

Student Learning Outcomes of Chemistry Education Undergraduate Program Through Online Mode

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ABSTRAK

Pembelajaran online sangat mempengaruhi hasil belajar siswa. Proses pembelajaran online yang sangat berbeda dengan tatap muka menuntut siswa untuk dapat beradaptasi dengan baik. Proses pembelajaran dilakukan secara online, sebagian besar siswa akan kesulitan memahami materi sehingga hasil belajar yang diperoleh kurang maksimal. Penelitian ini bertujuan untuk menganalisis hasil belajar dan kesulitan yang dialami mahasiswa selama pembelajaran online. Jenis penelitian ini yaitu kualitatif. Subyek dalam penelitian ini ditentukan dengan menggunakan teknik purposive sampling. Teknik pengumpulan data yang digunakan adalah analisis dokumen dan wawancara terstruktur. Data yang telah ditemukan selanjutnya diolah dengan teknik reduksi data, penyajian dan verifikasi. Peneliti menemukan bahwa setiap mata kuliah menyebarkan nilai dari A sampai BC. Hasil analisis data wawancara menunjukkan bahwa kesulitan mahasiswa selama pembelajaran online adalah lemahnya layanan internet, mahasiswa kesulitan mengatur waktu, ciri-ciri materi sulit diajarkan secara online, dosen hanya menyediakan bahan ajar, tugas terlalu banyak, dan tugas relatif singkat. waktu pengumpulan. Dengan demikian, dapat disimpulkan bahwa hasil belajar mahasiswa Prodi Pendidikan Kimia tergolong sangat tinggi.

ABSTRACT

Online learning dramatically affects student learning outcomes. The online learning process that is very different from face-to-face requires students to adapt well. The learning process is carried out online, and most students will have difficulty understanding the material, so the learning outcomes obtained are less than optimal. This study aims to analyze the learning outcomes and difficulties experienced by students during online learning. This type of research is qualitative. The subjects in this study were determined using the purposive sampling technique. Data collection techniques used are document analysis and structured interviews. The data that has been found is then processed using data reduction, presentation, and leverage techniques. The researcher found that each course spread the score from A to BC. The results of data analysis show that learning difficulties during online learning are weak internet services and difficulty managing time. The characteristics of a material that is difficult to teach online are lecturers only providing teaching materials, too many assignments, and relatively short assignments. Collection time. Thus, it can be said that the student learning outcomes of the Chemistry Education Study Program are classified as very high.

1. INTRODUCTION

The COVID-19 pandemic has caused Indonesia to change its face-to-face learning system to online or online. Based on the circular letter of the Ministry of Education and Culture (Kemendikbud) number 4 of 2020 regarding the implementation of education policies during the emergency period of the spread of COVID-19 (Basar, 2021; Nathavitharana et al., 2020). The circular instructs to conduct distance learning and advises students to study at home and the teaching and learning process is directed towards understanding the spread and prevention of the corona virus outbreak (Abidin et al., 2020; Abumalloh et al., 2021; Nahdi & Jatisunda, 2020; Noori, 2021). Online learning or also known as distance learning is learning designed for students who are in different places from educators (Kusuma, 2020)(Nartiningrum, 2020; Nikdel Teymori & Fardin, 2020). One of the universities that implement online learning is Syiah

Kuala University (USK) by circulating letter number: B/1491/UN11/KP.11.00/2020 which contains lectures conducted online for two weeks to prevent and protect all academics and education staff as well as external parties within the USK environment, and decided to extend the online learning system until the end of the 2020/2021 even semester in the rector's circular number: B/1669/UN11/KP11.00/2020.

