

Psychological Well-Being and Creativity in University Students
Creativity, Divergent Thinking, and Well-Being
Principles of Human Flourishing

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Abstract

Background: Every person has a certain level of creativity, and on a subclinical level, creativity is assumed to enhance psychological well-being. University students' study year as well as study program influence the three aspects creativity, divergent thinking, and psychological well-being. For social science students' creativity is believed to be higher and increasing with an increase in study years, while the opposite is the case for technological science students. Similarly, divergent thinking is thought to be higher for social science students but decreasing for both study program groups over the years. Lastly, higher study year and study programs in the field of social sciences indicate a slightly positive impact on psychological well-being.

Aim: Based on prior research this study investigates the relationship between creativity, divergent thinking, and psychological well-being and how these factors are influenced by study year and study program.

Methods: A quantitative study with Likert scales on the Kaufman Domains of Creativity Scale and Ryff Psychological Well-Being Scale, and open questions on the Alternative Uses Test, has been conducted among a sample of 134 University students.

Results: A significant correlation, which was positive, was only found between creativity and psychological well-being. Additionally, psychological well-being showed a difference between groups on the variable study year. No group differences between study years or study program were found.

Conclusion: The study indicates that in future research more attention has to be paid to creativity facilitation in university students in order to maximize their psychological well-being. Moreover, more research in this direction has to be conducted to understand the relationship between creativity and well-being with the goal of enhancing student well-being. The limitations of the current study regarding the Alternative Uses Test's low intercoder reliability and the non-representative sample have to be taken into account when drawing conclusions of this research and when planning future research.

Keywords: creativity, psychological well-being, divergent thinking, study program, study year

Introduction

From making use of stones as hunting tools over the invention of the wheel to cell phones – ever since the existence of humanity, finding creative solutions has been of great importance. In today’s literature creativity is a widely discussed topic. Even though there is not just one definition of creativity, many researchers agree that it consists of (at least) two important factors: Originality and value (Runco & Jaeger, 2012; Newton & Newton, 2014). Originality concerns imagination and invention of novel outcomes (Runco & Jaeger, 2012). Hence, a solution has to be new, original, and innovative in order to be creative. Additionally, the value of this original outcome has to be taken into consideration. The value involves the appropriateness as well as the usefulness of the invention (Runco & Jaeger, 2012). Both originality and value have to be balanced in order to achieve creativity.

Creativity

According to Newton and Newton (2014) all people are able to creatively master everyday challenges, which means that everyone has potential creativity. This assumption is in line with the Four C Model by Kaufman and Beghetto (2009) in which everyday creativity with the Mini-C and Little-C such as respectively a first painting attempt or cooking a new dish out of two leftovers, is distinguished from greater achievements of creativity, for instance making a living off selling one’s own music creations or becoming a world-famous artist. Kaufman and Beghetto (2009) differentiate four different levels of creativity. The most basic level of creativity is so-called Mini-C which is responsible for the development and learning processes. Activities such as learning how to play a song on the piano or acquiring a new drawing technique would be considered the Mini-C. A bit more complex processes in everyday creativity are labelled Little-C. Examples of such engagements are creating a scrapbook or cooking a new meal from leftovers. Pro-C is for a creative progress in a specialized field, for instance successfully publishing a book or selling one’s art creations. Lastly, the Big- C is for rare, genius inventions and great minds, such as Leonardo DaVinci or other eminent people in history. These four types of creativity by Kaufman and Beghetto (2009) are distinguishable based on their worldly impact, complexity, and influence on the creator.

Creativity’s Impact on Well-Being

High level of creativity is thought to have a negative impact on well-being (Carson, 2011). Well-being is a broad term that includes not only physical but also mental and social aspects including absence of any physiological or mental impairments as well as satisfaction with work, family, friends, and the social interpersonal environment (World Health

Organization). Low levels of distress, high levels of happiness, and life-satisfactions are contributing factors to increased well-being (American Psychological Association). How creativity plays into well-being is a debated topic, but according to Carson (2011) there is evidence that proves that high levels of creativity decrease well-being. This finding is in line with the mad-genius hypothesis. The mad-genius hypothesis states that creative people show certain levels of psychopathology (Becker, 1978). Carson (2011) found that creative people suffer more from certain vulnerabilities such as emotional liability, hyper-connectivity, and cognitive disinhibition, which cause a lower level of psychological well-being.

According to Acar et al. (2020) the relationship between creativity and psychological well-being is negative on a clinical level, while it is reversed on a subclinical level. This means, in a healthy person creativity can enhance well-being rather than diminishing it. The assumption of a state of increased well-being due to creativity can be based on the engagement in self-involved processes, for instance self-actualization, self-expression, and self-exploration (Acar et al., 2020). Therefore, based on the findings of the study by Acar et al. (2020) it can be assumed that creativity can increase psychological well-being. This finding seems contradicting to the mad-genius hypothesis. The difference of the creativity level of the participants has to be considered: The mad-genius hypothesis concerns people with a minimum level of Pro-C (mainly Big-C), while other studies of creativity, which found positive effects of creativity on well-being, involve participants with a creativity level of Little-C. Therefore, when researching creativity, it is important to distinguish between the type of creativity and the levels on these scales. This research will investigate creativity levels on the scale of the Little-C (in the latter only referred to as “creativity”) which involves everyday activities, for instance making up rhymes or organizing an event that meets the participants’ needs.

