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# An Investigation of Students' Difficulties in Statistics Courses on Online Learning at Universitas Terbuka Taiwan

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***Abstract***

*This study aims to determine the students' difficulties in online learning. Online learning is one solution offered by several parties such as the government, universities, and teachers. However, this has not been fully able to help students understand the statistics well. This study investigates students' difficulties in terms of topics, learning processes, and assignments. The students have taken statistics courses for one semester. The data collection techniques with open questionnaires via google Forms and online interviews. The number of participants for open questionnaires was 25 students and 6 students were taken to be interviewed. Based on the questionnaires and interviews conducted with students, the results of the study are that students still have difficulty in understanding the material itself because of complicated calculations, complicated formulas, and Unrealistic. While the difficulties of students in online learning are limited time, network problems, explanations and examples of questions are not written in detail in online learning, the strategies used in online learning make some students negligent in learning, and the number of online meetings is still lacking, online learning can be helpful but not maximized. Moreover, students' difficulties with assignments such as the formula are very much, the book has several errors, students do not understand the stages in solving problems, difficulty in determining the symbols used in the story problem, difficulty in calculating it, difficulty in imagining the application of the formula into real life. The recommendation from this study is the statistics teacher can choose the appropriate learning model for statistics courses.*

***Keywords:*** *Students' Difficulties, Statistics Learning, Online Learning*

## 1. INTRODUCTION

Statistics courses are one of the important topics taught in higher education, all majors study it because of the importance of this science. Although we already know how important statistical education and learning are, the reality that we have discovered lately is that many students experience difficulties in learning statistics. Student difficulties in statistical learning is a condition where students cannot follow the learning and understand the material delivered by the teacher both face to face in class and online. Although the government, schools, and education experts have designed the curriculum. This online-based learning has positive benefits to help students learn while at the same time they also have to work. But student difficulties are increasing when they have to learn statistics and other calculating knowledge when taught online. The difficulty of students in this learning cannot be allowed to continue to occur. If this

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problem is not immediately analyzed and studied in depth, students will always have difficulty in learning statistics.

The case of students experiencing difficulties in learning statistics has been known by many people and also many previous researchers who analyzed it, including[1], [2], and [3]. Students' difficulties in learning statistics ultimately affect psychology such as anxiety, and discomfort until finally dislikes the learning of statistics [4]. Online-based learning has also been carried out by several previous researchers, including [5] the results of this research confirm the size of the class on online learning affects the success of the quality of learning. Client-based goals aim to enable many students to access and respond to posts. Here the teacher must be actively involved in online conversations. Furthermore, [6] stated video and visuals are important to be used as a learning tool. Many students use YouTube online in learning, but this is only a supporter of classroom learning. Learning is very helpful and makes the achievement more significant. And this is also expressed by [7] maintains online learning is very helpful in learning in the classroom, so learning in the classroom becomes more effective and saves some time, both for teachers and students. [8] Online-based learning has a positive impact and a negative impact on learning. The positive impact is that online-based learning is better for students in conditioning themselves, students are more responsible for themselves in learning, improving students' ability to use computers and the internet. However, online-based learning also has a negative impact, namely changes in learning becoming more slowly, testing different subjects will create obstacles, and finding the right technology as a support in learning control.

All of these studies say that online learning is very helpful for students in learning and can improve learning outcomes, but online learning is carried out as a support for learning carried out in the classroom. Other research [9] maintains online statistics-based learning has an impact on student anxiety and student attitudes. But many researchers previously researched quantitatively by assuming that the treatment to be given will have a better impact than before. However, this condition cannot be said to be one hundred percent successful if it is used for all cases, because other researchers do not dig deeply into the conditions experienced by actual students. So, in this study, researchers want to analyze in depth what is the cause of students' difficulties in learning statistics.