Chemistry learning is one of the most difficult lessons to teach online. Chemistry is a group of natural sciences which is seen as a process (scientific activity to discover or perfect a knowledge) and a product (the result of a process discovered by chemical scientists, namely in the form of facts, concepts, principles, laws and theories) (Sari et al., 2020; Smith & Friel, 2021; Suardana et al., 2018). Materials in the form of abstract or complex concepts (reactions), and procedures in the form of calculation materials are widely available in the odd semester (MK) courses for the 2020/2021 academic year. The constitutional court with calculation material is a little complicated because there are several formulas and formula derivations that must be understood because they are related to existing theories so you have to think and reason to find patterns, solve problems in the form of questions, and link patterns. Likewise, the material for reactions requires detailed understanding because each material is related to one another, so that both materials require students to be actively involved in learning activities. Both types of material must also be explained *step by step* because they are procedural materials. This is because students have difficulty understanding concepts and lack the ability to operate mathematics (Sudiana et al., 2019).

If the learning process is carried out online, most students will have difficulty understanding the material so that the learning outcomes obtained are less than optimal (Fikri et al., 2021; Hutaaruk & Sidabutar, 2020; Nartiningrum, 2020; Primasari & , Zulela, 2019). In addition, educators also have difficulty finding media and easy methods to explain the material so that students are not bored and active during the learning process (Lutfi, A. et al., 2021; Shirish et al., 2021; Shodiq & Zainiyati, 2020). Based on the results of initial observations, several students of the Department of Chemistry Education FKIP USK stated that online learning was not fun because of the difficulty of accessing the internet, and the high demand for internet quota. Limitations in the field of technology include the use of *mobile phones* or laptops which are often jammed and slow, as well as overheating and even exploding due to prolonged use. Some students do not have laptops, but there are also students who only have one laptop but have to take turns with other family members because online learning is carried out at the same time. These obstacles could be the reason why chemistry students get C, D, and E grades even though there has been a circular from the USK Chancellor containing the student's score during online learning at least BC.

The application used during online learning is in accordance with the policy in the Department of Chemistry Education, namely using applications that have been agreed upon by the department, namely *zoom*, and *whatsapp* (WA) for students who have network difficulties (Marsiding, 2021; Mulyono et al., 2021; Oktario et al., 2019; Suhery et al., 2020). However, lecturers can use other applications according to their skills such as *google meet*, *gmail*, *e-learning*, *google classroom*, and so on (Amrina & Sundari, 2021; Guswara, 2020; Suhery et al., 2020). Educators do not need to wait for the presence of students for a long time because students can immediately join the application easily. Students can also observe carefully and thoroughly the material explained or written by educators, and can record the learning process and can be viewed again in their accounts *cloud* respective (Marsiding, 2021; Mayang Ayu Sunami & Aslam, 2021; Mpungose, 2021).

Previous research found that applications *google meet* and *zoom* often used for online learning, because it can facilitate educators in controlling learners (Kasman & Hamdani, 2021; Putra, 2021; Setyawan et al., 2020). The applications *zoom* and *google meet* require a stable internet network, a large enough *megabyte* (MB) size to makememory *mobile phone* full (especially *phones* with low storage capacity), and use limited time on *zoom* (Kasman & Hamdani, 2021; Mpungose, 2021). The use of *zoom* is very influential on learning outcomes. Other research found that 92% of students scored >65 by using *zoom* (Vegatama & Amiruddin., 2021). There is no study on student learning outcomes in the chemistry education program through online mode. This study aimed to analyze the learning outcomes and difficulties experienced by the 2019 USK FKIP Chemistry Education students during online learning using a qualitative descriptive method.

2. METHODS

This study uses a qualitative-descriptive approach. Qualitative-descriptive research was used to gain an in-depth understanding of learning outcomes and barriers for students of the Department of Chemistry Education Class of 2019 during online learning. The subjects in this study were students of the Department of Chemistry Education class of 2019 who took part in the odd semester learning of the 2020/2021 academic year during online learning. This research was conducted by determining the subjects to be analyzed first. Courses that have been set for learning in the odd semester of the 2020/2021

academic year were selected using a *purposive sampling technique*, so that 5 subjects were used as research subjects, namely monofunctional organic chemistry, structure and reactivity of inorganic compounds, chemical and phase equilibrium, chemical bonding, and teaching and learning strategies. After that, it is determined which students will be interviewed in each subject based on the percentage of learning outcomes, which is 30%.