Divergent Thinking

Besides measuring creativity levels, this research will also explore the function of divergent thinking and how it relates to psychological well-being. Divergent thinking can be defined as spontaneous brainstorming as it is the opposite of convergent thinking, which includes organization and structuring of ideas (Runco, 1993). It is an explorative thinking style which contemplates into multiple and diverse directions from an initial starting point (De Vries & Lubart, 2019). Divergent thinking is thinking beyond rules and expectations (Goodman, 2014). It is often described to as “thinking outside the box” and accompanies creativity (Goodman, 2014). Moreover, it can be considered an abstract and creative solution finding process (De Vries & Lubart, 2019). Additionally, divergent thinking is a measuring

tool of predicting an estimated potential of creative thought (Runco, 1993; Acar et al., 2020). Therefore, divergent thinking is often considered a part of creativity. One measure of divergent thinking abilities is the use of a functional fixedness task. According to German and Barrett (2005) for most objects there is a dominantly primed function associated with it. When someone is not able to come up with a different function for this object than the dominantly primed one, they experience functional fixedness (German & Barrett, 2005). Functional fixedness inhibits divergent thinking as it is a limitation of applying an object's properties to a different context (Chrysikou et al., 2016). Overcoming functional fixedness, is, hence, an act of divergent thinking (Chrysikou et al., 2016). Overcoming functional fixedness means generating possible ways of using a certain object different than the dominantly primed use of that object (German & Barrett, 2005). Therefore, a functional fixedness task can be used to measure divergent thinking.

Divergent Thinking and Well-Being

Better divergent thinking performances enhance psychological well-being (Alfonso-Benlliure et al., 2021). Resulting from their study, participants with high scores on divergent thinking also showed high scores on psychological well-being. Therefore, divergent thinking is believed to be positively correlated to well-being (Alfonso-Benlliure et al., 2021). However, the study by Alfonso-Benlliure et al. (2021) was performed on older participants (older than 65 years). Accordingly, examining creativity levels, well-being states, and performance on a divergent thinking task in university students can bring new insights into the topic of the relation between creativity, divergent thinking, and psychological well-being.

Creativity among University Students

Cheung et al. (2013) assume that based on the Social Learning Theory (Bandura, 1977) social science students would show a higher level of creativity compared to technological science students. The researchers base this assumption on the more holistic, artistic, and creative environment of social science students. Therefore, being surrounded by more creative fellow students, the social science student is believed to develop a more creative way of thinking as well because they are assumed to learn from and adapt the behavior from their fellow students (Cheung et al., 2003). Ekvall and Ryhammar (1999) agree that the orderly and structured work technological science students have to adhere to inhibits the enlargement of creativity. Similarly, based on the Social Learning Theory (Bandura, 1977) creative thinking can be improved among students, when they surround themselves with creative others. Therefore, the longer one is around these creative other students, the more creative they would become (Cheung et al., 2003). In other words, with an increase in

study year, a student would become more creative (Cheung et al., 2003). On the other hand, increasing complexity in the education at universities has been found to attenuate creativity among students (Simonton, 1994).

Divergent Thinking among University Students

Prior studies show that students' divergent thinking abilities varies as a function of their study year and study program (Cheung et al., 2003). Cheung et al. (2003) report the finding of a decrease in divergent thinking abilities in social science and technological science students with increasing study year. Additionally, the study program, when comparing social sciences to technological sciences, is predicting for the level of students' divergent thinking ability (Cheung et al., 2003). They assume that this is due to adherence to protocols and procedures, limiting the students' creativity. Here it is interesting to look at an overall difference in university students across different study years. Furthermore, according to their research social science students perform better on divergent thinking tasks than technological science students (Cheung et al. 2003; Zhu & Zhang, 2011). Concludingly, university students' divergent thinking abilities do not only differ individually, but it also varies as function of their study year and study program.

Well-Being among University Students

An insufficient psychological well-being can inhibit academic performance and therefore is an important topic among university students (Andrews & Chong, 2011). Wörfel et al. (2016) suggest a tendency of higher well-being among social science students as compared to technological science students. In their research, it shows an increased prevalence of depression among technological science students compared to social science students (Wörfel et al., 2016). The authors imply that these differences are mainly influenced by study demand which promotes depression and by social support and time latitude which minimize depression. Additionally, Jahani Hashemi et al. (2008) also have found a significant relation between the study program and mental health. Moreover, study year has a minor, but significant effect on both depression and anxiety (Wörfel et al., 2016). The authors, assume that these findings, as well, are based on influences of the magnitude of study demand and the lack of social support. Further, the research by Jahani Hashemi et al. (2008) indicates an increase in symptoms of light mental disorder with increased study year. Thus, a decrease in psychological well-being with increased study year is implied (Jahani Hashemi et al., 2008). Concludingly, based on these indications in prior research psychological well-being is positively influenced by studying social sciences, while study year negatively impacts psychological well-being.

Present Study

Based on the research reviewed so far, it can be assumed that creativity and psychological well-being are positively correlated. However, it is also evident that divergent thinking, a measure of creativity, has a positive correlation with psychological well-being. Additionally, it is apparent that the study experience in terms of study year and study subject, influences university students' creativity, divergent thinking, and psychological well-being. Hence, the following research question derives from the findings previously stated: How are creativity, divergent thinking and psychological well-being correlated and how does study experience influence the individual factors?

Regarding this research question the following four hypotheses will be investigated in this study: (1) University students' creativity level is positively correlated to their psychological well-being. (2) University students' level of divergent thinking is positively correlated to their psychological well-being. (3) Social science students have a higher creativity level, higher psychological well-being, and higher divergent thinking ability than technological science students. (4) Students of higher study years (third year bachelor, master) have a lower creativity level, lower psychological well-being, and lower divergent thinking ability than students of the first two study years.

Methods

Design

A cross-sectional online survey design including multiple choice/Likert-indication questions as well as open questions was used to study the relationship between creativity and well-being in university students. Additionally, the study investigated the influence of the study program and study year.