## 2. RESEARCH METHODS

This type of research is grounded in qualitative research, which will be investigated the difficulty of students in learning statistics by using online-based learning. The students have

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taken statistics courses for one semester before being interviewed. The data collection techniques with open questionnaires via google Forms and online interviews. The interview used is the semi-structured interview. This semi-structured interview was conducted to direct the research but still be able to explore in-depth information. Interviews are conducted using social media as a tool and recording videos during the conversation. The interview begins by asking about the respondent's identity and asking about the condition of the respondent's work first until the respondent feels comfortable then starts giving the questions that have been planned. Making respondents comfortable is an important thing to do to get more information that researchers want to get. As well as the researcher asks several supporting questions that are needed when there are important things to ask about the responses of the respondents. All questions in the interview and open questionnaire are based on matters relating to the constraints and difficulties of students during online statistical learning. The things that are seen are the difficulties students have on statistical topics, constraints in the learning process, and constraints in doing assignments.

The number of participants for open questionnaires was 25 students (one class of management students at Taiwan Open University) and 6 students were taken to be interviewed, of which 3 male students of various abilities and 3 female students of various abilities as well. (That means various abilities are: high, medium, and low). The following is attached data from participants using a pseudonym to keep their privacy of the participants:

**Table 1.** Participants Background

| No | Name | Sex | Category | Age (Years) | Nationality | Department | Duration of study |
|---|---|---|---|---|---|---|---|
| 1 | Pirma | Male | High Level | 38 | Indonesian | Management | 1 year |
| 2 | Aris | Male | Medium Level | 31 | Indonesian | Management | 1 year |
| 3 | Mukhlis | Male | Low Level | 23 | Indonesian | Management | 1 year |
| 4 | Hesti | Female | High Level | 30 | Indonesian | Management | 1 year |
| 5 | Ike | Female | Medium Level | 23 | Indonesian | Management | 1 year |
| 6 | Tina | Female | Low Level | 26 | Indonesian | Management | 1 year |

Data collection is done using open questionnaires and interviews. Data collection using the open questionnaire was carried out from November 25-29th, 2018 using the google form. And interviews were conducted with students on December 2nd, 2018 by video call. The research procedure can also be seen in Figure 1 below:

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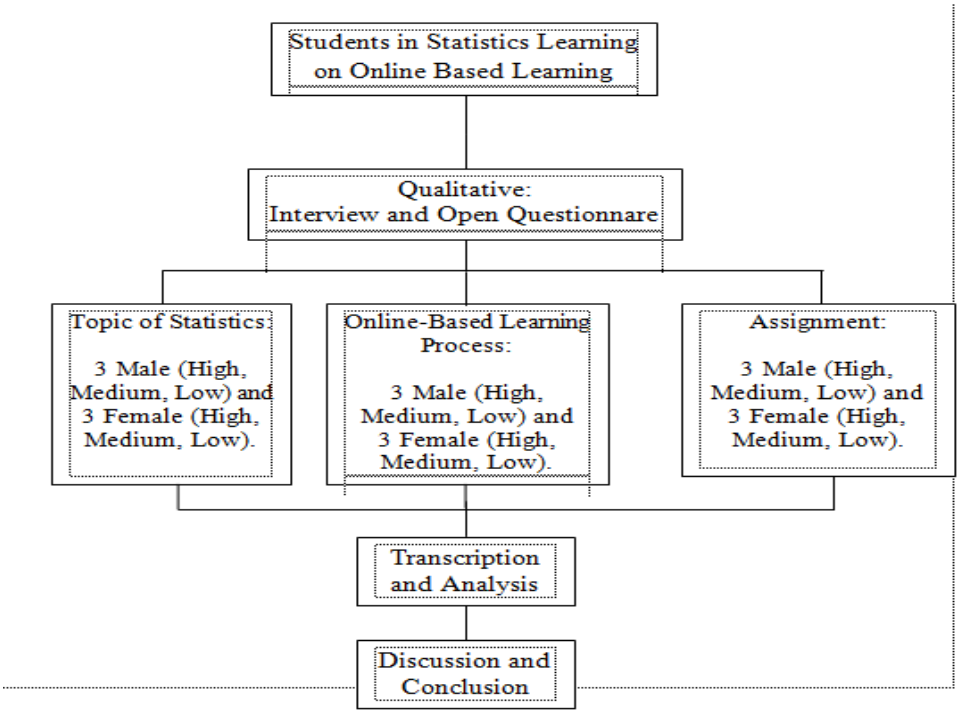