The data in this study were collected by researchers by obtaining directly from the study program coordinator and the course coordinator lecturer in the form of a recap of grades in *softcopy (microsoft excel)*. It is aim to get student grades in the form of letters and numbers that are used as samples. The data collection techniques used in this research are documentation studies and structured interviews. Where, interview guidelines were obtained from existing research, namely from thesis related to online learning. This research used qualitative data analysis techniques according to Miles and Huberman, which consisted of data reduction, presentation and verification. The steps of the data analysis technique carried out were: First, the data obtained from the documentation of student learning outcomes were analyzed carefully and in detail, namely looking for the percentage value first using simple statistics. Second, the data obtained from the interview activities are summarized first, searched for and selected important things according to the focus of the problem regarding student learning outcomes of the Chemistry Education Department, FKIP USK batch 2019 odd semester 2020/2021. Third, the reduced documentation data will be described and presented in the form of a diagram. Fourth, interview data is described in the form of narration. Fifth, conclusion.

3. RESULTS AND DICCUSSION

Results

Monofunctional Organic Chemistry is carried out online using the WA application, *google meet*, *email* and *zoom*. WA, *google meet* and *zoom* are used as a means of teaching and learning during the pandemic, while *email* is used as a place for collecting assignments. Based on the analysis of the assessment document in accordance with the attachment recap of the value recap of the Chemistry Education Department of FKIP USK 2019. The results obtained are pictures of monofunctional organic chemistry learning in [Figure 1](#).

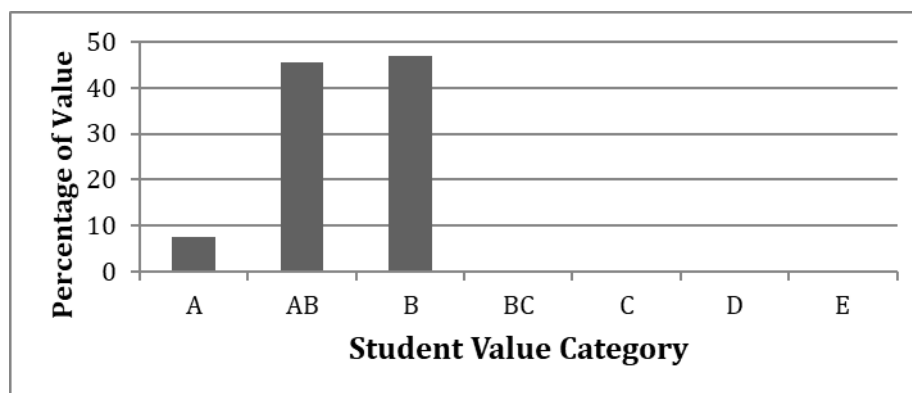


Figure 1. Learning outcomes of monofunctional organic chemistry

[Figure 1](#) shows that student learning outcomes in monofunctional organic chemistry courses can be categorized as low because students get an A score which is much lower by 7.6%, while for AB and B scores, it is much higher. Students who got AB scores were 45.6% and B grades were much more, which was around 46.8%, even so it can be said that students have been able to achieve the expected learning outcomes. Research conducted by Giatman, et al. (2020) also stated that students who got AB scores around 29.3% and B scores around 33.6% have been able to achieve the expected learning outcomes, although students who got A grades were only 8.6%.