Participants

A snowball sampling method was used to gather participants via social media (Instagram, LinkedIn, WhatsApp). In addition, more responses were collected by publishing the study on the test subject pool, SONA system of the University of Twente. These students were granted 0.25 credits for their participation. The only requirement for taking part in the study was being a student at a university. The total amount of participants resulted in a number of $n=134$, after excluding 50 responses as these participants answered to less than 50% of the questions. Of these participants 64.2% were female and 34.3% male. The mean age was 21.26. 50.0% were German, 35.1% Dutch, 10.4% European (other than German or Dutch), and 4.4% non-European. The majority of participants studied social sciences 74.6%, while 22.4% studied technological sciences. Moreover, 85.0% were in their Bachelor and

15.0% in their Master (or pre-Master). 18.5% have study delay of one year or more. For a more specific overview, see *Appendix A*.

Materials

The study consisted of a questionnaire including open and multiple-choice questions. The first part of the survey was an informed consent form about the study's purpose, approximate time spent on the study, and the contact information of the researcher (see *Appendix B*). All material has been approved by the ethics committee of the University of Twente before the start of the data collection on the 28th of March 2022 (Approval code: 220284). The data was collected for two weeks, as the collection ended on the 11th of April 2022.

Measures

Psychological Well-Being. Psychological Well-Being Scale (RPWBS) by Ryff et al. (1995) was used to measure psychological well-being (see *Appendix C*). On a 7-point-Likert scale ranging from “strongly agree” to “strongly disagree” the participants answered 18 questions. An example item was “I am good at managing the responsibilities of daily life”. This scale was chosen, because it measures psychological well-being among six components, namely self-acceptance, environmental mastery, purpose in life, positive relations with others, personal growth, and autonomy (Ryff & Keyes, 1995). Furthermore, the scale shows sufficient validity and reliability (Bayani et al., 2008). Moreover, the Psychological Well-Being Scale has internal consistency (Ryff & Keyes, 1995). According to the Cronbach's alpha the scale has a good reliability, and no items have to be deleted to increase the reliability ($\alpha = 0.886$).

Creativity Level. The creativity level was measured with the Kaufman Domains of Creativity Scale (K-DOCS) (see *Appendix D*). On this 5-point-Likert scale ranging from “much less creative” to “much more creative” participants indicated how creative they are in the task indicated in the given statement. There was a total of 50 statements. An example item was “Finding something fun to do when I have no money”. The K-DOCS was included in this research because it is a reliable, valid, and robust tool for the assessment of creativity (Kapoor et al., 2021). Its reliability is good, and no items have to be deleted, based on the Cronbach's alpha ($\alpha = 0.798$). The scale measures creativity among five domains (everyday creativity, scholarly creativity, performance creativity, mechanical/scientific creativity, and artistic creativity) which have good internal consistency and adequate test-retest reliability (Kaufman, 2012; Tan et al, 2016). Therefore, Tan et al. (2016) suggest using the K-DOCS to assess creativity among students.

Divergent Thinking. Two open ended questions assessed divergent thinking. Participants had to perform a divergent thinking task with a time limit of two minutes per task, they had to overcome functional fixedness in performing two exercises of the Alternative Uses Test (AUT) designed by Guilford (1960) (*see Appendix E*). The AUT assesses flexibility of thought through verbal associations in the form of comparing different functions of an object (Jones, 2019). Thus, the AUT is a tool that measures overcoming functional fixedness (Jones, 2019). It is a valid and reliable measure of divergent thinking (Oppezzo, & Schwartz, 2014). The participants had a total of two minutes (per object) to write down as many non-obvious uses as possible. Then they were automatically guided to the next screen. The objects I chose were “paperclip” and “hand cuffs”. I picked these objects from list of items suitable for the AUT established by Briss (2022). I decided for these items, because I expected to evoke a differing range of answers, as the items themselves are not closely related in their traditional function as well as their size, material, and look. According to Jones (2019), two items are sufficient to assess students’ divergent thinking.

Study Program and Year. Lastly, as part of the demographics the participants’ study programs and study year were indicated. In order to investigate the differences between participants from different studies, the variable “study program” was researched. The variable consisted of three categories, namely social science students, technological science students, and business students. Furthermore, they were asked in what study year they are, and if any, how much study delay they have. These questions enabled to create an overview of the sample and to research whether students display differences in creativity, psychological well-being and divergent thinking based on their study year. Additionally, differences on these variables between social science students compared to technological science students could be investigated, without taking the business students’ answers into regard.

Procedure

After scanning a QR code or following the link distributed via social media or the SONA system the participants were directed to the survey. At first they had to read and agree to an informed consent in order to proceed to the study. The informed consent included informative statements about the anonymity and confidentiality of the data collected in this research. Additionally, the participants’ rights to withdraw at any point during the survey and the contact details of the researcher and the supervisor were stated in the informed consent. Furthermore, the participants were informed that it takes a maximum of 15 minutes to complete the survey (*see Appendix B*).

Then followed two multiple-choice question matrices, one about the dependent variable, psychological well-being, and the other one about the independent variable, creativity (see *Appendix C and D*). Afterwards, they performed two AUTs on the objects ‘paperclip’ and ‘handcuffs’. For each word they had two minutes of answering before being directed automatically to the next page (see *Appendix E*). The last part of the questionnaire gathered demographic information including the participants’ study program. At last, the participants were informed about the registration of their responses and thanked for their participation.

Data Analysis

The collected data was analyzed using the statistical program IBM SPSS (version 28). The data was screened for normality. 50 responses were excluded because the participants responded to less than 50% of the questions, which resulted in a total sample size of $n=134$. Then, the variable “study program” was recoded into a dummy variable with 0 = “social sciences” and 1 = “technological sciences”. Additionally, the variable “study year” was recoded into a dummy variable as well with 0 = “First Year Bachelor” and “Second Year Bachelor” and 1 = “Third Year Bachelor”, “Pre-Master”, “First Year Master”, and “Second Year Master”. To receive an overview of the sample’s demographics, descriptive statistics were calculated.

