcing Covid-19 regulations to minimise the spread of the virus, the university's academic staff were encouraged to transition their teaching and learning online. In addition, Wits and private accommodations closed their residences and as a result, students were forced to vacate and continue their learning from home. This meant that students had to manage their time by self-directing their studies and learning to study in homes that were mostly not conducive to learning.

This disruption and the lack of face-to-face interaction with lecturers and other students had a detrimental effect on students' learning. Some students reported an increased level of stress, anxiety and isolation. While adapting to the changes, staff and students' readiness needed to be assessed and the necessary support given to ensure efficient delivery of online teaching and learning. For example, academic staff that were not ready and comfortable transitioning to online teaching were provided with the required support by the University's Information and Communications Technology (ICT) department. The students were also supported with computers and data to enable remote learning.

While the transition process provided opportunities to expand on traditional teaching and learning methods, it also came with challenges. At the start of the 2022 academic year, Wits adopted a blended approach where teaching and learning takes place both online and on-campus (face to face). With students having gone through face-to-face and online teaching and learning, it is important to understand their experiences and take lessons to ensure effective delivery of blended teaching and learning. The objective of the paper is to develop a framework for blended teaching and learning to enhance students' performance.

Impacts of Covid-19 on students' performance

As per the university's directive, the School of Mining Engineering transitioned from fully face-to-face to online teaching and learning during the lockdown imposed in 2020 and 2021. As was the case across institutions, the School of Mining Engineering experienced a myriad challenges, which affected students' performance. Figure 1 to Figure 3 show students' performance based on average test marks for three years of study (YOS) (i.e., 2, 3 and 4). The periods as depicted on the Figures 1 to 3 are academic years running from February to December each year. The periods, 2018 and 2019 were face-to-face teaching and learning, 2020 and 2021 were online teaching and learning, and 2022 is currently blended teaching and learning. Figure 1 shows the average test marks for selected courses undertaken by second year students in the study academic years.

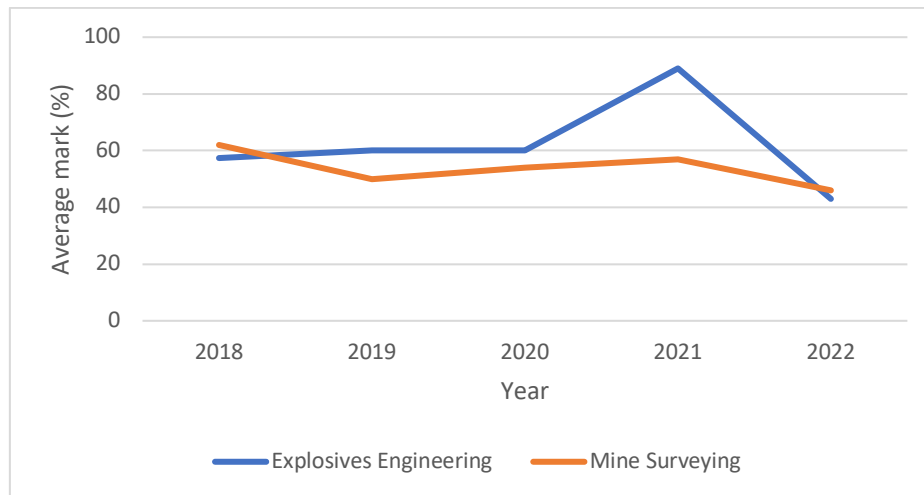


Figure 1. Students' average test marks for two courses in the second year of study.

As can be seen in Figure 1, the performance of students during the face-to-face teaching and learning is relatively similar across the two courses. Relatively similar marks are also observed in 2020 when the university transitioned to online teaching and learning. This may be that components of the course material had been delivered face-to-face before the lockdown restrictions in March 2020. For explosives engineering, a sharp increase in the marks is seen in 2021 (i.e., the average mark is 89%). In 2022, the average marks for both courses significantly reduced to about 45%. Figure 2 shows the performance of third year students from 2018 to 2022.

