

The Effect of COVID-19 on Teacher's Readiness for Online Teaching

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## Abstract

Due to COVID-19 teachers faced challenges in adapting to online teaching (Huber & Helm, 2020). The closure of schools through the pandemic occurred during a century that has been shaped by digitalisation in educational contexts (Selwyn, 2012). Faculty readiness for online teaching is a major component that determines the success of online education (Martin et al., 2019). This study investigates whether teachers actually felt ready to teach online (Brooks & Grajek, 2020) and whether educational institutions were able to adapt to online teaching in such a massive manner (Carey, 2020). The aim of this study is gaining insight in how COVID-19 changed the perceptions of teachers in the Netherlands towards their readiness for online teaching and comparing these perceptions for different educational levels (MBO, HBO and WO). This study also focuses on examining hindering or stimulating factors for teachers in online teaching. A quantitative survey study was conducted and Mixed Model ANOVA and ranking scores were used in order to answer the research questions. The results show that the perceptions of teachers' readiness for online teaching before COVID-19 changed in comparison to during COVID-19. Among all educational levels, a change in the readiness for online teaching was found but the expected differences among educational levels were not significant. Furthermore, the results of this study indicate that lack of interaction is identified as most hindering factor, while innovation is identified as most stimulating factor.

## **Introduction**

The Corona-Virus Disease 2019 (COVID-19) quickly spread across the world and was declared as a pandemic by the World Health Organization (WHO, 2020). The pandemic disrupted life with borders closing and regions being shutdown (Alon et al., 2020). Because of the vulnerability in school settings, schools closed in various countries (UNESCO, 2020). According to UNESCO (2020) 92% of the students in the world have been affected in their education by these circumstances. COVID-19 has led to a significant disruption of education with numerous of consequences (Ratten, 2020).

The school closures confronted various stakeholders such as teachers, students and parents with a completely new situation. Teachers faced challenges in adapting to this new situation through alternative means of schooling, such as online teaching, which required them to use Information and Communication Technology (ICT) tools and implement new approaches for teaching and learning (Huber & Helm, 2020).

The closure of schools through the pandemic occurred during a century that has been shaped by digitalisation in educational contexts (Selwyn, 2012). The usage of ICT in education is considered as an important innovation in teaching and therefore advocated by many educational policymakers (Mirzajani et al., 2016). Integrating ICT in education is used as a strategy to increase the effectiveness of the teaching-learning process as it contributes to significant changes in this process (Kocaleva et al., 2015). However, the increased use of ICT did not automatically lead to an effective use of technology in education (Park et al, 2008; Tondeur et al, 2016). Particularly, research has shown that effective use of technology demands faculty support (Donnelly, 2010). According to Johnson and Berge (2012) faculties should receive training in teaching methods, learner support and course delivery when teaching online. Faculty readiness for online teaching is a major component that determines the success of online education (Martin et al., 2019).

Due to the circumstances of COVID-19, teachers were confronted to adopt online teaching. Likewise in the Netherlands, where the schools closed in March 2020. This unique and rapid transition from traditional teaching to online teaching provides an opportunity to research whether teachers actually felt ready to teach online (Brooks & Grajek, 2020) and whether educational institutions were able to adopt to online teaching in such a massive manner (Carey, 2020). Also, the question arises which factors stimulate and which factors hinder teachers in online teaching (Ćukušić et al., 2010).

Gaining insight in teachers' readiness for online teaching contributes to scientific literature about the effect of COVID-19 on education. This can be done by exploring how teachers' perceptions on online teaching have changed and comparing these for different educational levels in higher education (MBO, HBO and WO). Such analyses have been carried out focussing on a single educational level such as primary education, secondary education or higher education (Mukarromah & Wijayanti, 2021; Howard et al., 2020; Schmid et al., 2021), but studies comparing different educational levels are still lean.

In addition, it is socially relevant to gain insight in this topic, so this can be applied in practice. The measurement of readiness and development of strategies is vital for successful online learning and teaching (Rohayani et al., 2015). According to Bruggeman et al. (2020) understanding whether teachers feel ready or not to adapt to online teaching is also relevant for the ability to provide appropriate support. Providing appropriate support can assist teachers in overcoming obstacles and becoming successful ICT users (Ghavifekr et al., 2016). Further, research on which factors are stimulating or hindering teachers in online teaching can provide guidelines to institutions how to operate; with the insights derived from this study they can anticipate on this.

The aim of this study is to gain insight in how COVID-19 changed the perceptions of Dutch teachers regarding their readiness for online teaching and if there are differences

among educational levels (MBO, HBO and WO). In addition, this study will also examine which are hindering or stimulating factors for teachers in online teaching.

## Theoretical framework

### Online education

The past 20 years, online education has risen in popularity in the educational field (McBrien et al., 2009; Clark & Mayer, 2016; Martin et al., 2019). Clark and Mayer (2016) define online education as instruction that is delivered via a digital device (e.g., laptops, mobile phones, tablets, etc) that is intended to support learning. Another definition is from Singh and Thurman (2019), who define online education as learning experiences delivered via a digital device in synchronous or asynchronous environments where students can learn and interact with each other and with instructors from anywhere. In synchronous environments there is a live interaction between instructor and students (for example using videoconferencing) while asynchronous environments are not live (for example using earlier video recording).