Moreover, both scales were inspected for reversed items. The K-DOCS did not include any reversed items. A high score on this scale indicated the person to be more creative rather than less creative. On the RPWBS ten items were reversed, so that a higher score on the scale indicated a higher psychological well-being. Descriptive statistics were assessed for the dependent variable psychological well-being and for the independent variable creativity.

The Alternative Uses Test

Researchers’ methods of evaluating the AUT differ widely. In their research Jones (2019) analyzed the answers of the AUT among four dimensions: Fluency, originality, flexibility, and elaboration. However, Kudrowitz and Dippo (2013) only take the score for originality into account when investigating creativity with the AUT. For this research I have decided to include three of the four dimensions introduced by Guilford (1995) and used in the research by Jones (2019). I excluded the elaboration score, because it lacks validity (Kudrowitz & Dippo, 2013). To be more precise, some people use more words to describe a function without being more detailed or elaborative in their description. For instance, the response “unlocking a door” would receive three points, while the response “using it to unlock a door” would receive six points according to the instructions (Jones, 2019; Briss,

2022). Additionally, I have decided to exclude the criterion elaboration, because the weight of the elaboration score was unproportionate compared to the other three scores. Participants were able to achieve a higher overall score by simply describing a function with multiple words, instead of naming the use with a single word. Therefore, I exclude the elaboration dimension in this research and focus only on fluency, originality, and flexibility. The written responses on the AUT were quantified among these three dimensions in the following way.

Firstly, fluency refers to the total number of alternative ideas. Quantifying the responses for this fluency score means counting the number of different answers given. Therefore, the total number of responses given by one participant was summarized in the fluency score.

Secondly, originality means how non-obvious the idea is. To quantify these responses, I categorized the answers by their purpose of use. For example, answers such as “using it to unlock a lock”, “to open a door”, “key replacement”, or “lockpick” belong to the category “lock”. All categories were scored on a 5-point scale ranging from 1 = “very obvious” 2 = “somewhat obvious”, 3 = “expected”, 4 = “somewhat expected”, to 5 = “unexpected”. This ranking dependent on the amount of people who indicated answers from the same category. Then, the score of each item was added together and divided by the fluency score in order to receive one mean score for originality.

Thirdly, flexibility considers range of the ideas across different domains of function. Therefore, the items were categorized by their function. For instance, for the item “handcuffs” the responses “as a sex object”, “to lock my bike”, or “BDSM” belonged to the same category of “restraining movement” as they refer to the same function of the object. The number of categories referring to different functions of the object per participant’s response made up the score on flexibility (Kudrowitz & Dippo, 2013).

Lastly, the final score for each participant was calculated by adding the three components together. To be precise, I took the number of responses (fluency), expectancy of responses (originality), and the range of responses (flexibility) into account to establish a participant’s final score. A higher score indicated a better performance in overcoming functional fixedness on the AUT. To achieve a quantified score for the variable divergent thinking I calculated the average score of the final scores on both items, the “paperclip” task and the “handcuffs” task.

Hypothesis Testing

To answer the first two hypotheses the Pearson correlations were calculated. For this, the answers of the whole sample on the K-DOCS and the RPWBS were analyzed for the first

hypothesis and the answers on the AUT and RPWBS were used for the analysis of the second hypothesis. Furthermore, to analyze the other two hypotheses several independent t-tests were performed. The sample was divided by the variable “study program” which was coded in a dummy variable. Then the answers of each group on the all three tests, the K-DOCS, the RPWBS, and the AUT were compared by performing an independent sample t-test. The same was done to answer the fourth hypothesis by grouping the sample different according to their study year.

Results

Descriptive Statistics

The descriptive statistics consisting of minimum value, maximum value, mean, and standard deviation of the variables psychological well-being, creativity, and divergent thinking are displayed in the table below (see *Table 1*).

Table 1

Descriptive Statistics of the Variables (n = 134).

	Minimum	Maximum	Mean	Standard deviation
Psychological well-being	3.50	6.50	5.21	0.62
Creativity	1.92	4.40	3.13	0.44
Divergent thinking	1.50	20.34	9.95	3.59

Note: Lower values represent a lower level of psychological well-being/creativity/divergent thinking and higher values show higher levels of well-being/creativity/divergent thinking.

AUT Analyses

For the originality score of the item “Paperclip”, responses with items belonging to categories that were only indicated 4 times or less were granted 5 points. Responses of indication score between 5 and 10 achieved 4 points. Categories between 11 and 25 times of mentioning got 3 points. From 26 to 40 times of indication the response was granted 2 points. And responses that mentioned items belonging to categories that were indicated more than 41 times achieved only 1 point. The deviation of the responses among the key terms can be found in Figure 1 for the item “Paperclip”. The responses for the item “Handcuffs” were categorized into key terms to calculate the originality score (*see Figure 2*). Here, categories indicated less than 3 times or less achieved 5 points. Key terms between 4 and 10 got 4 points, while key terms between 11 and 30 got 3 points. Categories indicated between 31 and

50 times gained 2 pints. Lastly, key terms that were mentioned more than 50 times were granted only 1 point.

