Measuring internet addiction: comparative studies based on gender using Bayesian analysis

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Abstract. The Internet becomes a necessity that is in a vital position for both children, teenagers and adults. Lately the use of the Internet to be a matter of concern and need to be studied, especially related to Internet addiction. As for the gender aspect, men and women have special forms of Internet addiction experienced. Based on this case, the authors designed a study related to the difference Internet addiction of male and female. The ultimate goal is the description of research results will be used for treatment. The sample for this research is 84 men and 84 women, the number of samples taken based on consideration using software G-Power 3.1 where for sample 84 people each group effect size is 0.3159282, α err prob 0.05 and power (1 - β err prob) 0.65. The instrument used is Chen Internet Addiction, which amounts to 26 items. Data analysis using JASP 0.8.5.1 software uses two types of analysis of Classic Test Theory Independent Sample T-Test and Bayesian Independent Sample T-Test. A result of research from both analysis that there is significant difference of Internet addiction of man and woman.

1. Introduction

The Internet is a very important requirement [1]–[5] for users both the age of children, adolescents, and adults [6]–[9]. Internet use among older age groups has increased over the last five years, but many are still non-users [10]–[12]. The development of Internet media usage is increasing and increasing every year [3], [13], [14]. Internet usage in Indonesia is ranked the fourth world with a time over 8 hours 51 minutes per day [15]. Data of Internet users in Indonesia-based on age in 2017 are: a) 13-18 years (16.68%); b) 19-34 years (49.52%); c) 35-54 years (29.55%); > 54 years old (4.245) [16]. When viewed in terms of demographics, internet users on the island of Java put the highest rating. The second rank is West Sumatra. Based on the findings of the study showed that the frequency of accessing teenage internet is done every day [17].

In terms of gender, introverted men are more likely to be addicted to the Internet than extroverted men. Extroverted women are more likely to experience Internet addiction than introverted women. Meanwhile, women are more likely to experience Internet addiction than men and extrovert personality types are more likely to experience Internet addiction than introverted personality types [18]. According to Griffiths, internet addiction is a non-chemical addiction that involves the active and
passive interaction of humans with machinery that strengthens and encourages features that contribute to increase the tendency of addiction [19]. In generalized, Internet addiction refers to the problematic use of the Internet covering a broad range of Internet-related activities such as excessive online video gaming or activities in social networks [20], [21].

The research findings explain that the impact of Internet use for women can increase consumptive behavior because women dependence using the Internet, to do online shop [22]. This finding is supported by data from United Nations (UNCTAD) Year 2018 in 25 countries and total number of Internet users is 25.262 known Indonesia has a high percentage of online payment usage of 93% [23]. The findings explain the influence of psychiatric factors as the use of Internet women and men [24]. The addiction of using the Internet is appropriate to be included in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition [25]. Internet addiction is also caused by the level of education, age, sex of tobacco use thus causing poor Internet usage control [26]. For women, the Internet is used for access to social media, online shopping, and community communications. As for the Internet, men are used for online gaming and community communications. Based on this case can be identified the forms of Internet addiction of male and female. Therefore, the authors are interested to examine the difference between Internet addiction of male and female by using software JASP0.8.5.1 through analysis of Classic Test Theory Analysis and Bayesian Analysis. Based on these analyzes, researchers will design treatments for men and women in dealing with respondents who are identified as Internet addict users.

2. Method

This research uses quantitative research type with the comparative method. This study was conducted with the number of female samples 84 people and male samples 84 people. The number of such samples is determined through G-Power 3.1 software where for sample 84 people each group effect size is 0.3159282, α err prob 0.05 and power (1-β err prob) 0.65. The total sample of this study that amounted to 168 people. The instrument used is Chen Internet Addiction, which amounts to 26 items. Data analysis using JASP 0.8.5.1 software uses two types of analysis of Classic Test Theory Independent Sample T-Test and Bayesian Independent Sample T-Test. Data set can be accessed on Open Science Framework osf.oi/fmeah [27].