Based on the results of interviews, S48 students with A grades stated that "I have no difficulties when participating in learning using *google meet*, *zoom*, WA and *e-mail* because the network at my house is quite good, but the way the lecturer delivers the material is difficult to understand". Different things were conveyed by students with AB scores that they had difficulties when participating in learning because they were constrained by the network so that their interest in learning decreased. The number of students who get B grades in monofunctional organic chemistry courses is due to the characteristics of the material that are difficult to explain online. Students stated that the materials that were difficult to teach

online were the nomenclature of organic compounds, derivative materials, too many structures and structural formulas that were difficult to understand. Around 12.5% of students stated that the lecturer of the course was very helpful in the learning process because it provided teaching materials and delivery of material that was easy to understand. However, students also experience difficulties in understanding teaching materials, due to the language used is slightly standardized and in English, so students must translate first. The use of applications during online learning is very influential, the structure and reactivity of inorganic compounds uses WA, *quizizz*, and *zoom*. *Quizizz* is used to evaluate online learning and is very influential on learning outcomes. This is because the application *quizizz* can increase students' concentration and learning motivation, besides that the appearance of the application is also attractive so that it can foster student interest and enthusiasm.

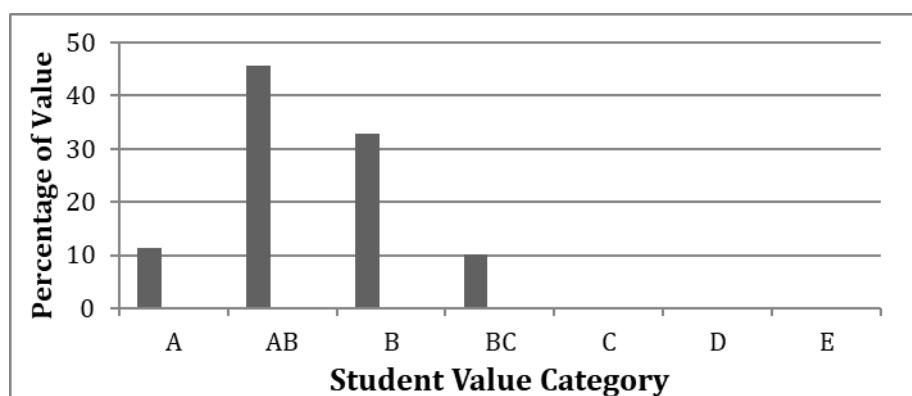


Figure 2. Learning outcomes of structure and reactivity of anorganic compounds

Based on [Figure 2](#), student learning outcomes of the Chemistry Education Department FKIP USK class 2019 can be categorized as high with the use of *quizizz*. This is because the AB score obtained by students is quite a lot, namely 45.6% and also the A grade is 11.4%, inversely proportional to the B value of around 32.9% and the BC value which is much lower, which is 10.1%. . The results of research conducted by Panggabean & Harahap (2020) also show that the use of *quizizz* has a major effect on learning outcomes of around 78%. Students with grades AB and BC said that the material characteristics of the structure and reactivity of inorganic compounds were difficult to teach using the application *quizizz*. This is because the questions given at the time of the exam are quite difficult and the processing time is relatively short so that students get unsatisfactory scores.

The use of *quizizz* also relies heavily on a good internet network. Students with B grades have difficulty accessing the internet, so they must first find a place to attend lectures. The S6 student with an A grade also said that "I am not constrained in the learning process because I can ask the lecturer if there is material that is difficult to understand". This shows that the interactions that occur between students and lecturers in this course continue to run well even though learning is carried out online, even students tend to be more active in asking questions. The online learning process for chemical and phase equilibrium courses is carried out using the WA application, *zoom*, *google meet*, *google classroom* and *e-learning*. *Zoom* and *google meet* are used for face-to-face activities during online learning, while WA, *google classroom*, and *e-learning* are for sharing teaching materials. The following are the results of the analysis of chemical and phase equilibrium data in accordance with the attachment of the recap of student scores of the Department of Chemistry Education FKIP USK 2019.