Figure 1

Originality Key Terms for the Item “Paperclip”

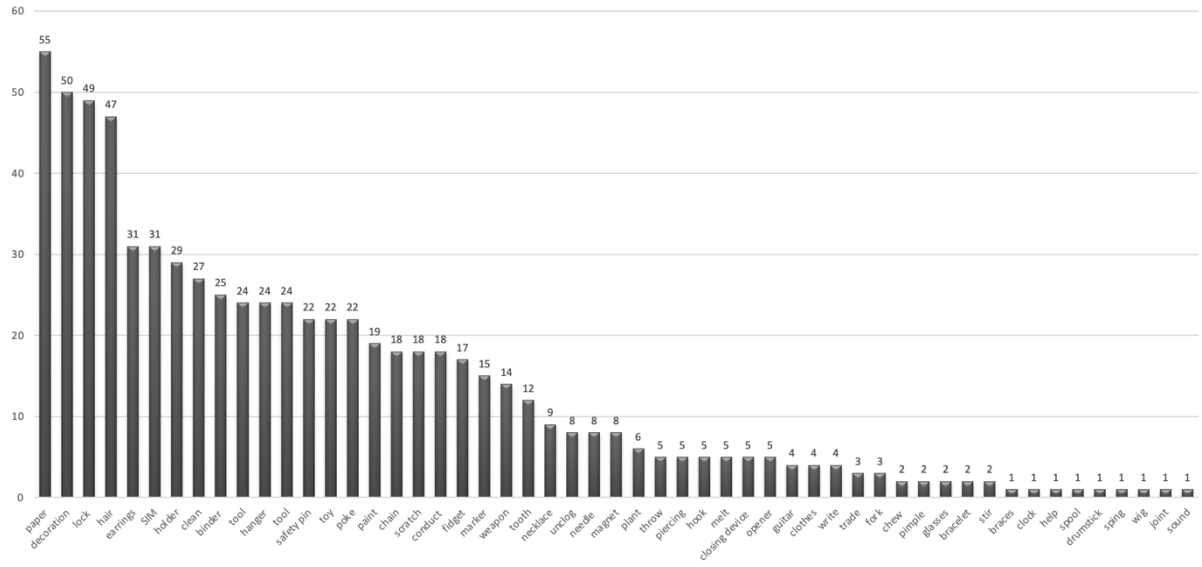
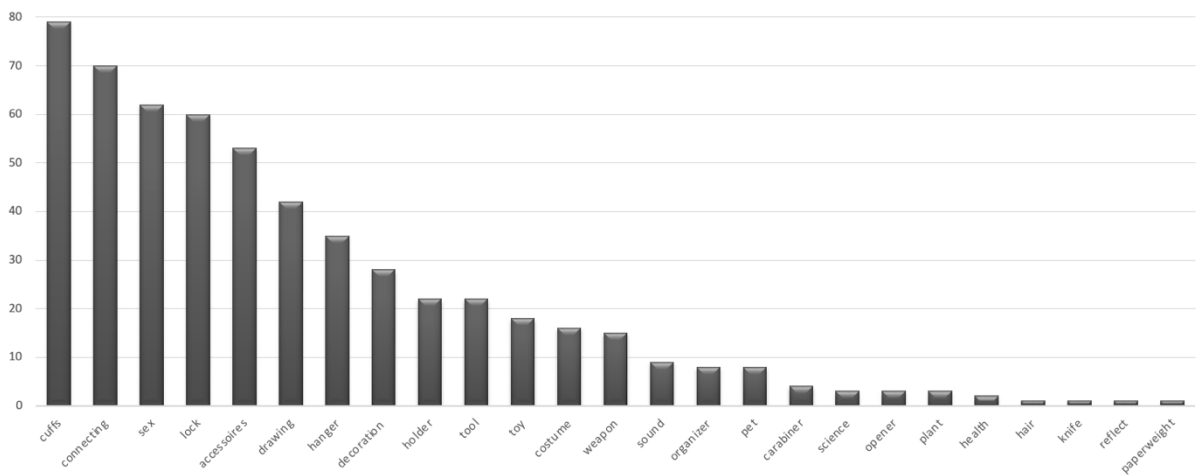


Figure 2

Originality Key Terms for the Item “Handcuffs”



For the flexibility score of the item “Paperclip” 17 functions were coded. In *Figure 3* the division of responses per function can be seen. 14 different functions were identified for the item “Handcuffs”. For the distribution of answers per item function, *see Figure 4*.

Figure 3

Fluency Function Terms for the Item “Paperclip”