**Figure 1** Research Procedure

Data were analyzed based on video recordings during interviews with participants. The video recordings are listened to repeatedly and transcripts are made from those delivered by participants. After the results of the transcripts were obtained, the data were analyzed based on the 5 stages: (1) compiling, (2) disassembling, (3) reassembling, (4) interpreting, and (5) concluding [10]. At the compiling stage, the researcher put all the responses from the participants on the transcript. At the stage of disassembling researchers make coding in table form by making substantives themes to recognize the disassembled fragments or pieces into different grouping and sequences. At the reassembling stage, the researcher rearranges and combines the first coding into table form and groups them according to themes and groups. At the interpreting stage, the researcher makes a graphic design based on three important parts that he wants to examine, namely the difficulties of students in understanding the topics in online learning, difficulties in the online learning process, and the difficulties of students in performing tasks given online and after learning. This graphic design is useful to make it easier for researchers to see in detail the relationship between each student's difficulties in learning statistics and can more easily make interpretations. And at the concluding stage, the researcher draws conclusions based on the interpretation and makes the metamorphosis of the phenomena of the students' difficulties in statistics courses.

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## 3. RESULTS AND ANALYSIS

Based on the research conducted using interviews and open questionnaires, some results could answer the research questions including:

Students like some topics in statistical learning because the topic is easy to understand such as calculating mean, modus, median, quartile, decile, percentile, etc, the formula is simple, and the concept can be applied to everyday life. On the other hand, students do not like some topics such as t-test, f-test, variance analyses, etc, because they have difficulty understanding formulas, using them, and calculating small numbers. And there is not much time they can use to study. The constraints that they have in statistical learning include: material that sometimes makes no sense because it is difficult to imagine the application in real life (such as the hypothesis), their difficulties are to remembering so many formulas and using them, calculations are also complicated, internet networks are sometimes problematic, and for some students, the available learning time is not right because they are still working while learning. This research is supported by other studies which say that students have difficulty understanding concepts, principles, and skills [11]. The factors that made learning difficult for students in the statistics course, namely the factors themselves, lecturers' factors, environmental factors/parents as well as facilities and infrastructure factors [12].#Besides the problem mentioned, there are other problems such as mistake in calculating and mistake in using the formula [13]. Students have obstacles in the online learning process [14].

The following are questions from students who say that not all topics in statistical learning are considered difficult, but some topics they like in learning.

The following is a conversation quote with students:

*“Saya rasa topik yang paling sulit dipahami adalah hipotesis, khususnya pada bagian observasi dan bagian menghitungnya uji-t dan uji-f.* ***Kesulitan dalam menghitung angka kecil dalam bentuk 0 komaan****, secara manual. karena nilainya itu kecil dan berkoma serta bukan bilangan bulat. Tetapi kalau* ***materi hipotesis itu sepertinya belum masuk akal****. Seperti Z-table lebih besar dari Z-hitungnya, saya hanya tau bagian itu, sedangkan untuk menghitungnya masih susah”.*

*(Pirma, Male Indonesia, High Level)*

In the statement revealed by Pirma above, it appears that she is having difficulty because of the small number calculation. And on the topic of the hypothesis, according to him, it could not make sense because the problems raised were not realistic or were not close to the problems he often faced.

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*"Saya baru mendapatkan pembelajaran statistik disini, sehingga mungkin bisa sedikit memahaminya. Tapi saya akan selalu berusaha memahaminya. Kesulitan pertama adalah* ***susah memahami rumus dan penyusunan kata-katanya****".*

*(Aris, Male Indonesia, Medium Level)*

Based on the interview conducted with Aris, it was seen that the difficulties in understanding the formulas in statistical learning and the words used in learning such as hypotheses and so on were still difficult to understand.