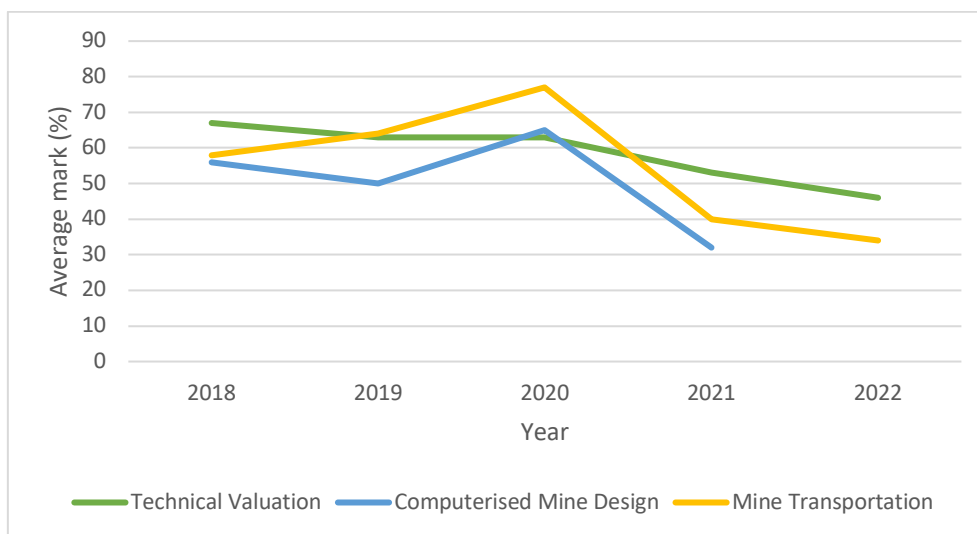


Figure 2. Students' average test marks for three courses in the third year of study.

As seen in Figure 2, the trends differ, however, marks have declined across the three courses. An increase in the performance is observed in 2020 when courses moved online. A performance decline is seen in 2022 with the introduction of blended teaching and learning. Computerised mine design is a second semester course (i.e., it is starting in July 2022) and hence test marks are not available.

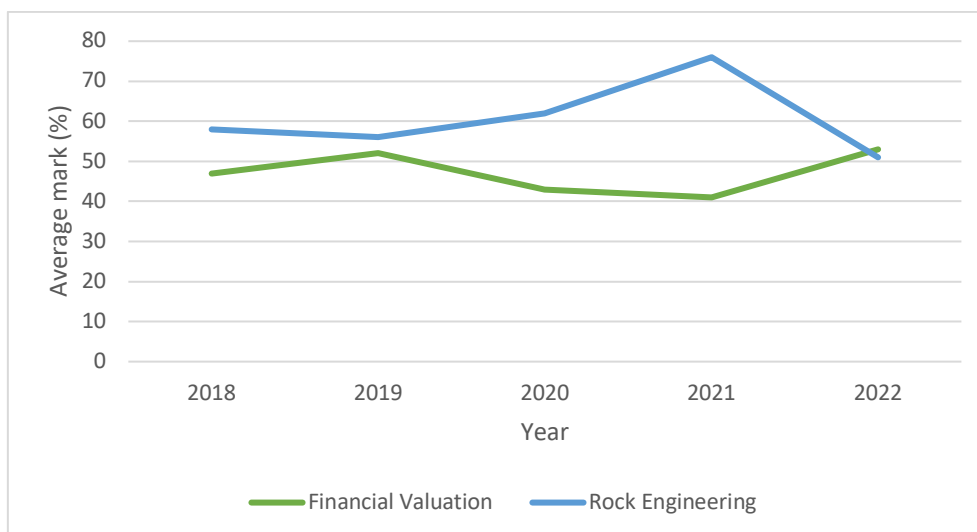


Figure 3. Students' average test marks for two courses in the fourth year of study.

Figure 3 shows the average test marks for two courses undertaken by students in the fourth year of study. The performance of students in the two courses is relatively the same in 2018 and 2019. For rock engineering, average marks in 2020 and 2021 were lowered compared to the previous years when teaching and learning was face-to-face. An opposite trend is seen in financial valuation with performance increasing during online teaching and learning. In 2022, the average marks for financial valuation declined while rock engineering increased. The average mark for both courses is about 51%.

The average test marks for all courses between 2018 and 2019 show a similar trend. This may be because all teaching and learning including assessments were conducted on site. In 2020, some of the tests were written face-to-face before the lockdown, while some were delivered using online platforms during the lockdown. The average test marks for some courses remained the same (i.e., comparing with 2018 and 2019) while some increased or decreased in 2020 when the transition was made. The difference in the performance can be attributed to several factors. In implementing online teaching and learning at the start of the restrictions, there was no standardised approach. The individual lecturers had to adopt methods that they were comfortable with to deliver assessments. For most courses, assessments had already been prepared for face-to-face, and with the transition to online some of the assessments were not appropriate for online delivery.

The other factors that can be used to explain the difference in the performances across courses are the challenges that students faced. Students complained about poor internet connectivity and as a result, based on the lecturers' judgement and the need to be fair, some assignments were allocated more than double the usual test time limit to allow some students time to complete their assignments. With the lack of appropriate invigilating strategies, students consulted their peers and also referred to their lecture material to complete assignments, and hence the test average marks of some of the courses are high in 2020 and 2021.