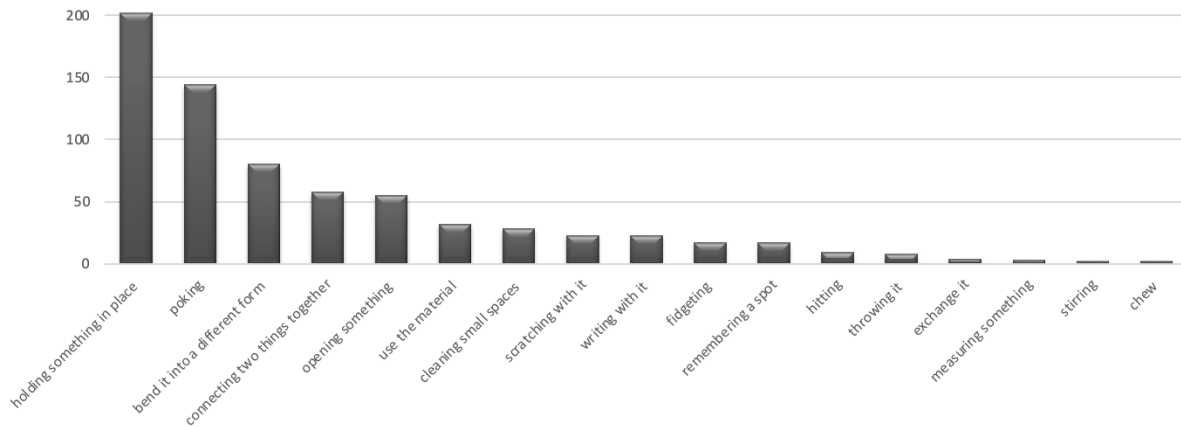
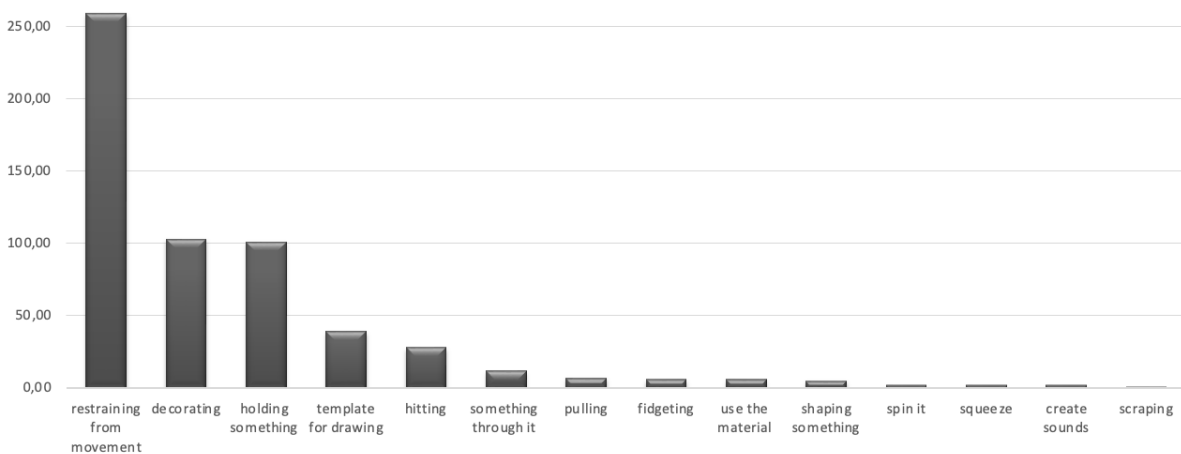


Figure 4

Fluency Function Terms for the Item “Handcuffs”



Hypotheses Testing

To answer the first hypothesis “University students’ creativity level is positively correlated to their psychological well-being” a bivariate correlation analysis was performed. According to the Pearson correlation, the results show a slightly positive correlation between creativity and psychological well-being ($r(132) = 0.194, p = .025$). Therefore, the hypothesis can be confirmed.

Another bivariate correlation analysis assessed the second hypothesis “University students’ level of divergent thinking is positively correlated to their psychological well-being”. The results indicated a weak positive correlation which was not statistically significant ($r(132) = 0.015, p = .861$). Therefore, the hypothesis has to be rejected.

Table 2*Correlations for Variables*

	Psychological well-being	Divergent thinking	Creativity
Psychological well-being	–	–	–
Divergent thinking	0.015	–	–
Creativity	0.194*	0.191*	–

* $p < .05$ (2-tailed).

An independent sample t-test answered the third hypothesis “Social science students have a higher creativity level, higher psychological well-being, and higher divergent thinking ability than technological science students”. Firstly, social science students ($M = 3.154$, $SD = 0.470$) showed a slightly higher level of creativity compared to technological science students ($M = 3.133$, $SD = 0.317$). However, these results were not significant ($t(71) = 0.274$, $p = .785$). Secondly, social science students ($M = 9.855$, $SD = 3.539$) have a lower divergent thinking ability than technological science student ($M = 10.423$, $SD = 3.684$). These results were against expectations, but similarly, they were not significant ($t(128) = -0.764$, $p = .446$). Thirdly, social science students ($M = 5.164$, $SD = 0.673$) have a lower psychological well-being than technological science students ($M = 5.306$, $SD = 0.441$). However, these results are not significant as well ($t(73) = -1.350$, $p = .181$). Hence, the hypothesis is rejected.

Table 3*Creativity, Divergent Thinking and Psychological Well-Being Scores as a Function of the Study Program*

	Social sciences ($n = 100$)		Technological sciences ($n = 30$)	
	Mean	Standard Deviation	Mean	Standard Deviation
Creativity	3.1538	0.47036	3.1333	0.31703
Divergent thinking	9.8546	3.53883	10.4227	3.68373
Psychological well-being	5.1639	0.67297	5.3056	0.44126

* $p < .05$.

Similarly, an independent sample t-test also tested the fourth hypothesis “Students of higher study years (third year bachelor, master) have a lower creativity level, lower psychological well-being, and lower divergent thinking ability than students of the first two study years”. Firstly, the results are non-significant, but indicate that students of lower study years ($M = 3.137$, $SD = 0.423$) have a slightly lower level of creativity compared to students

of higher study years ($M = 3.144$, $SD = 0.464$), ($t(131) = -0.080$, $p = .937$). Secondly, students of lower study years ($M = 9.634$, $SD = 3.325$) have a lower divergent thinking ability than students of higher study years ($M = 10.320$, $SD = 3.918$). These results are, as well, not significant ($t(131) = -1.090$, $p = .278$). Thirdly, students of lower study years ($M = 5.061$, $SD = 0.648$) have a slightly lower psychological well-being than students of higher study years ($M = 5.428$, $SD = 0.499$). These results have been found to be significant ($t(131) = -3.691$, $p < .001$). Therefore, the hypothesis is partially rejected, except for the influence of study year on psychological well-being, as this relationship has significant results but against the direction indicated in the hypothesis.

Table 4

Group Statistics on Study Year (n = 133)

	Lower study years (n = 76)		Higher study years (n = 57)	
	Mean	Standard Deviation	Mean	Standard Deviation
Creativity	3.1374	0.42264	3.1435	0.46398
Divergent thinking	9.6344	3.32477	10.3204	3.91748
Psychological well-being*	5.0607	0.64815	5.4279	0.49911

* $p < .05$.