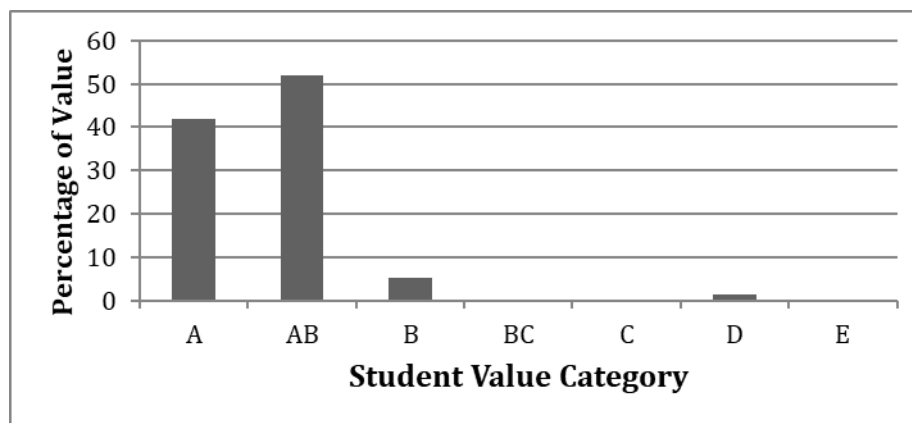


Figure 3. Learning outcomes of chemical and phase equilibrium

Figure 3 shows that student learning outcomes in chemical and phase equilibrium are very high, due to the varied applications used. This is because students get 41.8% and 51.9% A and AB grades, while B grades are only 5.06% and D grades are around 1.3%. The results of previous research conducted by Sari, et al. (2021) also showed that students obtained good learning outcomes with the use of varied applications. The S33 student with a B grade said that "Using zoom and google meet is very useful in the learning process, lecturers can share the explained ppt while whatsapp is only a photo so they are confused which material is being explained". A S7 student with a D said that "When I was online, I didn't really respond to lectures because there was a shop at home and I wasn't good at adjusting the time." In addition, the characteristics of the material in this course are more calculations or procedures so it is very difficult to teach online.

Some students are lacking in calculation material, some even feel that the value they get is not the original value. There is help when doing assignments and completing exam questions both from friends and searching from *Google*. Students also said that there are lecturers in this course who only provide teaching materials and then students are required to study independently so that they lack understanding of some materials. Independent learning is a learning process based on one's own desires and choices, without encouragement from others, having self-confidence so that they are actively involved in the learning process and are able to solve the problems they face. This is what makes the value of students in the chemical equilibrium course relatively high. Chemical bonding courses use WA *group* (video integrated LKM) and zoom as learning media during online learning. Learning by using videos or *YouTube* can make it easier for students to understand the material taught by lecturers, because the material is clearer and more interesting. level of student understanding of the material being taught is very influential on learning outcomes. This is in accordance with the analysis of student learning outcomes in chemical bonding courses in Figure 4.

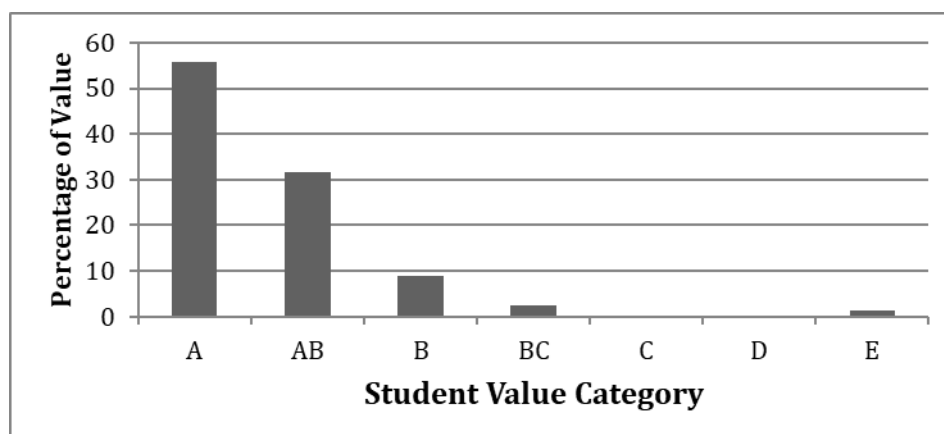


Figure 4. Learning outcomes of chemical bonds

Based on Figure 4, it can be concluded that the learning outcomes of the 2019 USK FKIP chemistry students in the chemical bonding course are in the very high category, because students get A and AB scores which are much higher than other scores, namely 55.7 for A and 31 grades. 7% for the value of AB.