*"Kalau saya mempunyai masalah karena pembelajaran hitungan, karena angka pasti jadi tidak bisa hanya menggunakan logika saja dalam menjawabnya.* ***Perhitungannya rumit****, sebenarnya bisa dipahami tetapi saya malas melihat dan mikirkan angka-angka yang banyak itu,* ***karena butuh beberapa proses untuk menyelesaikannya".***

*(Mukhlis, Male Indonesia, Low Level)*

Based on the statement suggested by Mukhlis, it seems that the difficulty in understanding statistical topics is because of their complex calculations and solving statistical problems requires many stages of completion so that eventually they can find a solution.

*"Saya lebih suka pembelajaran tatap muka, karena pada pembelajaran online* ***teman-teman saya presentasi ada yang hanya membaca saja jadi susah dipahami, disitu kendalanya****. Terkadang jaringan juga bermasalah. Sedangkan pembelajaran tatap muka tidak ada masalah, tetapi sebaiknya waktu pembelajarannya lebih di percepat dimulai".*

*(Hesti, Female Indonesia, High Level)*

Based on the statement from Hesti, it was seen that he did not experience significant difficulties in understanding statistical topics, but that made him not understand the topic because his friend who presented learning while online was not very clear, so he did not understand statistical material.

*"Analisis variansi, karena rumus-rumusnya itu susah dijabarkan sehingga susah dipelajari.* ***Susah memasukan soal-soal ke dalam rumus****. Susah menentukan setiap item yang ada dalam soal kepada rumus".*

*(Ike, Female Indonesia, Medium Level)*

Based on the statement stated by Ike, it can be seen that the difficulty in understanding statistical material is the difficulty in entering questions into the existing formula.

*"Rumusnya seperti φ dan yang lainnya.* ***Saya susah mengingat rumus****. Jika ada soal yang akan dikerjakan* ***belum paham rumus yang mana yang digunakan*** *dan juga belum paham bagian* ***lambang-lambang dari rumus pada soal*** *juga belum paham.*

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*(Tina, Female Indonesia, Low Level)*

Based on the interviews conducted with Tina, it was seen that she still could not understand the symbols on the question and did not understand how to enter the formula to the questions given. Another difficulty is that Tina feels she has difficulty remembering existing formulas.

All students think face-to-face learning is better than online learning because the explanation is more detailed, written every step of the solution, can be seen directly using the formula, and can focus on learning. And the learning model used is also interesting with the holding of games and quizzes. While in online learning, students feel unable to focus on learning, because some students work while learning. And the explanation is only displayed in the form of a PowerPoint. But on the other hand, online learning has the advantage of being able to save time, and also the learning process is directly focused on the point. The obstacles experienced by students in online learning are too late at night and still working at the time. And the explanation of the formula is not detailed. Students hope that the meeting can be added, the learning time is accelerated, the learning methods used in group forms, and the stages in using the formula can be written accurately on the board because they need the process of applying the formula to the questions. All students feel helped by online learning because there is guidance from the teacher, so they can still learn even in working conditions. With the guidance of the online teacher, they become able to understand statistics and can answer the test. Next is the question of students who say that the difficulty in online learning is:

*"Tidak ada masalah, tetapi sebenarnya pengen mulai pembelajaran jam 9 malam,* ***biar tidak terlalu ngantuk*** *tetapi teman-teman masih ada yang kerja lembur jadi tidak apa-apa. Kalau soal-soal hitungan walaupun sudah larut malam masih semangat, tetapi kalau sudah materi hipotesis, saya tidak mengerti malah membikin mengantuk. Kalau hitungan-hitungan yang kita mengerti sedikit-sedikit malah semangat. Kalau mata kuliah lain yang tidak hitungan jam 11 itu sudah ngantuk banget. Materi hipotesis di akhir-akhir jam bikin ngantuk sudah malam karena masih belum paham karena masih kurang membaca dan belajar".*

*(Pirma, Male Indonesia, High Level)*

Based on the statement stated by Pirma, it was seen that the learning carried out was problematic with time because the learning time carried out at night made him drowsy during online learning.