Note: Lower study years includes students of the first- and second-year bachelor, Higher study years includes students in the third-year bachelor and (pre-)master

Discussion

This study's purpose was to investigate the correlation between psychological well-being and creativity. Prior research has indicated both a positive and negative relationship between the two variables (Acar et al., 2020). This research had the intention to shed light on this debate in the population of university students. Additionally, the research aimed to investigate the influence of study program as well as study year on creativity, divergent thinking, and psychological well-being. Moreover, the influence of divergent thinking on psychological well-being was researched.

Firstly, the hypothesis "university students' creativity level is positively correlated to their psychological well-being" was confirmed as the results were statistically significant. Prior research by Acar et al. (2020) has proven evidence that creativity can enhance well-being on a subclinical level. This research has confirmed that higher levels of creativity increase psychological well-being, and vice versa. Therefore, the finding is empirically relevant. The results show that in a university student population, creativity has a positive

relationship to psychological well-being. Thus, a trend is shown that creative students have a higher well-being than not creative students. Therefore, it can be beneficial to focus on enhancing creativity in university settings by promoting general creative behaviors and supporting students in expressing and enhancing their creativity. This study has contributed to outlining the importance of creativity in student life. Psychological well-being enhances academic performance and is thus, of great importance in a university setting (Andrews & Chong, 2011). Based on this research, it can be argued that more attention has to be paid to enhancing creativity in order to enhance psychological well-being among university students.

Secondly, the hypothesis “university students’ level of divergent thinking is positively correlated to their psychological well-being” had to be rejected. Therefore, the creativity subcategory divergent thinking, has no direct influence on psychological well-being, or vice versa. The findings of a positive correlation between divergent thinking and well-being by Alfonso-Benlliure et al. (2021), can therefore not be confirmed for the student population. In their research they conducted the tests with participants older than 65 years, hence it was interesting to investigate a similar situation in university students. However, similar results were not found. This could indicate that divergent thinking levels become more important in elderly than they are for university students. Further studies are needed to confirm this, but it could indicate that keeping a higher divergent thinking level throughout aging could improve psychological well-being.

Thirdly, the third hypothesis “social science students have a higher creativity level, higher psychological well-being, and higher divergent thinking ability than technological science students” had to be rejected. Scientists have assumed that due to the Social Learning Theory (Bandura, 1977) social science students were more creative, as their environment is filled with more creativity. Ekvall and Ryhammar (1999) as well as Cheung et al. (2003) found such indications in their research. However, the current findings were not in line with previous research. Additionally, the study program has been believed to impact well-being despite previous lack of significance (Wörfel et al., 2016). However, the current study’s results were not significant as well. Therefore, it can be concluded that the field of study has no effect on either creativity, nor divergent thinking, or psychological well-being.

Fourthly, the last hypothesis “students of higher study years (third year bachelor, master) have a lower creativity level, lower psychological well-being, and lower divergent thinking ability than students of the first two study years” was partially rejected. Both creativity as well as divergent thinking do not seem to be influenced by study year. This is not in line with previous research showing minor negative influences of study year on creativity

and divergent thinking (Simonton, 1994; Cheung et al., 2003). Despite findings of prior studies indicating a slightly negative correlation between psychological well-being and study year, the current research found a statistically significant, positive relation between the variables. The mean difference of psychological well-being for students in earlier study years compared to students in later study years are significant and quite high. Therefore, the findings imply a positive correlation between increased study year and psychological well-being. For a practical implication of the finding, it would be interesting to see what can be done by the university to improve the well-being of students of younger years. The current research stresses the need of action in this context, as the difference in psychological well-being is significantly lower among younger students than older students.

Strengths and Limitations

The research investigates a topic that is largely debated among the scientific community. The debate concerns whether creativity has a positive or negative influence on well-being. The high relevance of this debate is one of the strongest points of the study, because well-being is considered an important factor in every person's life. Therefore, factors that contribute to well-being as well as ways to improve well-being are relevant for all people. Improved well-being is a generally desired aim in society and influential factors to achieve a better well-being should be investigated. Moreover, the K-DOCS investigates creativity among multiple different scales which provides a larger impression of creativity in a person. Similarly, the RPWBS includes items from six different dimensions of psychological well-being. Hence, both scales used in the study design are reliable and valid, as they have been used for similar studies in the past. However, the third measure, the AUT, was less reliable. Despite use in prior research, the coding of the AUT was highly subjective. Hence, the final scores of each participant might be different depending on the coder. Thus, intercoder reliability is very low as is the replicability of this measurement. Therefore, the AUT is considered a limitation of this research design and a different method to measure divergent thinking should be investigated for future research.

Moreover, another limitation is the sample. While the sample size for social science students was adequate, the number of the technological science students participating in the study was too small. Hence, in the group comparison between study programs, the sample of technological science students is not very representative of the population of technological science students. Additionally, in the other settings of analyses the sample is not representative of a general student population, because of the large number of social science students. Hence, a larger number of technological science students should be used in a

replicative study to confirm the current study's findings. Additionally, a more diverse, as well as balanced sample would be good to use in a replicative study in order to fully understand the differences between students' varying scores on psychological well-being, creativity, and divergent thinking.

Furthermore, it has to be considered that the study was focused on solely the Little C (Kaufman, 2009). Hence, a positive impact of creativity on psychological well-being on a subclinical level as reported by Acar et al. (2020) can be confirmed, but no inferences can be made about other levels of creativity. Thus, further research including for example a measure of the Pro-C is needed to make an inference about the mad-genius hypothesis and to understand the impact of creativity on psychological well-being on a clinical level.