Students got a B score of 8.9%, and a BC score of 2.5%, but there were also students who got an E score of around 1.3%. Students feel that the chemical bond course requires extra effort to understand the material compared to other subjects so that the results obtained are also satisfactory. Lecturers have conveyed the material as much as possible, but there are also those who only teach the basic concepts. The S29 student with an A said that "Using *zoom* is very useful because there is a *share screen* which is very helpful in the learning process".

The student who got the AB score, namely S42, also said that "I am more interested in learning through *YouTube* because it is very interesting, easier to understand, and can be repeated again", while the S48 student stated that "The learning process that takes place depends on the lecturer's use of the application. , because some lecturers cannot use it properly". Students who got BC and E grades said that they preferred face-to-face learning because the characteristics of this course material were very difficult, namely discussing elements and a lot of procedural material in the form of calculations. Students find online learning quite burdensome. This is because the learning system is much different from face-to-face and there are lecturers who only provide teaching materials without explaining the material first and giving assignments instead of changing lecture hours. Teaching and learning strategy courses are taught online using WA, *google meet* and *zoom*. *Google meet* and *zoom* are applications that provide video conferencing so that teaching and learning activities feel real, because lecturers and students can meet face to face. Online learning that is carried out using video conferencing applications can increase the effectiveness of learning, but the use of *theplatform* rightcan also increase student comfort in learning so that it affects learning outcomes, such as WA which is very liked by students during online learning.

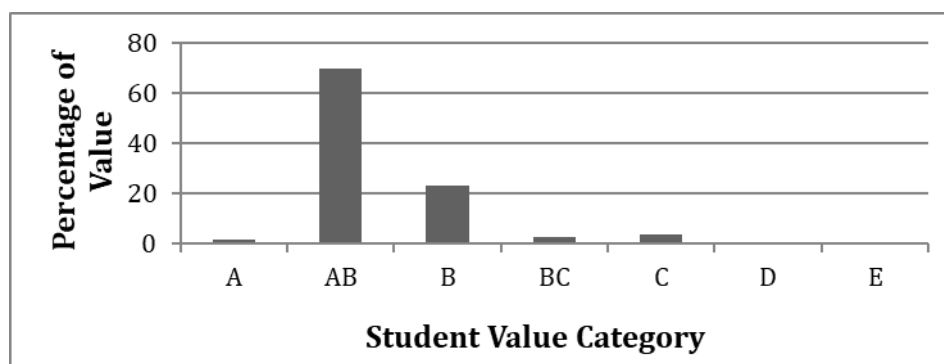


Figure 5. Learning outcomes of teaching and learning strategies

Figure 5 shows that students who get an A score are only 1.3%, but students who get an AB score are 69.6% and a B grade are 22.8%. Students who get a BC score of 2.5%, and a C score of 3.8%. Based on this, it can be concluded that student learning outcomes in teaching and learning strategies are relatively high, in accordance with previous research conducted by Juwita (2020) that the use of online media affects learning outcomes with a percentage of 81 for students who score >78. The S10 student who got a B said that "Teaching and learning strategies are very difficult to teach online because there are too many theories and not explained in detail. Lecturers also use the lecture method so that it is less interesting and several times they do not enter so they are overwhelmed by their own learning".

Students get AB scores which are much more than A scores because the questions given during the exam by one of the lecturers are too difficult. The characteristics of the questions given are applications in everyday life so that students find it difficult to work because they do not understand the material well. In addition, the lecturer did not attend several times so that some material was not taught, only providing teaching materials and assignments. The poor quality of the internet network makes it difficult for students to log into the application, besides that the image quality is also not good and the sound is intermittent. Some lecturers will not accept assignments if they are submitted late, as well as during exams it is sometimes difficult to log in. Limitations in buying internet quotas, the Ministry of Education and Culture, Research and Technology on Education and Culture *the Ministry of website* (<https://www.kemdikbud.go.id>) does state that it has distributed internet quota assistance to support online learning, but the quota cannot meet the needs of students.