While student performance differs across the various courses in 2022, it is seen that students' marks declined with the introduction of blended teaching and learning. The average test marks for all years of study averaged between 40% to 51% which is lower compared to face-to-face assessments. From the lecturers' perspectives, the declining performance can be linked to poor attendance of face-to-face sessions. For the majority of courses, teaching is delivered online while assignments are done face-to-face. This mix of teaching and learning has therefore affected performance of students as seen in the marks.

Methodology

A mixed method approach was adopted for the study. Quantitative data was collected through online surveys that were administered to students. Qualitative data was gathered through a focus group

discussion with selected students. Both data collection methods aimed to obtain students' experiences and views on the different modes of teaching and learning that have been implemented in school and university. The survey comprised of structured questions covering the aspects relating to the three modes of teaching (i.e., structure of teaching and learning, delivery, benefits, disadvantages, and others). The students that participated in the surveys are enrolled in mining engineering and had experienced all three modes of teaching. A total of 46 surveys were completed.

Of those that participated in the surveys, 19.6% enrolled in the university in 2020, 32.5% in 2019, 28.3% in 2018, and the remainder between 2017 and 2015. Most of the students are in their final year of study (i.e., 37%). About 60.8% are in the third and second year of study (i.e., 30.4% in each year). A total of 12 students participated in the focus group discussion, where in-depth understanding of their experiences was obtained. The results as provided discusses students' experiences with the three modes of teaching and learning.

RESULTS AND ANALYSIS

Face-to-face teaching and learning

Figure 4 provides the perspectives of students on face-to-face teaching and learning. Students were asked several questions covering the design and delivery of the courses as well as their participation in the courses offered. As seen in the Figure 4, the students' experiences of students in face-to-face teaching and learning are mixed. However, their overall experience is positive. Most of the students (i.e., 54%) found face-to-face courses to be engaging. Most of the students indicated that they were satisfied with the delivery of face-to-face courses. About 64% of the students expressed that they feel motivated to learn and 44% enjoy the face-to-face interaction. From the results, about 44% indicated that they do not get distracted easily while 22% submitted otherwise. Most students (i.e., 39%) indicated that they ask questions during face-to-face session, however not as often.

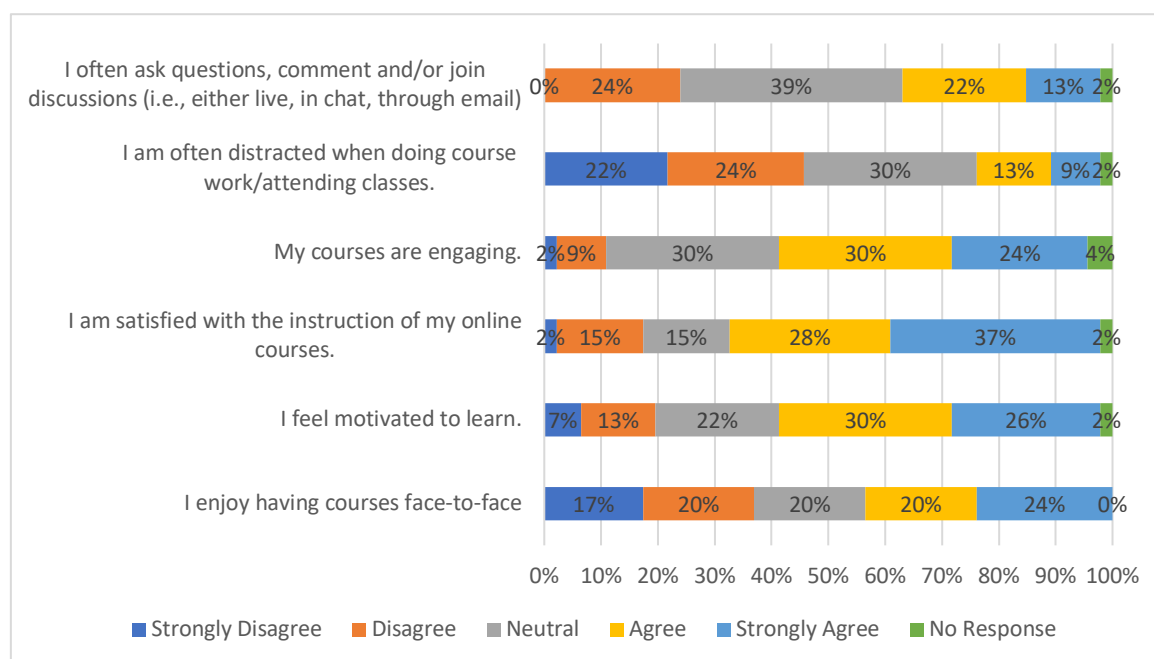


Figure 4. Face-to-face learning experience.

Amongst the benefits of face-to-face classes is the level of interaction between students as well as students and lecturers. It was highlighted that lectures are usually interactive providing students with an opportunity to ask questions during the sessions. The students also raised that, during face-to-face sessions, lecturers are able to pick up if students understand the material or not. If the former is picked up, more explanation and/or more examples are given to ensure that students understand the material being covered.