Synchronous environments allow direct feedback and response which can provide opportunities for real time social interaction, while in asynchronous environments interaction is possible but not in real time (McBrien et al., 2009). In this study online education is defined as the delivery of learning content and the creation of learning experiences with usage of digital platforms and/or ICT tools (Rogers et al., 2009).

### Online teaching competencies

Competencies can be defined as knowledge, skills or abilities that enables an individual to effectively perform the activities of a profession to the standards expected in the employment (Richey et al., 2001). Ko and Rossen (2017) argue that online teaching does differ from traditional teaching. Within the adaption to online teaching, teachers are challenged to rethink the role as educator and the underlying assumptions on education (Wiesenbergs & Stacey, 2013). The understanding that online teaching requires other competencies than traditional

teaching has made that various researchers investigated the competencies of teachers within online education (e.g., Johnson & Berge, 2012; Ko & Rossen, 2017; Gay, 2016; Martin et al., 2019). These studies are important, since they provide guidelines on what competencies teachers need and about how faculties can be trained and supported (Baran et al., 2011).

### **Readiness for online teaching**

According to Blayone (2018) competencies are factors within the framework of readiness. Dada (2006) defines online readiness as the degree to which an individual is prepared to obtain benefits from ICT. Readiness for online teaching explores the preparedness of people and faculties to teach online (Blayone, 2018; Martin et al., 2019; Gay, 2016). Gay (2016) did research on readiness for online teaching and found that the availability of online helpdesk services is an urgent need for faculties. Faculties who teach online focus on virtual management techniques, instructional design and the ability for engagement of students through virtual communication (Easton, 2003). Martin et al., (2019) also did research on faculty readiness to teach online. With faculty they refer to all kinds of teachers within higher education, such as professors, instructors and lecturers. Within online teaching competencies, Martin et al., (2019) examine four areas, namely course design, course communication, time management and technical competencies.

### ***Course design***

Course design can be defined as a pedagogical competency that involves planning of a course, creating course objectives, instructional design and assessment. These can be organized into a course syllabus which offers course guidelines to define the requirements (Martin et al., 2019). Course design also involves the preparation of materials, lessons, lectures and exams. It's required to design an organized course where objectives, structure, activities and assessments are clear (Varvel, 2007).

### ***Course communication***

Course communication is the ability to communicate through writing and/or audio within the given learning modality (Varvel, 2007). Interaction between teachers and students is important according to Goodyear et al. (2001). Communication can vary from communicating on due dates, course expectations, feedback et cetera. When teaching online, the key competency of teachers is facilitating discussions (Redmond, 2011). To encourage participation, teachers need to be able to moderate, participate and advance discussions (Darabi et al., 2006).

### ***Time management***

The first time designing an online course is more time-consuming compared to the second time. All the course objectives, activities and assessment must be redesigned to an online format (Visser, 2000). According to Darabi et al. (2006) the most time goes to reassessment of learning objectives, providing feedback, formulating questions that promote higher order thinking and creating online assessments. But also, time outside class needs to be considered, such as time spent on helping students who struggle, personal assistance and documenting student performance (Napier et al., 2011; Darabi et al., 2006). The time and effort involved in course development and delivery is related to previous experience with online teaching, level of institutional support and technical support (Martin et al., 2019).

### ***Technical competencies***

Technological competencies include technological knowledge (such as knowledge about operating systems, software, ICT tools, internet et cetera), competencies in usage of current technology, ability to troubleshoot technology issues and the ability to assist learners effectively (Varvel, 2007; Darabi et al., 2006).

## **Stimulating and hindering factors**

According to Kaufman (2014) developing digital competence can be challenging for teachers because of the rapidly changing ICT. Ungar and Baruch (2016) did research on factors that are stimulating and hindering the implementation of ICT. They qualified lack of time, insufficient knowledge and skills, infrastructure and technological aspects as most hindering factors. Technological-pedagogical support, offering incentives, accessibility and availability of equipment were qualified as most stimulating factors.

Research from Hiltz et al. (2007) on stimulating and hindering factors has shown that better and more personal interaction with students is seen as a stimulating factor. On the other hand, more workload and lack of adequate support are hindering factors.

Research of Gratz and Looney (2020) has shown that an absence of time, discipline not suitable for online teaching and lack of skills and confidence are hindering factors for teaching online. Reported stimulating factors included financial incentives, increased flexibility and keeping current with various modes of delivery of learning materials.

Research of van der Spoel et al. (2020) has shown that professionalisation, innovation and revaluation of ICT are stimulating factors for online teaching. A lack of interaction, time pressure and lack of skills were identified as hindering factors.