*"Yang menjadi kendala adalah* ***waktu****, karena kita bekerja secara bergantian (terkadang bekerja pagi dan terkadang bekerja malam). Pada saat mendapatkan jam bekerja pagi maka*

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*malamnya susah mengikuti pembelajaran, jika bekerja malam hari maka* ***belajarnya sambil bekerja sehingga susah untuk memahaminya****. Sewaktu libur bekerja yang 2 hari dalam seminggu terkadang ada dimanfaatkan untuk belajar".*

*(Aris, Male Indonesia, Medium Level)*

Based on the statement stated by Aris, it is seen that time is also a problem he faces. Because in Taiwan, the work using alternate systems sometimes works during the day and sometimes at night. The obstacle he faces if working at night is not being able to focus on learning, because he only listens without seeing it, especially in statistical learning that uses steps that need to be understood.

*"****Terlalu malam****, kalau saya lembur pulangnya jam 9 malam. Tapi kalau teman-teman kelas saya selesainya bekerja jam 10 malam ke atas apalagi anak-anak pekerja rumah tangga masih bekerja. Kalau kita di pabrik jam 5 sore itu sudah bisa pulang".*

*(Mukhlis, Male Indonesia, Low Level)*

Based on the statement presented by Mukhlis, it can be seen that the obstacle in online learning is the time of learning carried out at night. But on the other hand, he understands that time at night is the right time for learning for all students.

*"Pertemuan pada pembelajaran tatap muka lebih diperbanyak, jangan hanya 2 kali pertemuan saja. Karena kalau tatap muka lebih mudah dipahami terutama pembelajaran berhitung. Karena* ***di tulis di papan tulis sehingga lebih mudah dipahami****. Karena saya belajar itu dikasih kuncinya baru mudah dimengerti, kalau terfokus menjelaskan saja malah susah masuk. Pembelajaran berbasis online sudah bagus karena sudah dibagi menjadi kelompok untuk presentasi, cuman jangan langsung dibagi materi presentasinya di awal, jadi* ***kita kayak mempersiapkan bagian presentasi masing-masing saja.*** *Sebaiknya kelompoknya saja yang dibagi di awal, sedangkan materinya dibagi perminggu".*

*(Hesti, Female Indonesia, High)*

Based on the statement from Hesti, he hopes that online learning still has some disadvantages, such as the method used is limited, he hopes that online learning can be carried out like face-to-face learning, where everything is explained and written on the table and the group learning system should be improved, because if the group at the same time as the material, students will focus on the material to be displayed only and will only understand the parts that will be presented only.

*"Saya belum memiliki masalah dengannya,* ***sebaiknya pada saat pembelajaran online dimana guru menjelaskan penjabaran rumus-rumus*** *dinyalakan videonya dan difokuskan ke buku*

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*sehingga dapat dilihat proses-prosesnya sehingga membuat kami lebih paham. Jika materi yang bukan hitungan kami bisa mempelajarinya sendiri".*

*(Ike, Female Indonesia, Medium Level)*

Based on the statement expressed by Ike, it can be seen that the explanation when online learning is still written is the stages of using the formulas in the questions in detail, not just presenting what has been written completely like in PowerPoint and others.

*"Terkadang sewaktu pembelajaran online butuh presentasi, kalau* ***saya masih bekerja di malam hari****. Jadi Hand Phone otomatis diletakan di dalam saku sambil bekerja, jika hanya mendengar penjelasannya tanpa melihat tentu tidak mudah mengerti. Waktu untuk saya bekerja tidak menentu, terkadang masih banyak yang harus dikerjakan disaat pembelajaran. Kalau belajarnya terlalu malam juga capek, tapi saya jam 10 malam masih bekerja".*

*(Tina, Female Indonesia, Low Level)*

Based on the statement presented by Tina, it was seen that time was also an obstacle for him where he had to work at night while studying. This inefficiency makes it difficult for online-based learning.