Discussion

The applications used are very influential on the teaching and learning process, for example *Google Meet* and *Zoom*. Lecturers present teaching materials through *share screens* and explain the material and students listen at the same time as during face-to-face learning, even though they still have

drawbacks because lecturers cannot see student activities and students are not necessarily 100% listening to the material being taught (Firman et al., 2021; Nugroho et al., 2021; Uygarer & Uzunboylu, 2017). This can happen because students are less focused in participating in online learning so that they do other activities outside of lectures, for example, such as daydreaming, using social media, doing homework, and others (Fauza et al., 2020; Fikri et al., 2021; Hutauruk & Sidabutar, 2020). The interactions that occur between students and lecturers continue to run well even though learning is carried out online, even students tend to be more active in asking questions. Online learning makes students' self-confidence increase so that they are actively involved in the teaching and learning process (Astuti & Febrian, 2019; Kumari et al., 2020). Students said that online learning was quite burdensome and preferred face-to-face learning. This is because the learning system is much different from face-to-face and students are getting bored with online learning due to giving a lot of assignments so they are lazy to do them and become late in collecting assignments (Ferreira et al., 2018; Rahayu et al., 2020). In addition, network constraints also prevent students from participating in online learning as much as possible so that students experience a decrease in motivation due to low absorption of knowledge on the material taught by lecturers (Muhammad et al., 2021).

Based on data analysis of learning outcomes for chemistry students of FKIP USK class of 2019 in the odd semester of 2020/2021 which was carried out online, it showed that the achievement of learning outcomes obtained was very maximal. On average, students get grades A, AB, B, and BC although there are students who get grades C, D and even E in several courses. Based on the results of interviews, students said that good grades were obtained by continuously repeating the material that had been taught, studying independently by looking for other teaching materials if the teaching materials provided by the lecturer were difficult to understand. Other research found that the teaching materials provided by the lecturers in the form of videos, *power points* (PPT), *portable document format* (PDF) greatly facilitate students in understanding the material because they are considered clearly interesting and can be repeated when studying individually (Agustina & Nandiyanto, 2021; Sari et al., 2021). In addition, the presence of assistance when doing assignments and completing exam questions is also one of the reasons. This is a violation and can cause students to become lazy and tend to rely on their friends. As a result, the level of student understanding of the material being taught is low. The learning outcomes obtained tend to be good but the level of understanding of the material is low (Byrka, 2017; Mulyono et al., 2021; Nainggolan & Manalu, 2021).

The method used by lecturers in online learning is also very influential in the learning process. This is in accordance with research states that the ability of educators and students to access and manage technology systems used in online learning is one of the factors supporting the success of the teaching and learning process (Binali et al., 2021; Khatoony & Nezhadmehr, 2020; Mishra et al., 2020). Lecturers often use the lecture method during online learning. The lecture method will benefit students who have a learning style by utilizing the sense of hearing to facilitate the learning process (auditory learning style), while students who do not have this learning style will be left behind in the learning process because it takes a long time to process information (Wahyuni, 2017). This of course does not take into account the various aspects of student learning tendencies (Wahyuni, 2017). An alternative that can be done by lecturers to overcome this is to use applications that students prefer. This is because students will feel comfortable using the applications they like, so they can participate in learning activities optimally (Mahendra, 2021).

4. CONCLUSION

The student learning outcomes of the Chemistry Education Department FKIP USK class of 2019 odd semester 2020/2021 which are carried out online are relatively high, this is because student learning outcomes are evenly distributed in all subjects getting grades A, AB, B, and BC. The difficulties experienced by students of the Department of Chemistry Education during online learning are: weak services in accessing the internet, students have difficulty in managing time, the characteristics of the material are difficult to teach online so it is difficult to understand, lecturers only provide teaching materials, too many assignments, and time to collect assignments. relatively short.

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