The students that favour face-to-face courses also highlighted the importance of the timetable because of the structure that it provides. It was noted that it instils discipline and ensures that students are able to manage their time properly. It was highlighted that the timetable provides a structure to day-to-day learning. Students start their days early to attend all the courses, and because they attend multiple courses, they are able to keep track and multi-task, ensuring that all courses are up-to-date. It was raised that during face-to-face teaching, tutorials were compulsory. This is deemed important in that students are motivated to engage the material covered on a weekly basis and to prepare for the tutorial sessions.

Face-to-face learning also creates opportunities for students to work together during lectures as well as outside. The students indicated that on-campus teaching and learning offers an environment that encourages 'peer' studying. It was raised that learning becomes 'active' as students are encouraged by fellow students to study. Another benefit of on-campus teaching is the support that is available to students and its accessibility. This is in relation to the socioeconomic challenges that students face which affect their learning. It was noted that it is easy to access the university's facilities to seek assistance, and the response is usually quick when they are on campus. They gave an example of the university's Counselling and Careers Development Unit which offers services aimed at ensuring students' wellbeing.

The main disadvantage of on-campus teaching and learning is the availability of learning material. With courses running according to the timetable, lecture material is presented during class at an allocated slot. Students who are unable to attend classes have to depend on fellow students for notes and/or insights on the material that was covered. Even though students are given an opportunity to ask questions, it was highlighted that there is a fixed time to grasp the material. According to the timetable, there are 90- and 45-minutes lecture slots, and students are expected to learn within those allocated times.

While face-to-face teaching and learning imparts time management skills, it is also seen as a disadvantage because lecturers are usually strict with time. If students arrive late for a lecture, they are not allowed to enter the venue until the next period. With the timetable running from 08:00 to 17:00 on some days, it was mentioned that self-study takes place in the evening when students are tired. The other concern was the travelling distances between venues when attending classes. It was raised that they do not get to rest because of the time allocated between lectures.

Online teaching and learning

Figure 5 captures students' experiences with online teaching and learning. The level of satisfaction with online teaching and learning is lower compared to face-to-face. About 46% of the students indicated that they find online course engaging (i.e., this compares to 54% of students who rated face-to-face courses as engaging). Also, 50% of the students are happy with the delivery of online courses (i.e., this compares to 65% for face-to-face courses). The online courses were delivered using several platforms. Most of the lecturers provided pre-recorded lecture presentations to students. Live online sessions were also delivered using platforms such as the university's learning platform (i.e., Canvas/Ulwazi) as well as Microsoft Teams, Zoom, etc. The other platforms that were used were discussion forums, chats and email communication.

Of these various platforms, most students indicated that they preferred the recorded lectures (i.e., about 87%). This is followed by live online sessions (i.e., 48%) and uploaded teaching material (37%). Through the use of various online platforms, 37% of the students shared that they are motivated to learn. A considerable percentage of the students expressed that they often get distracted during online courses (i.e., only 22% said they get distracted during face-to-face teaching sessions). In comparing the two modes (i.e., face-to-face, and online), more students (i.e., 39%) indicated that they often ask questions (i.e., this compares to 35% for face-to-face).

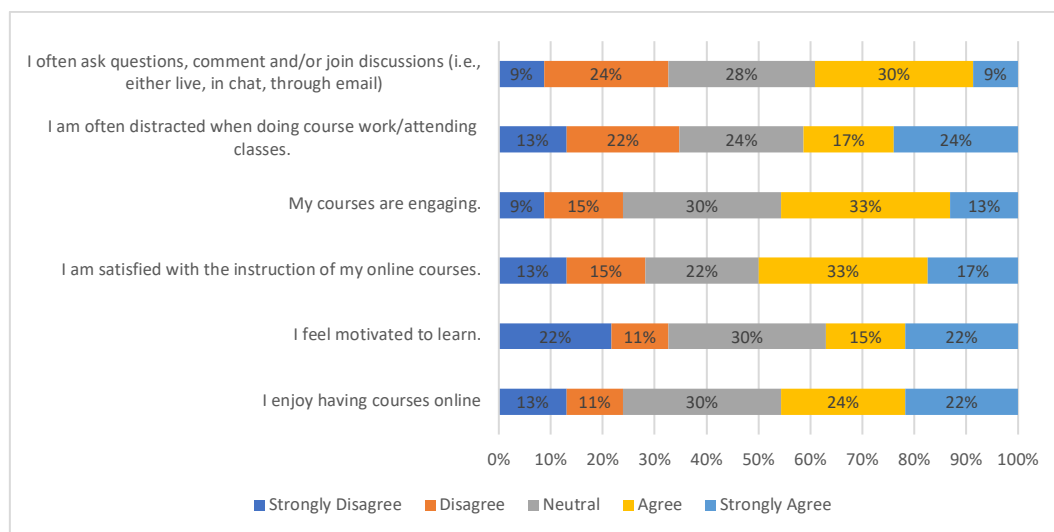


Figure 5. Online learning experience.