3. Result and Discussion

3.1 Classic Test Theory Analysis

Based on T-test result in table 1, it is known df = 166, t-table with df = 166 with α = 0.05 are 1.65408 while \( t_{count} = 2.876 \). It means that \( t_{count} \) t-table interpreted that there is a significant difference Internet addiction of male and female. Next, also supported based on p-values, we reject the null hypothesis \( H_0 \) if either \( |t| > t_1 - α/2, v \) or \( p < α \) [28], based on the above data \( α = 0.05 \) and value \( p < 0.05 \). It can thus be known \( H_0 \) rejected and \( H_1 \) meaning that there are significant differences in Internet addiction male and female.

| Table 1. Independent Samples T-Test |
|-----------------------------------|
| t       | df  | p       | VS-MPR* | Mean Difference | SE Difference | 95% CI for Mean Difference | 95% CI for Cohen's d |
| Internet Addiction                 | 2.876 | 166.0 | 0.005   | 14.98            | 4.619           | 1.606                  | 1.448                        |
|                                   |       |       |         |                 |                | Lower | Upper | 0.444 | Lower | Upper |
|                                   |       |       |         |                 |                | 1.448 | 7.790 | 0.444 | 0.137 | 0.749 |

*Vovk-Sellke Maximum p -Ratio: Based on a two-sided p -value, the maximum possible odds in favor of \( H_1 \) over \( H_0 \) equals \( 1/(e \cdot p \cdot \log(\ p \)) \) for \( p \leq .37 \) (Sellke, Bayarri, & Berger, 2001)[29].
Table 1 shows, the effect size on this result is known from the value of Cohen’s d with a value of 0.431, rounded to 0.4. This can mean that the Cohen value position is in the medium stage. As for planning treatment that can be planned researchers that can be analysed With a Cohen’s d of 0.4, 66% of the treatment group will be above the mean of the control group (Cohen’s U3), 84% of the two groups will overlap, and there is a 61% chance that a person picked at random from the treatment group will have a higher score than a person picked at random from the control group (probability of superiority). In order to have one more favourable outcome in the treatment group compared to the control group we need to treat 7.7 people. This means that if 100 people go through the treatment, 12.9 more people will have a favourable outcome compared to if they had received the control treatment. The mean difference means that the difference between the two-mean data of men and women is 4.619 where the lowest mean is 1.448 and the highest is 7.790. then the lowest effect size is 0.137 and the highest is 0.749.

3.2 Assumption Checks

Then, table 2 describes the linkage to the Homogeneity Levene Test which is a homogeneity test. That is, test the difference of variance for the data. Based on $F = 3.119$ ($p = 0.079$) note that $p > 0.05$. It thus means that Internet data addiction is a homogeneous data.

Table 2. Test of Equality of Variances (Levene's)

|                |  F    |  df |  p  |
|----------------|-------|-----|-----|
| Internet Addiction | 3.119 | 1   | 0.079 |

Based on table 3 above it can be seen that the mean values Male > Female mean that Internet addiction male higher than women with a difference of 4.61 where the significance difference equal to 4.61. The difference can be seen in figure 1.

Table 3. Group Descriptives

| Group Descrip | N  | Mean | SD    | SE   |
|---------------|----|------|-------|------|
| Internet Addiction | 1  | 84   | 66.40 | 11.090 |
| 2             |    | 84   | 61.79 | 9.679 |

Ket: Group 1: Male
Group 2: Female

Figure 1. Descriptive Plot of Internet Addiction

3.3 Bayesian Analysis

3.3.1 Bayesian Independent Samples T-Test

Based on table 4 it is known the bayes factor used is BF10 with a value of 7,245 with the error percentage is 3.009e -7.

Table 4. Bayesian Independent Samples T-Test

|              | BF10 | error % |
|--------------|------|---------|
| Internet Addiction | 7.245 | 3.009e -7 |

In table 5 it is known mean Internet addiction male > mean Internet addition male which can be interpreted that Internet addiction male is higher than female Internet addiction. SD and SE values that Internet addiction values male > mean Internet addiction female. The Credible Interval Internet addiction of the lowest male is 64.00 and the highest is 68.81; while the Credible Interval Internet
addiction of female the lowest is 59.69 and the highest 63.89. Descriptive picture of Internet addiction of male and female differences based on bayesian analysis.