## **This study**

The aim of this study is gaining insight in how COVID-19 changed the perceptions of teachers in the Netherlands towards their readiness for online teaching and comparing these perceptions for different educational levels (MBO, HBO and WO). This study will also focus on examining which are hindering or stimulating factors for teachers in online teaching. By way of quantitative survey research, the following research questions will be examined:

- *How did COVID-19 change the perceptions of teachers regarding the readiness for online teaching?*

- *Does the perception of teachers regarding the readiness for online teaching differ among educational levels (MBO, HBO or WO)?*
- *What factors do teachers identify as stimulating or hindering factors regarding online teaching?*

Based on the results of previous research on this topic, the following hypothesis have been defined:

- ‘COVID-19 has led to a significant change in the perceptions of teachers regarding the readiness for online teaching.’ This hypothesis is in line with the results of van der Spoel et al. (2020).
- ‘The perception of teachers regarding the readiness for online teaching differs among educational levels. Teachers of MBO have experienced the biggest change in perceptions of readiness for online teaching.’ This is hypothesized because of the practical nature of MBO education, which makes it more difficult to change physical education to online education. Where HBO and WO education generally has a more theoretical basis, MBO education is more often focused on practical lessons.
- ‘Teachers identify professionalisation as most stimulating factor and a lack of interaction as most hindering factor.’ This is hypothesized because these factors were reported in the study of van der Spoel et al. (2020) where they researched positive and negative effects of online teaching in the Dutch context.

## **Method**

### **Research design**

This study was an exploratory quantitative survey study. This type of research was chosen to test differences in the perceptions of teachers prior to and during COVID-19 and examining the differences in perceptions among different educational levels.

## **Participants**

The participants of this study were teachers from different educational levels, namely MBO, HBO and WO, living in The Netherlands. The sampling method that was used to reach participants is snowball sampling, because the target audience – especially given the pressure due to COVID-19 – can be hard to reach. The intended number of respondents was 189 respondents, which was calculated using the G\*Power program (Faul et al., 2009). The calculation can be found in Appendix 1. The total sample consists of 144 participants. The participants were 32 male (22.20%) and 109 female (75.70%) teachers. Three persons did not reveal their gender. The mean age for participants was  $M = 42.56$  ( $SD = 11.97$ , min = 21.00, max = 69.00). The mean years of work experience was  $M = 12.06$  ( $SD = 9.68$ , min = 1.00, max = 40.00), mean years of experience with ICT was  $M = 20.88$  ( $SD = 8.39$ , min = 1.00, max = 40.00) and the mean years of experience with online teaching in years was  $M = 2.28$  ( $SD = 3.73$ , min = 0.00, max = 30.00). A number of 81 participants were teaching at MBO (56.30%), 46 participants were teaching at HBO (31.90%) and 17 participants were teaching at WO (11.80%).

## **Instruments**

With survey research, it was intended to reach a large number of teachers to participate in the study to increase the representativeness of the results. The online survey consisted of three parts and is added in Appendix 2. The first part of the survey consisted of six items to access background variables of the participants, which are gender, age, years of working experience as a teacher, on which level of education they teach, years of experience with ICT in general and years of experience with online teaching. The second part of the survey consisted of items to measure teachers' readiness for online teaching.

The Faculty Readiness to Teach Online (FRTO) from Martin et al., (2019) is originally in English, but was translated into Dutch and adjusted to the Dutch context. The translation was done using backwards translation with an official translator. Two items have been removed due to a misfit with the context of this study. These items were focused on policies on academic integrity and copyright law, which makes the items not suitable for this research. The survey was pilot tested by three teachers; this did not result in any adjustments.

The existing validated instrument Faculty Readiness to Teach Online (FRTO) from Martin et al., (2019) is used to measure teachers' perceptions on readiness for online teaching. In this study, Martin et al. (2019) reviewed research studies from Gay (2016), Lichoro (2015) and Downing and Dyment (2013) to identify a theoretical framework. Based on this theoretical framework, they started to develop an instrument that can be used for measuring readiness for online teaching. They used readiness instruments of University of Toledo (2017) and Pennsylvania State University (2017) as a base and adapted it to their context with adding items and constructs. With six experts in educational technology and online teaching reviewing the instrument, content validity was checked. Recommended adjustments were made, which has led to an instrument with 32 items to measure readiness to teach online. With a Cronbach's alpha of .92 the reliability of the FRTO scale can be considered as excellent (Evers et al., 2010). The Cronbach's alpha of the subscales of the FRTO scale were .92 for course design, .86 for course communication, .83 for time management and .88 for technical competences. The Cronbach's alpha of the instrument used in this study was .95. According to Evers et al. (2010) this can be considered as excellent. The Cronbach's alpha of the subscales in this study were .90 for course design, .81 for course communication, .88 for time management and .88 for technical competence. Table 1 shows an overview of the Cronbach's alpha from Martin et al. (2017) and this study.

**Table 1**

*Cronbach's alpha of instruments and subscales*

	FRT0 (Martin et al., 2019)	This study
Overall	.92	.95
Course design	.92	.90
Course communication	.86	.81
Time management	.83	.88
Technical competence	.88	.88

To measure the perceptions of teachers before and during COVID-19, the survey consisted of two answer boxes. In the first answer box, the participants were asked to rate their readiness for online teaching before COVID-19 using a 5-point Likert scale from 1 (*I could not do it at all*) to 5 (*I could do it well*). In the second answer box, the participants were asked to rate their readiness for online teaching during COVID-19 using a 5-point Likert scale from 1 (*I cannot do it at all*) to 5 (*I can do it well*).