In contrast to face-to-face, the main benefit of online teaching and learning is the availability and easy access to learning material. The students also indicated that they were able to go through the material at to their own pace as well as several times, since recordings are made available. Online teaching and learning also removed travelling time (i.e., to and from the university) and this offered students sufficient time to work on assignments and projects. It was highlighted that they had control of their days/schedules.

When the university moved to online teaching and learning, students faced a myriad challenges which they had to work through. Many students from disadvantaged backgrounds lacked the resources such as computers, cell phones, data, and a dependable internet connectivity to ensure learning remotely. Some students reported having to travel to central business districts for better internet connectivity to download and listen to narrated presentations and complete assessments (tests, exams). Some students raised that they did not have laptops and hence had to use their mobile devices to learn and complete online assignments.

During this period, the university provided data (i.e., internet bundles) to students. It was noted that the data provided was insufficient and would finish before the end of the month. Although the university provided zero rated sites for students to access learning material, some lessons were conducted over MS Teams, Zoom and other platforms for question-and-answer sessions to clarify concepts. This was particularly important for courses that are highly practical/visual and require explanations and sometimes drawings from lecturers. Due to exorbitant data costs and poor connectivity, many students were consequently excluded from such sessions. Completing group projects was also a challenge because students were not centrally located and thus communication was a problem. Many explanations were lost in translation.

Students also had to deal with power outages and socioeconomic issues at home. They also spoke about adapting to the 'home' environment and ensuring that they were able to balance between household responsibilities (i.e., chores) and school responsibilities. For most students, the 'home' environment was not conducive for learning. The learning material that was provided during the transition period also presented challenges. While narrated presentations were found to be helpful, some students expressed that some were not adequate because lecturers did not have adequate time and resources to plan and deliver appropriate narrated presentations for online teaching.

Because teaching and learning was disrupted by Covid-19, teaching and learning had to be delivered in less months. As a result, students were required to study some of the material on their own. The duration of the assignments was reduced. Students indicated that they had to write nine exams in 20 days. While this was a difficult period, amongst the personal benefits that students gained from this

experience was emotional stability and ability to work under pressure. They learnt to use multiple online platforms. Some students shared that they learnt to conduct research because they had to study some of the material on their own. They learnt how to use Microsoft Excel and to make sure that the material that they download was organised properly. They learnt to be patient and developed the courage to seek assistance.

The downsides of online teaching and learning was lack of interaction amongst students, and between students and lecturers. While easy access to learning material was preferred, it was noted that this comes with comfort which can equate to students not going through the material as thoroughly as they should. This was worsened by most the assessments being open book. As a result, students fell into the trap of not studying and understanding the material thinking that they would page through the lecture material to complete the assessments. The other disadvantage of online teaching and learning was that it did not follow a timetable, and as such lecture material from different courses would be posted at the same time and students would get overwhelmed and end up concentrating on particular courses. It was also raised that it was difficult to grasp courses that required physical demonstrations (i.e., laboratories, field work etc.). The students expressed that the instructions given were normally insufficient, making learning difficult.

While a considerable percentage of students indicated that they were able to ask questions, it was raised that phrasing questions and writing them down were found to be difficult and this resulted in some students refraining from sending questions. The other concern was the way online assessments were structured. In particular, the tests and how the questions were captured on the platform used. The students indicated that questions depended on each other, and if you struggled with one question, several questions were affected. While the time to complete assessments was increased in some of the courses, the home environment made it difficult for students to complete assessments on time. This was worsened by power outages and internet connectivity issues. Some students indicated that they had to travel to nearest towns to be able to have access to stable network. Some students raised that they'd had to make arrangements with family members and friends in order to have a conducive environment to complete assessments.

Blended teaching and learning

Figure 6 provides students' views on the design and delivery of blended teaching and learning as currently being implemented. Most of the students were satisfied with how blended courses have been structured and delivered. About 12% and 9% of the students rated blended teaching and learning 'good' and 'excellent'. Of those that participated in the survey, only 5% found the design and delivery of blended courses to be poor. As is the case with online teaching and learning, the benefits of blended courses were that lecture material is made available to students and hence, they have an option of attending face-to-face sessions or not. So, there is flexibility in learning with students being able to go through the material in their own time. It was also highlighted that blended learning offers multiple platforms for consultation. Students can send their questions online using the available platforms. They can also schedule face-to-face appointments with their lecturers. Blended learning has also brought back interaction amongst students, and this has made group work easy.