Student's difficulties in understanding statistical topics and also in the learning process also affect students in doing assignments. Student's difficulties in solving questions in statistical learning include: The questions are mostly different from the examples given, there are so many formulas and there are many errors in the textbook. Other difficulties students do not understand the problem-solving phase given. They find it difficult to understand the symbols in both written and implied questions. They are also difficult to calculate and imagine the application of formulas in everyday life. Following is the question of students who say that the difficulty in working on statistical questions:

*"Ada kesulitan karena ada* ***kesalahan-kesalahan juga di dalam buku*** *seperti langkah-langkahnya, angka-angkanya, dan kunci jawabannya. Saya belum paham di bagian X bar dan* ***simbol-simbol*** *lainnya pada soal yang diberikan, karena saya baru mendapatkan pembelajaran statistika di kampus ini".*

*(Aris, Male Indonesia, Medium Level)*

Based on the statement put forward by Aris, it can be seen that the difficulty in working on the problems also arises from book errors in explaining concepts and guiding questions. So that makes it increasingly confusing in solving questions. And also Aris has not fully understood the existing symbols.

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*"Tidak ada masalah. Kalau mengerjakan soal dengan melihat buku bisa dipahami kalau tidak melihat buku tidak bisa mengerjakannya. Kalau ada buku bisa kita mencontoh tahapan penyelesaiannya. Jika tidak melihat buku penyelesaiannya jadi tidak menentu. Saya* ***belum benar-benar paham dengan tahapan penyelesaiannya****. Saya juga* ***kesulitan dalam memahami lambang-lambang yang ada pada soal-soal****, terkadang bisa dipahami dan terkadang tidak".*

*(Mukhlis, Male Indonesia, Low Level)*

Based on the statement stated by Mukhlis, it was seen that he had difficulty in solving the questions given because he did not fully understand the stages of problem-solving and did not understand the symbols in the question.

*"Ada kesulitan karena* ***rumusnya banyak sekali dan juga modul kita banyak kesalahan. Rumus susah di ingat*** *sehingga harus dibolak-balik buku lagi supaya ingat. Susah mengingat lambang-lambang yang mana untuk populasi dan sampel. Karena kurang mengulang-ngulangnya juga".*

*(Hesti, Female Indonesia, High Level)*

Based on the statement stated by Hesti, it can be seen that the difficulty is because there are too many formulas in statistical learning that make it often forgotten and bold in determining which formula is right to be used to solve each given problem.

*"Tentu, biasanya contoh soal di modul dengan soal-soal latihannya itu ada perubahan-perubahan sehingga menjadi susah. Artinya* ***soal-soalnya berbeda dengan contoh****".*

*(Ike, Female Indonesia, Medium Level)*

Based on the statement put forward by Ike, it can be seen that the difficulties in working on the problems occur because there are changes in the practice questions. Where the difference between practice questions and examples of questions he has learned makes him unable to work on the questions. It can be seen that Ike still does not fully understand and can apply the concepts and formulas he already knows.

*"****Banyak kesulitan****, kalau masalah matematika dan statistika dan hitungan-hitungan lainnya yang menggunakan rumus, saya memikirnya hitung-hitungan lagi, dan menghitungnya tidak sekedar tambah, kurang, kali, bagi. Kalau maksud dan soalnya bisa dipahami. Bagian* ***memasukan yang diketahui pada soal-soal ke dalam rumus-rumusnya*** *itu yang kurang paham. Kesulitan dalam* ***membayangkan rumus-rumus dalam kehidupan sehari-hari*** *juga susah serta* ***mengaplikasikan rumus-rumus yang ada itu****".*

*(Tina, Female Indonesia, Low Level)*

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Based on the statement stated by Tina, it can be seen that the difficulty in solving statistical questions is in entering the questions into the formulas that he has, and the difficulty in imagining the applications of existing formulas in real life.