After filling in FRT0, the participants were asked what stimulates them regarding online teaching. A list of stimulating factors, which are derived from literature of Ungar and Baruch (2016), Hiltz et al. (2007), Gratz and Looney (2020) and van der Spoel et al. (2020), was provided. The participants were asked to rank the factors from most important to less important. The stimulating factors from which participants could choose are technological support, financial incentives, accessibility and availability of equipment, more interaction with students, increased flexibility, keeping current with ICT, professionalisation, revaluation of ICT and innovation. After ranking them, participants got an open question if they want to add stimulating factors that were not listed.

Next, the participants were asked what hinders them regarding online teaching. A list of hindering factors, which are derived from literature of Ungar and Baruch (2016), Hiltz et al. (2007), Gratz and Looney (2020) and van der Spoel et al. (2020) were provided. The participants were asked to rank them from most important to less important. The hindering factors from which participants could choose are lack of time, insufficient knowledge and skills, more workload, lack of support, discipline not suitable for online teaching, lack of confidence and lack of interaction. After ranking them, participants got an open question if they want to add hindering factors that were not listed.

Finally, the last question of the survey contained the question if the participants have any remarks. This provides the participants the opportunity to share insights that have not been covered in the survey.

## **Procedure**

The participants of this study filled in the survey online. The survey was digitized within the survey program LimeSurvey. Before the participants could access the online survey, they had to agree with the informed consent in which the purpose and context of the research was explained and anonymity was guaranteed to the participants.

## **Results**

Descriptive statistics were calculated for the variables course design, course communication, time management, technical competence and the total score of readiness for online teaching. In Table 2 and 3 the sample size, minimum, maximum, mean scores and standard deviations before COVID-19 and during COVID-19 are listed.

**Table 2**

*Descriptive statistics of variables before COVID-19 and during COVID-19*

	n	Before		During	
		COVID-19		COVID-19	
		Mean	SD	Mean	SD
Course design	144	3.12	.75	3.88	.67
Course communication	144	3.79	.58	3.85	.68
Time management	144	2.47	.78	2.90	.80
Technical competence	144	3.39	.80	3.78	.73
Total readiness	144	3.20	.60	3.60	.62

To answer the first research question “*How did COVID-19 change the perceptions of teachers regarding the readiness for online teaching, and how do these compare?*” and the second research question “*Does the perception of teachers regarding the readiness for online teaching differ among educational level (MBO, HBO or WO)?*” a Mixed Model ANOVA is performed. First, total scores and mean scores were calculated for teachers’ readiness to teach online before COVID-19 and during COVID-19. This resulted in two variables; one score represented the total mean score of teachers’ readiness to teach online before COVID-19 and one score represented the total mean score of teachers’ readiness to teach online during COVID-19. The total mean score of readiness before COVID-19 was within-subjects factor 1 and the total mean score of readiness during COVID-19 was within-subjects factor 2. In this study, the rating scale was administered at a single time point, assessing teachers’ readiness for online teaching previous to COVID-19 and during COVID-19.

The Shapiro-Wilk,  $F_{\max}$  and Levene's test statistics were used to test the assumptions of normality and homogeneity of variance. Here,  $F_{\max} = 1.591$ , indicating that the homogeneity or variance assumption per the repeated measures factor has not been violated. Furthermore, Box's Test of Equality of Covariance Matrices was used to determine whether the data violate the assumption of homogeneity of covariance matrices. Here, the test is non-significant ( $Sig = .413$ ) meaning that the assumption of homogeneity of covariance matrices has not been violated. Neither Levene's Test for Equality of Error Variances is significant at  $\alpha = .05$ ,  $F(2, 141) = .28, p = .743; F(2, 141) = .21, p = .814$ . The assumption of homogeneity of variance for the between subjects factor has not been violated.

A significant main effect for before COVID-19 and during COVID-19 was obtained  $F(1, 141) = 79.60, p = .000, \eta^2 = .36$  with teachers' readiness for online teaching during COVID-19 ( $M = 3.60, SD = .62$ ) being significantly higher than before COVID-19 ( $M = 3.20, SD = .61$ ). This means that the participants of this study felt more ready for online teaching during COVID-19 in comparison to before COVID-19.

A significant effect between before/during COVID-19 and educational level was reported,  $F(2, 141) = 6.45, p = .002, \eta^2 = .08$ . Post hoc tests using the Bonferroni correction revealed that the expected differences among educational levels were not significant. Although there is no significant difference among MBO, HBO and WO, examination of the means indicated that there was a change in the readiness for online teaching measured for all educational levels. Table 3 shows the mean scores and standard deviations for each educational level.

**Table 3**

*Mean scores and standard deviations before COVID-19 and during COVID-19*

Educational level	<i>n</i>	Before		During	
		COVID-19	COVID-19	Mean	<i>SD</i>
MBO	81	3.16	.58	3.67	.62
HBO	46	3.14	.66	3.44	.63
WO	17	3.49	.53	3.72	.53
Total	144	3.20	.61	3.60	.62

For teachers at MBO level the largest change in readiness for online teaching before COVID-19 ( $M = 3.16$ ,  $SD = .58$ ) in comparison to during COVID-19 ( $M = 3.67$ ,  $SD = .62$ ) appeared.

For teachers at HBO level there was a smaller change in readiness for online teaching before COVID-19 ( $M = 3.14$ ,  $SD = .66$ ) in comparison to during COVID-19 ( $M = 3.44$ ,  $SD = .63$ ).