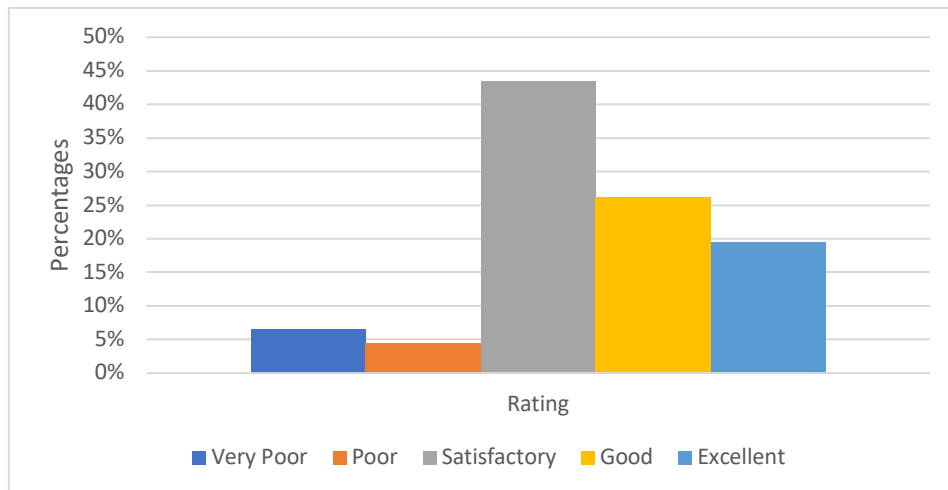


Figure 6. Perspectives on the design and delivery of blended courses.

Figure 7 captures the perspectives on how face-to-face and online teaching and learning is structured within blended courses. Most of the students (i.e., 38%) are satisfied the ratio between on-campus and online teaching and learning as implemented in blended courses. They are followed by those who are on the fence (i.e., 30%). There is a considerable percentage (i.e., 32%) who are not happy with the balance between on-campus and online teaching and learning.

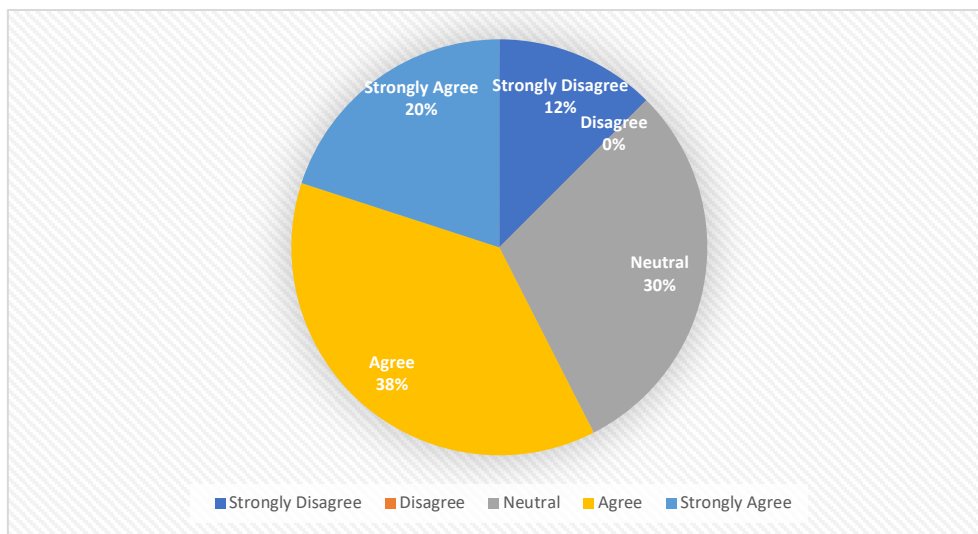


Figure 7. Balance between face-to-face and online teaching and learning.

While the university is implementing blended teaching and learning, students mentioned that not all the courses are blended. There are courses that are delivered fully online. With those that are blended, lecture presentations are still delivered online and only tutorials are run face-to-face. While blended teaching and learning offers benefits of online and on-campus modes, the students raised that the environment within the university is not conducive to catering for both. Amongst the challenges pointed out by students is moving between online and face-to-face sessions. As with face-to-face learning, students are required to follow the timetable. The challenge comes when one session is face-to-face, and the next one is online. It was raised that it is difficult to attend online classes in computer labs because of the 'noise' coming for students who are using the labs. Students also cannot attend online classes in library because of noise restrictions. As a result, they have to move between campus (i.e., for face-to-face sessions) and their accommodation (i.e., for online classes).

Students' position on teaching and learning modes

Figure 8 shows overall position on the different teaching and learning modes. The majority of students prefer blended teaching and learning. This is followed by face-to-face (i.e., on-campus) teaching and learning. The online teaching and learning came out last with only 5% of the students choosing it as the preferred mode.