Based on the difficulties of students in terms of understanding the topics, researchers try to interpret the phenomena that exist. Students' difficulties and their interpretations can be seen in Figure 2:

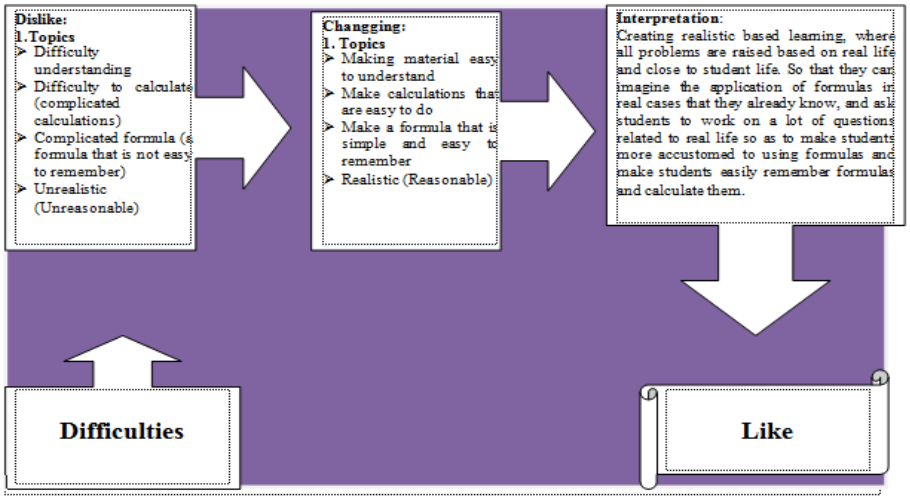


**Figure 2** Students' Difficulties in Understanding Statistical Topics

Based on the difficulties of students in terms of the learning process, researchers try to interpret the phenomena that exist. Be clearer also can be seen in Figure 3:

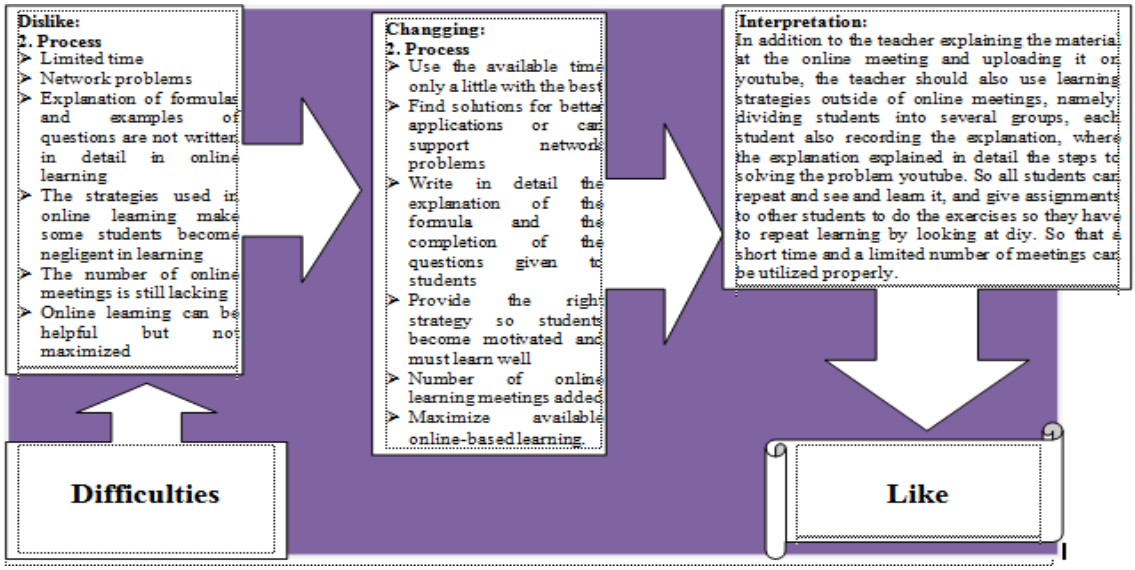


**Figure 3** Students' Difficulties in Online-Based Statistical Learning Processes

Based on the difficulties of students in terms of doing assignments researchers try to interpret the phenomena that exist. To be clearer also can be seen in Figure 4:

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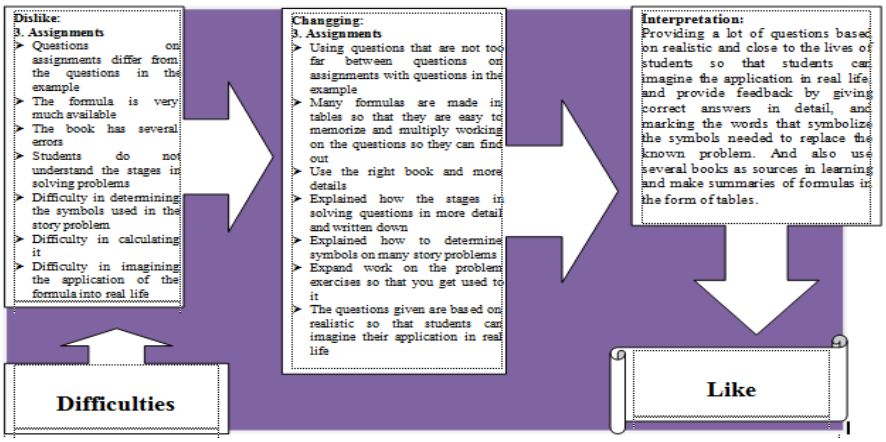


**Figure 4** Students' Difficulties in Completing Assignments

## 4. CONCLUSIONS

Some student difficulties that can be found based on three important items in learning are as follows:

### a. Topics

Students' difficulties with statistical topics include (1) Difficulty understanding. (2) Difficulty to calculate (complicated calculations). (3) Complicated formula (a formula that is not easy to remember). (4) Unrealistic (Unreasonable). These problems can be overcome by making the material easy to understand, making calculations that are easy to do, and making a formula that is simple and easy to remember, and realistic (reasonable).

### b. Process

Students' difficulties in online-based statistical learning processes include (1) Limited time. (2) Network problems. (3) Explanation of formulas and examples of questions are not written in detail in online learning. (4) The strategies used in online learning make some students negligent in learning. (5) The number of online meetings is still lacking. (6) Online learning can be helpful but not maximized. These problems can be overcome by using the available time only a little with the best, finding solutions for better applications or can support network problems, writing in detail the explanation of the formula and completion the questions given to students, provide the right strategy so students become motivated and must learn well, several online learning meetings added, maximize available online-based learning.

### c. Assignments

Student's difficulties in completing assignments include: (1) Questions on assignments differ from the questions in the example. (2) The formula is very much available. (3) The book

has several errors. (4) Students do not understand the stages of solving problems. (5) Difficulty in determining the symbols used in the story problem. (6) Difficulty in calculating it. (7) Difficulty in imagining the application of the formula in real life. These problems can be overcome by using questions that are not too far between questions on assignments with questions in the example, many formulas are made in tables so that they are easy to memorize and multiply working on the questions so they can find out, use the right book and more details, explained how the stages in solving questions in more detail and written down, explained how to determine symbols on many story problems, expand work on the problem exercises so that you get used to it, the questions given are based on realistic so that students can imagine their application in real life.

The metamorphosis of students' difficulties in learning statistics is like someone who is "lost in the desert". They don't know where to move to get out and solve this problem, while there are clues (objects) that they find as a way out but they don't understand it. On the other hand, they still have to continue to get out of this situation. During their trip, they still have to try (work) to find food for their survival.

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