For teachers at WO level there was also a smaller change in readiness for online teaching before COVID-19 ( $M = 3.49$ ,  $SD = .53$ ) in comparison to during COVID-19 ( $M = 3.72$ ,  $SD = .53$ ).

To conclude, a significant main effect for before COVID-19 and during COVID-19 has been found with teachers' readiness for online teaching during COVID-19 being significantly higher than before COVID-19. In addition, a significant effect between before/during COVID-19 and educational level has been found. However, the expected differences among educational levels were not significant. Therefore, covariates were added to the Mixed Model ANOVA. The covariates that were added are age, years of working

experience as a teacher, years of experience with ICT in general and years of experience with online teaching. None of the covariates were significant.

### **Hindering and stimulating factors**

The last research question “*What factors do teachers identify as stimulating or hindering factors regarding online teaching?*” is analysed using ranking scores. The frequencies of how many times a factor is called as hindering or stimulating factor were count. This outcome was divided by the number of participants of the study. This results in the mean ranking of a factor. The ranking of all participants were compared to each other to see which factors teachers identify as stimulating or hindering.

#### ***Hindering factors***

When comparing the ranking scores, lack of interaction is identified as most hindering factor. Lack of confidence is identified as less hindering factor. This means that teachers find it most hindering to communicate less, while confidence is a factor which hinders them less in online teaching. In Table 4 the ranking of all hindering factors can be found.

**Table 4**

*Ranking scores of hindering factors*

Hindering factors	Ranking scores
Lack of interaction	2.35
Lack of time	2.81
More workload	2.97
Lack of support	4.63
Discipline not suitable for online teaching	4.82
Insufficient knowledge and skills	4.85
Lack of confidence	5.57

*Note.* The factors are sorted top-down from most hindering to less hindering. Lack of interaction with students is identified as less hindering factor and lack of confidence is identified as most hindering factor.

### *Stimulating factors*

In addition, ranking scores were also used to identify which factors are stimulating teachers regarding online teaching. Innovation is identified as most stimulating factor. Technological support is identified as less stimulating factor. This means that teachers experience the innovation, which online teaching entails, as most stimulating while the ability to receive technological support is a factor which they experience as less stimulating. In Table 5 the ranking of all stimulating factors can be found.

**Table 5**

*Ranking scores of stimulating factors*

Stimulating factors	Ranking scores
Innovation	3.50
Increased flexibility	3.57
Professionalisation	3.73
Financial incentives	4.47
Accessibility and availability of equipment	4.72
More interaction with students	4.83
Keeping current with ICT	5.01
Revaluation of ICT	5.89
Technological support	6.23

*Note.* The factors are sorted top-down from most stimulating to less stimulating. Innovation is identified as most stimulating factor and technological support as less stimulating factor.

## **Discussion**

The purpose of this study was to gain insight in how COVID-19 changed the perceptions of Dutch teachers regarding their readiness for online teaching and if there are differences among educational levels (MBO, HBO and WO). In addition, this study also examined which are hindering or stimulating factors for teachers in online teaching. The results of this study show that the perceptions of teachers' readiness for online teaching before COVID-19 changed in comparison to during COVID-19. Among all educational levels, teachers felt more ready for online teaching during COVID-19 in comparison to before COVID-19. However, the results of this study did not show any significant difference

between MBO, HBO and WO. Furthermore, the results of this study indicate that lack of interaction is identified as most hindering factor, while innovation is identified as most stimulating factor. The main conclusion of the current study is that the perceptions of teachers on the readiness for online teaching have changed prior to the COVID-19 pandemic and during the COVID-19 pandemic.

First of all, it was hypothesized that COVID-19 has led to a significant change in the perceptions of teachers regarding the readiness for online teaching. The results of this study support the hypothesis. This finding is in agreement with those obtained by van der Spoel et al. (2020). In their research they found a significant change in the perception of teachers regarding their resolutions to implement technology in their lessons in a post-corona era. The possible explanation for this result emerges out of insights from previous studies, for example from Amhag et al. (2019) and Ottenbreit-Leftwich et al. (2010). They support the idea that if awareness of the possibilities of ICT arises among teachers, a difference will be measured between what teachers expect and their actual experience. Due to the circumstances caused by the COVID-19 pandemic, teachers had to adapt to alternative means of schooling, such as online teaching, which forced them to use ICT tools (Huber & Helm, 2020). Because they were confronted to adopt the online teaching, they possibly became more aware of the possibilities of ICT which changed their perceptions regarding the readiness for online teaching.

Secondly, this study examined if the perceptions of teachers regarding the readiness for online teachers differ among educational levels. The hypothesis stated that the perceptions do differ and that the teachers of MBO have experienced the biggest change in perceptions of readiness for online teaching because of the practical nature of MBO education. This research area has not yet been examined in scientific research, therefore there is no evidence supporting the hypothesis. Although a significant effect between before/during COVID-19

and educational level was reported, the reported change did not show significant differences of teachers' readiness for online teaching among MBO, HBO and WO. Therefore, the results of this study do not support the hypothesis. However, examination of the means show that teachers who teach at MBO level have experienced the largest change in perceptions in comparison to teachers from HBO and WO.