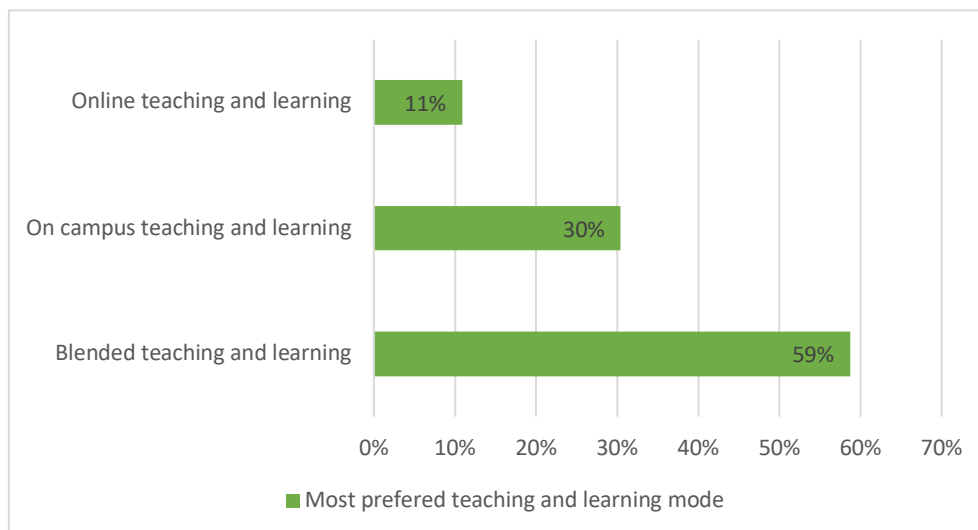


Figure 8. Preferred method of teaching and learning.

Framework for blended teaching and learning

Based on the students' experiences, five areas were identified as being critical to blended teaching and learning and these are (1) programme structure, design and delivery of courses, (2) teaching and learning resources and tools, (3) teaching and learning relationships, (4) teaching and learning environment and (5) students' support. Figure 9 illustrates the five pillars of blended teaching and learning. These five pillars are elaborated below.

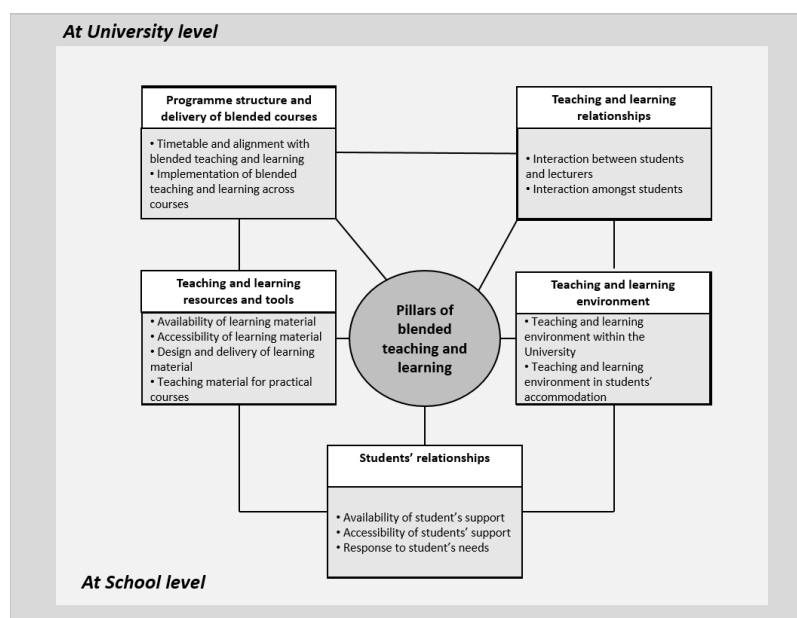


Figure 9. Framework for blended teaching and learning.