| Group                  | N  | Mean  | SD   | SE   | 95% Credible Interval | Lower | Upper |
|------------------------|----|-------|------|------|------------------------|-------|-------|
| Internet Addiction     |    |       |      |      |                        |       |       |
| Female                 | 84 | 61.79 | 9.679| 1.056| 59.69                  | 63.89 |
| Male                   | 84 | 66.40 | 11.090| 1.210| 64.00                  | 68.81 |

Based on figure 3, one way to interpret this prior is that under $H_1$ that is, presuming that in the population the effect is present—the expectation is that the effect is most likely to be small, although the possibility it is large is not ruled out. The solid line is the posterior distribution for effect size in the population, the knowledge about effect size obtained after updating the prior distribution using the observed data, and assuming that $H_1$ holds. This posterior distribution of effect size has a median of 0.415 (note that the prior distribution has shrunk the sample value of $d=0.444$ toward zero) and a wide 95% credible interval that ranges from 0.105 to 0.715 [30]. The credible interval informs us that 95% of the posterior mass lies in the interval from 0.105 to 0.715; the effect has been estimated with much precision.

Figure 2. Descriptive Plot Internet Addiction  
Figure 3. Inferential Plots Internet Addiction

The shrinkage towards zero lessens (because we used a zero-centered Cauchy prior) when the sample size increases, and when the sample sizes are large enough, the posterior median will be indistinguishable from Cohen’s $d$. The credible interval becomes more narrow as the sample size increases. Hence, as more data are collected, the posterior becomes more peaked and we gain more certainty about the point estimate. This large sample behavior implies that the influence of the prior vanishes as the sample size increases. Priors other than the Cauchy have the same large sample behavior as long as they assign prior mass on the values of effect size [31]. Pada picture 4 menjelaskan tentang Bayes Factor Robustness Check, The plot shows the Bayes factor with the default prior as the black dot; the line represents how the Bayes factor changes as the Cauchy prior width. This analysis suggests the final conclusion is not a peculiarity of the prior, and the reported Bayes factor is robust [32].

Figure 4 shows that the point 4 marks are on the couch prior width 1, and the evidence are in the moderate category. The table 5 above describes the related Sequential Analysis of the Internet addiction male and female who began moving the area of evidence anecdotal to strong evidence means strong toward the $H_1$ which means that there is a significant difference's Internet addiction of male and female. As for the red and white circles in the picture explain that 1/4 (white) region $H_0$ and 3/4 (colored red) are the region of $H_1$. It can be concluded that the dominant is there are differences in Internet addiction of women and men through Bayesian sequential anlysislysis description.
Based on these two analyzes, it can be seen that there is a difference Internet addiction of male and female. Internet addiction is an individual's inability to controlling the use of the Internet, which can lead to occurrence psychological [33], social, and work problems on the individual's life [34], an example that online games their inappropriate behaviors and making irrational decisions [35], [36] when facing Internet games [37]–[40]. Based on the results of research on the difference of Internet addiction of male and female occur because of factors that affect it, one of which is gender. Gender affects the application used, and the individual cause is experiencing Internet addiction [41]–[43]. Male are attracted to things that can show their dominance and online sexual fantasies, such as online games [44], [45], porn sites [46], and online gambling [47], [48]. While female are interested in fostering more intimate relationships, romantic relationships [49], [50], and prefer to communicate by hiding his identity, for example, chatting, tweet and shop online. This suggests that gender attributes also play a role on the Internet world and stereotypes between male and female in the real world. As if this condition is left might generate the generation of problematic psychological, physical, social consequences of Internet addiction. When the Internet addiction is left then it has the potential to cause emotional problems such as depression, and anxiety disorders and often use the fantasy world on the Internet as a psychological diversion of unpleasant feelings or stressful situations [51]–[53]. These conditions can affect the lives of individuals, whether it's education for students, work, family, career [54] and various aspects of the individual's life. Therefore, further research, it is good to conduct an appropriate treatment assess.assessmalet for male and female to address the Internet addiction in these two gender groups.

4. Conclusions
Based on the findings above using the analysis of Classic Test Theory Independent Sample T-Test and Bayesian Independent Sample T-Test got results in both analysis there are significant differences internet addiction of male and female. The Bayesian analysis is explained with the difference in internet addiction between the two gender groups. This research recommended to examine the treatment that can be used for both groups, male and female in handling internet addiction of both groups.
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