Finally, this study also investigated which factors teachers identify as stimulating and hindering. It was hypothesized that teachers identify professionalisation as most stimulating factor and a lack of interaction as most hindering factor. This study found that teachers identify innovation as most stimulating factor. Although this result does not support the hypothesis, this result is in line with the study of van der Spoel et al. (2020) where they found professionalisation, innovation and revaluation of ICT as stimulating factors for online teaching. This study also found that a lack of interaction is identified as most hindering factor. This result supports the hypothesis and is in agreement with those obtained by van der Spoel et al. (2020).

Nonetheless, the findings of this study have to be seen in light of some limitations. The first limitation concerns the retrospective nature of this study. The data in this study is collected retrospectively which can be prone to recall bias. Differences in the accuracy or completeness of memories can cause a recall bias. A situation can occur where participants do not remember previous events accurately; memories may be influenced by other events and experiences (Andrews, 2002). Although avoiding a recall bias in research can be difficult (Torelli & Jensen, 2010), future research could focus on trying to avoid this. In an ideal situation future research could use a research design with a pre and post test – examining the perceptions on readiness for online teaching in the normal situation compared to the situation in which teachers are forced to teach online. Nevertheless, no one was expecting a pandemic meaning that these measures could not have been done before the pandemic. Therefore, future

research can focus on selecting the appropriate recall period. In this study the recall period was approximately one year, while research has shown that a short recall period is preferable to a long one (Ziegel, 1993). Another limitation involves the issue that this study collected data with self-reporting. Participants were asked to assess their own capabilities before COVID-19 and during COVID-19. Self-reported data are threatened by the self-reporting bias. Self-reporting can lead to a bias in the results; the results can form an inconsistent reflection of reality by reason of a systematic measurement error (Pouwer et al., 1998). Future research should consider the potential effects of self-reporting more carefully, for example by also incorporating students' perceptions on teachers' readiness for online teaching. The other limitation concerns the scale that is used in this study, namely the Faculty Readiness to Teach Online (FRTA) from Martin et al., (2019). The FRTA is designed for measuring faculty readiness for online teaching. They used readiness instruments of University of Toledo (2017) and Pennsylvania State University (2017) as a base and adapted it to their context. All these instruments were designed for universities. In this study, the FRTA was used to measure teachers' readiness on different educational levels in the Netherlands, namely MBO, HBO and WO. The use of an instrument which is originally designed for universities can be a limitation of this study. The FRTA might not be suitable for all educational levels. Therefore, for future research it is recommended to design an instrument which is suitable for all educational levels. In addition, future research could also focus on employing quantitative methodologies to refine the results from this study, for example with in-depth interviews. In-depth interviews offers the opportunity to add depth, detail and better understand perceptions regarding a specific topic (Hoglund & Oberg, 2011).

To summarize, the main findings of this study show a significant effect of COVID-19 on teachers' readiness for online teaching. A change in readiness was measured among all educational levels, but the expected differences among educational levels (MBO, HBO and

WO) were not significant. Furthermore, the results of this study indicate that lack of interaction is identified as most hindering factor, while innovation is identified as most stimulating factor. The main conclusion of the current study is that the perceptions of teachers on the readiness for online teaching have changed prior to the COVID-19 pandemic and during the COVID-19 pandemic. As implications, this study can form the base for further research investigating teachers' perceptions on online teaching and what influences them in adapting to online teaching. In addition, the lessons learned from this pandemic can also be taken into account how educational organizations can support teachers to successfully teach online.