- Programme structure, design and delivery – It is important that the introduction of any teaching and learning strategy is supported by a delivery and design structure at various levels to ensure coherence at operational level. According to Kaur (2013), blended learning requires optimal use of appropriate resources to improve students' performance. Schools must take the lead in ensuring that the various courses offered within programmes are structured and planned in order to optimise the benefits of blended teaching and learning. If students are expected to come to campus, face-to-face lectures must be planned accordingly to ensure that students are able to move swiftly between various modes of delivery. For example, particular days of the week can be designated purely for face-to-face lectures. While acknowledging the importance of access and availability of learning material, it is important that the material is provided to students according to planned schedules developed within different courses, and these must be integrated to provide allow students to structure their learning.
- *Teaching and learning resources and tools* - Hermann (1996) highlights that there are a number of different learning styles and therefore students need to be taught in a variety of ways i.e., flexible and visual, detailed and structured, interactive and relational and quantitative and intellectual/technical. Some students prefer to have structured learning with hardcopy resources so that they can take notes, and some prefer the flexibility that comes with online learning. It is important that advantages and disadvantages of the various teaching and learning methods are evaluated and optimal strategies selected in line with course objectives. The adopted learning strategies should take into account diversity of students and learning abilities to ensure that various needs are catered for. Teaching and learning plans must be supported by appropriate resources and tools from both sides (i.e., staff and students). There must be an integration of the support offered to teaching and learning.
- *Teaching and learning relationships* – It is important to provide platforms that will foster relationships amongst students as well as between students and staff. From a teaching perspective, some of the avenues that can be used is face-to-face sessions where students are required to work in groups. The number of group assessments can also be increased to allow students to forge relationships. Part of the engineering qualification is evidence of teamwork and hence it is important for collaborative platforms to be created to ensure that students meet this requirement.
- *Teaching and learning environment* – It is important to acknowledge that socioeconomic issues affect teaching and learning. Creating a conducive environment extends beyond the technical aspects of teaching and learning and also include university surroundings where teaching and learning takes place. The university's facilities must be well equipped to support blended teaching and learning. Collaboration is needed to ensure that extended support is offered to students.
- *Students' support* - According to Kaur (2013), the other considerations of ensuring effective blended teaching and learning are institutional support, considering the needs of both staff and students. ICT support and identifying platforms to support online delivery as well as how these are integrated into face-to-face environments. The university should ensure increased access to support services. Awareness and education on available support services is important, and one avenue that must be supported is student societies because of direct interaction with fellow students.

CONCLUSION AND RECOMMENDATIONS

Three modes of teaching and learning were evaluated with the aim of developing a framework for blended teaching and learning. In doing so, the advantages and disadvantages of face to face, online and blended teaching and learning were noted from the students' perspectives. Of the three teaching and learning strategies, most students preferred blended teaching and learning because of the flexibility it provides. Face-to-face teaching and learning was accentuated on the basis of the importance of structure in terms of learning as well as interpersonal benefits obtained from interaction amongst students and between students and lecturers. The main benefit of online teaching and learning is available and easy access of learning material. Five components were identified as being crucial to blended teaching and learning. It is important that the university's strategy on blended teaching and

learning is supported by a design and delivery structure that brings together the various components of teaching and learning at operational level. The integration of various courses must take into account the advantages and disadvantages of the selected modes of teaching and learning to optimise delivery. The other components that are important are ensuring that the appropriate resources and tools are provided to match teaching and learning needs, creating an environment that supports blended teaching and learning, fostering relationships to support teaching and learning and ensuring that students' support takes into account the external factors affecting teaching and learning.

REFERENCES

- Amoed, Z. (2021). The Covid-19 Pandemic: Online Teaching and Learning at Higher Education Institutes. The ASOCSA 14th Built Environment Conference 654 (2021) 012026. pp.1-7. DOI: 10.1088/1755-1315/654/1/012026.
- Du Plessis, M., van Vuuren, C.D., Simons, A., Frantz, J., Roman, N., and Andipatin, M. (2022). South African Higher Education institutions at the beginning of the Covid-19 pandemic: Sense-making and lessons learnt. *Frontiers in Education*, Vol.6, Article 740016, pp.1-17. <https://doi.org/10.3389/feduc.2021.740016>.
- Gumede, L. and Badriparsad, N. (2021). Online teaching and learning through the students' eyes – Uncertainty through the COVID-19 lockdown: A qualitative case study in Gauteng province, South Africa, *Radiography*. Vol. 28 (1), pp. 193-198.
- Hermann, N. (1996) *The Whole Brain Business Book*. McGraw-Hill. ISBN 0-07-028462-8, pp.30.
- Reddy, V., Soudien, C. & Winnaar, L. (2020). Disrupted learning during COVID-19: the impact of school closures on education outcomes in South Africa. *Human Science Research Council (HSRC) Review*. Vol.18(3), pp.10-12.
- Kaur, M. (2013). Blended learning - its challenges and future. *Procedia, Social and Behavioral Sciences*, 3rd World Conference on Learning, Teaching and Educational Leadership (WCLTA-2012), pp. 612 – 617.
- National Institute for Communicable Diseases. (2020). First case of Covid-19 announced – An update. [Online] <https://www.nicd.ac.za/first-case-of-covid-19-announced-an-update/>. [Accessed on 26 May 2022]
- Pokhrel, S. and Chhetri, R. (2021). A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning. *Higher education for the future*. Vol.8(1), pp 133-141. DOI: 10.1177/2347631120983481
- Republic of South Africa. About Coronavirus COVID-19. [Online] <https://www.gov.za/covid-19/about>. [Accessed 14 June 2022]



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