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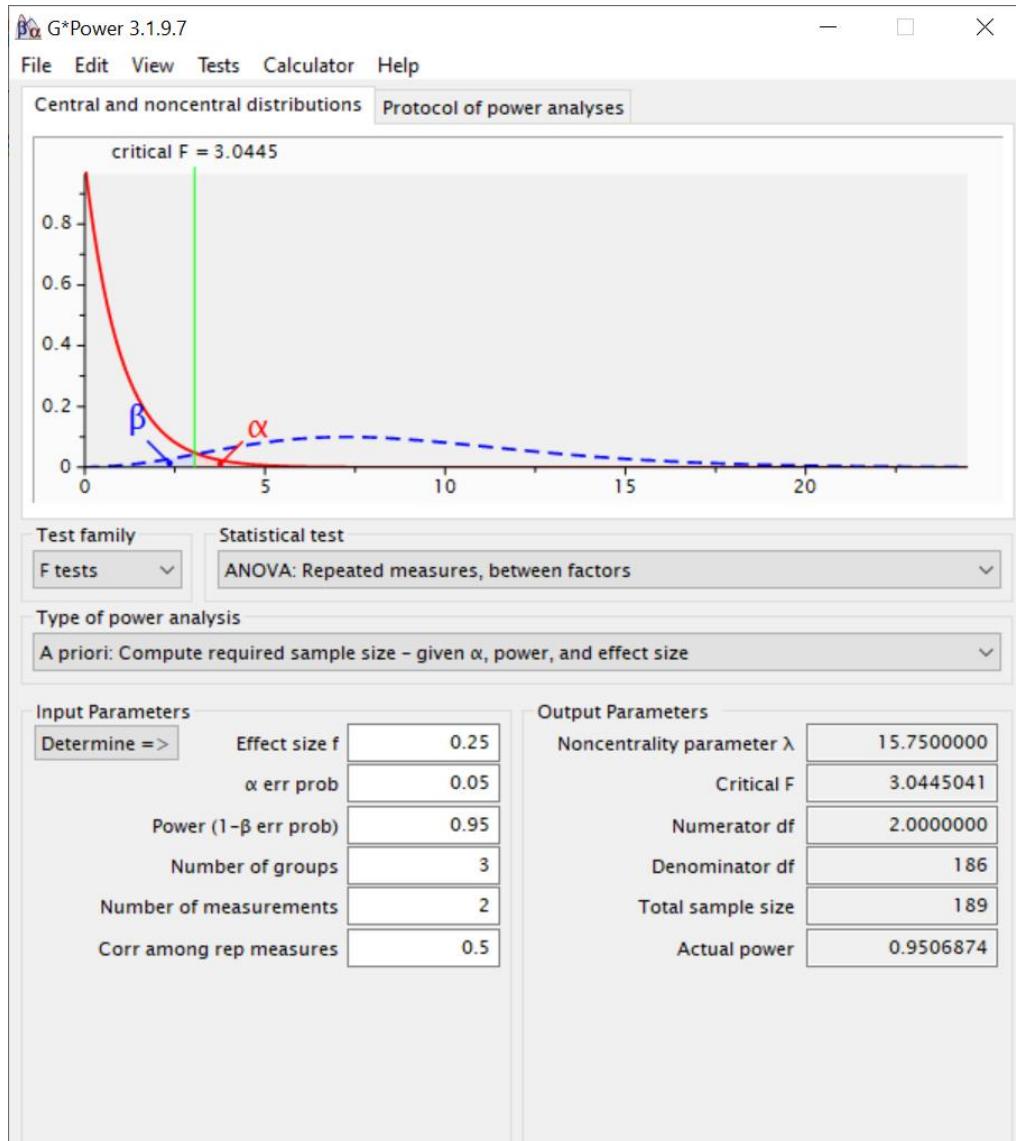
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## Appendix 1 – G\*Power measure



## Appendix 2 – Survey

<b>Achtergrond variabelen</b>		<b>Beoordeling</b>
1	Wat is uw leeftijd?	Open vraag
2	Wat is uw geslacht?	Man / Vrouw
3	Hoeveel jaren bent u werkzaam in het onderwijs?	Open vraag
4	Op welk onderwijsniveau bent u werkzaam?	MBO / HBO / WO
5	Hoeveel jaren heeft u ervaring met ICT in het algemeen?	Open vraag
6	Hoeveel jaren heeft u ervaring met online onderwijs?	Open vraag

<b>Readiness for online teaching</b>		<b>Beoordeling</b>
<b>Ontwerpen van online onderwijs</b>		Voor COVID-19: Kon ik helemaal niet   Kon ik goed Tijdens COVID-19: Kan ik helemaal niet   Kan ik goed
1	Een handleiding over het online onderwijs maken (bijv. cursushandleiding, syllabus)	1 2 3 4 5
2	Meetbare leerdoelen opstellen	1 2 3 4 5
3	Leeractiviteiten ontwerpen die studenten interactiemogelijkheden bieden (bijv. discussieforums, wiki's)	1 2 3 4 5
4	Lesmateriaal opdelen in logische modules of onderwerpen	1 2 3 4 5
5	Instructievideo's maken (bijv. hoorcolleges, demonstraties of tutorials)	1 2 3 4 5
6	Verschillende onderwijsmethodes gebruiken in de online omgeving (bijv. brainstormen, groepsopdrachten, discussies, presentaties)	1 2 3 4 5
7	Online toetsen en quizzen maken	1 2 3 4 5
8	Online opdrachten maken	1 2 3 4 5
9	Online resultaten beheren	1 2 3 4 5
<b>Communicatie over online onderwijs</b>		
10	Aankondigingen/e-mailreminders versturen naar studenten	1 2 3 4 5
11	Discussieforums opzetten en beheren	1 2 3 4 5
12	E-mail gebruiken om te communiceren met studenten	1 2 3 4 5
13	Binnen een redelijke tijd antwoorden op vragen van studenten (bijv. 24 of 48 uur)	1 2 3 4 5
14	Opdrachten van feedback voorzien (bijv. 7 dagen na de inleverdatum)	1 2 3 4 5
15	(Video)chatprogramma's gebruiken (bijv. Skype, Microsoft Teams, Google Hangouts)	1 2 3 4 5
16	Duidelijk zijn over de verwachtingen wat betreft gedrag (bijv. in een netiquette)	1 2 3 4 5

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**Time management**

- 17 Tijd vrijmaken om het online onderwijs vorm te geven voordat het af moet zijn (bijv. een semester vóór de start) 1 2 3 4 5
- 18 Elke week uren inplannen om het online onderwijs te faciliteren 1 2 3 4 5
- 19 Bepaalde functies in het leermanagementsysteem gebruiken voor timemanagement (zoals Blackboard, Brightspace, Canvas, Moodle) 1 2 3 4 5
- 20 Hulpmiddelen inzetten om de tijd die je besteedt aan online onderwijs beter te managen (bijv. beheerders voor discussieforums, beoordelingssleutels, collectieve feedback) 1 2 3 4 5
- 21 Wekelijks uren inplannen om opdrachten te beoordelen 1 2 3 4 5
- 22 Tijd maken om nieuwe tools of strategieën voor online onderwijs eigen te maken 1 2 3 4 5

**Technische competenties**

- 23 Basishandelingen uitvoeren op de computer (bijv. documenten maken en bewerken, bestanden en mappen beheren) 1 2 3 4 5
- 24 De weg weten in het leermanagementsysteem van de online cursus (zoals Blackboard, Brightspace, Canvas, Moodle) 1 2 3 4 5
- 25 Het onderwijsrooster in het leermanagementsysteem gebruiken om teams of groepen te maken 1 2 3 4 5
- 26 Tools voor online samenwerking gebruiken (zoals Google Drive, Dropbox) 1 2 3 4 5
- 27 Video's maken en bewerken (bijvoorbeeld met iMovie, Windows Movie Maker, Kaltura) 1 2 3 4 5
- 28 Educatieve bronnen delen die openbaar toegankelijk zijn (zoals artikelen, websites, educatieve games) 1 2 3 4 5
- 29 Een online helpdesk of andere online hulpbronnen raadplegen 1 2 3 4 5
- 

**Stimulerende en hinderende factoren**
**Beoordeling**

- 33 Wat stimuleert je in het verzorgen van online onderwijs? Orden de factoren, waarbij 1 staat voor meest belangrijk.
- Technologische support
- Financiële stimulans
- Toegankelijkheid en beschikbaarheid van apparatuur
- Meer interactie met studenten
- Flexibiliteit
- Up-to-date blijven met ICT
- Professionalisering
- Herwaardering van ICT
- Innovatief

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34	Indien je nog aanvullingen hebt op de stimulerende factoren, kun je deze hier aan vullen:	Open vraag
35	Wat hindert je in het verzorgen van online onderwijs? Orden deze factoren, waarbij 1 staat voor meest belangrijk.	Tijdgebrek Onvoldoende kennis en vaardigheden Meer werkdruk Gebrek aan technologische ondersteuning Vakgebied is niet geschikt voor online onderwijs Gebrek aan vertrouwen Minder interactie
36	Indien je nog aanvullingen hebt op de hinderende factoren, kun je deze hier aan vullen:	Open vraag

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Toevoegingen	Beoordeling
37 Heb je nog een opmerking?	Open vraag

### Appendix 3 – Timetable

	<b>Planning</b>	<b>What?</b>
<b>Week 4</b>	<i>Processing feedback</i>	Processing the feedback on the concept
	<i>Writing thesis</i>	Writing theoretical framework
	<i>Instrument</i>	Translate the instrument to Dutch with translator
<b>Week 5</b>	<i>Writing thesis</i>	Finalize thesis for deadline
	<u>7-01 – Deadline Research Plan</u>	
<b>Week 6</b>	<i>Instrument</i>	Put survey in LimeSurvey
	<i>Instrument</i>	Search teachers for pilot test of survey
<b>Week 7</b>	<i>Writing thesis</i>	
	<i>Instrument</i>	Pilot test the survey

<b>Week 8</b>	<i>Processing feedback</i>	Processing the feedback on research plan
	<i>Searching for participants</i>	Contacting different schools and people in my network
	<i>Gathering data</i>	Participants can fill in the survey
<b>Week 9</b>	<i>Processing feedback</i>	Processing the feedback on research plan
	<i>Gathering data</i>	Participants can fill in the survey
	<i>Round tables</i>	Prepare for Round tables
<b>Week 10</b>	<u>10-03 – Round tables</u>	
	<i>Processing feedback</i>	Processing the feedback on research plan
	<i>Gathering data</i>	Participants can fill in the survey
<b>Week 11</b>	<i>Processing feedback</i>	Processing the feedback on research plan
	<i>Gathering data</i>	Participants can fill in the survey

	<i>Writing thesis</i>	Writing thesis
<b>Week 12</b>	<i>Analyze data</i>	SPSS
	<i>Writing thesis</i>	Writing thesis
<b>Week 13</b>	<i>Analyze data</i>	SPSS
	<i>Writing thesis</i>	Writing thesis
<b>Week 14</b>	<i>Results</i>	Write the results
<b>Week 15</b>	<i>Results</i>	Write results
	<i>Discussion</i>	Write discussion
	<i>Feedback</i>	Send draft to supervisor for feedback
<b>Week 16</b>	<i>Discussion</i>	Write discussion
	<i>Processing feedback</i>	Processing feedback

<b>Week 17</b>	<i>Processing feedback</i>	Write discussion
<b>Week 18</b>	<i>Finalize thesis for deadline</i>	Finalizing
<b>Week 19</b>	<i>Finalize thesis for deadline</i>	Finalizing
<b>Week 20</b>	<u>17-05 – Deadline concept Thesis</u>	
<b>Week 21</b>	<i>Processing feedback</i>	Processing feedback
<b>Week 22</b>	<i>Processing feedback</i>	Processing feedback
<b>Week 23</b>	<u>7-06 – Deadline Thesis</u>	
	<i>Prepare for conference</i>	Making presentation and practice it
<b>Week 24</b>	<u>16-06 – Master Thesis Conference</u>	