Future Research

The study touches upon the widely debated topic in the field of psychology regarding the influence of creativity on well-being. Therefore, future research in this area is highly recommended to settle the debate and fully understand the relation between creativity and well-being. Thus, a replicative study with a broader sample, especially regarding a bigger sample size for the technological science students is relevant to investigate possible influences and changes in the results. Additionally, including different study fields, such as business or art students, into the research supports to have a sample that is more representative of the student population. This would also allow to draw conclusions about which studies allow their students to express a creative interest the most and how that impacts their well-being. Furthermore, considering the limitation to the Little-C in this study design, future studies can include entrepreneurial university students. Understanding differences in their creativity and divergent thinking and how this relates to their well-being would allow more adequate inferences about the spectrum of creativity and its influences on psychological well-being.

Moreover, the study is cross-sectional and therefore does not investigate a possible causation (Tanner & Davies, 1985). In order to fully understand the relationship between creativity and well-being, an experimental, longitudinal study design would therefore be more informative (Tanner & Davies, 1985). For instance, Van de Vyver et al. (2019) investigated whether participation in art intervention enhances prosocial actions among children on both an interpersonal and an intergroup level. The authors describe this research and suggest that a similar design could be used: A student population could be semi-randomly divided into an experimental group, who practices creative tasks for a certain duration of time, and a control group, who restrains from creative tasks. After the set time duration of the experiment, the groups can be compared on pre- and post-well-being test measures. The group allocations

should be controlled for study program, study year, level of creativity, and psychological well-being. Intergroup comparisons can be conducted to see differences between the two groups in addition to individual differences of the students. Then, the researcher could make an inference about the impact of engaging in creative activities on well-being. With positive findings, this would imply for universities to encourage creativity in students in order to enhance their well-being.

Conclusion

Prior studies on creativity and well-being suggest a positive relationship on a subclinical level. Additional research has found a positive correlation between divergent thinking and positive psychological well-being. Furthermore, prior studies have found influences of study field and study year on the three variables creativity, divergent thinking, and psychological well-being. Therefore, this study focused on the questions of how are creativity, divergent thinking and psychological well-being correlated and how does study experience influence the individual factors? Results show that creativity and psychological well-being are positively correlated, while divergent thinking has no significant relationship to well-being. Moreover, most study experiences do not influence either of the variables according to the study results, except for an increased psychological well-being with higher study years. Considering these findings but also the limitations of the study, further research should explore the relationship between the variables in more detail. It is especially important to investigate the causality between creativity and psychological well-being in university students in order to facilitate well-being among students.

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Appendices

Appendix A. Demographics

Table A

Demographic Data of the Sample (n=134)

Variable	Frequency	Percentage (%)
Gender		
Male	46	34.3
Female	86	64.2
Non-binary/third gender	1	0.7
Prefer not to say	1	0.7
Age (years)		
17	1	0.7
18	5	3.7
19	20	14.9
20	29	21.6
21	20	14.9
22	25	18.7
23	22	16.4
24	6	4.5
25	3	2.2
27	1	0.7
28	1	0.7
31	1	0.7
Nationality		
German	67	50.0
Dutch	47	35.1
European (other than German or Dutch)	14	10.4
Asian	2	1.5
American	1	0.7
Other	3	2.2
Study program		
Social Sciences	100	74.6
Technological Sciences	30	22.4
Business	4	3.0
Study Year		
First Year Bachelor	57	42.9
Second Year Bachelor	19	14.3
Third Year Bachelor	37	27.8
Pre-Master	1	0.7
First Year Master	13	9.8
Second Year Master	6	4.5
Study Delay		
No	102	75.6
One module	2	1.5
One semester	6	4.4
One year	14	10.4
One and a half year	3	2.2
Two years	5	3.7
Two and a half year	2	1.5

Three years

1

0.7

Appendix B. Informed Consent

Thank you for your willingness to participate this study. This research examines the relationship between creativity and well-being among university students. You will be asked to fill in multiple choice questions as well as two open-ended questions. It will take approximately 15 minutes to complete the questionnaire. There are no right or wrong answers. Choose the one you believe fits you the best.

You have the right to withdraw from the research at any time without stating your reasons. The questionnaire will be saved by the programme Qualtrics. The collected data and the information you provide will be anonymized and cannot be traced back to you. No information about your identity will be collected or retained. The information you provide will be used in order to investigate the purpose of the study. The information will not be disclosed to third parties outside the research team.

If you have any questions about this research please contact Marie Theres Klinge (m.t.klinge@student.utwente.nl) or Dr. Gamze Baray (g.baray@utwente.nl) .

Please read the following statements and indicate your agreement by clicking the button below.

1. I am voluntarily taking part in this research.
2. I know that I can stop the research at any time.
3. I don't expect to receive any benefit or payment for my participation.
4. I understand that I am free to contact the researchers with any questions I may have in the future.

Do you agree to participate in this research?

Appendix C. Psychological Well-Being Scale (18 items)

Answer Format: 1 = strongly agree; 2 = somewhat agree; 3 = a little agree; 4 = neither agree nor disagree; 5 = a little disagree; 6 = somewhat disagree; 7 = strongly disagree.

Scoring:

The Autonomy subscale items are Q15, Q17, Q18.

The Environmental Mastery subscale items are Q4, Q8, Q9.

The Personal Growth subscale items are Q11, Q12, Q14.

The Positive Relations with Others subscale items are Q6, Q13, Q16.

The Purpose in Life subscale items are Q3, Q7, Q10.

The Self-Acceptance subscale items are Q1, Q2, and Q5.

Q1, Q2, Q3, Q8, Q9, Q11, Q12, Q13, Q17, and Q18 should be reverse-scored. Reverse-scored items are worded in the opposite direction of what the scale is measuring. The formula for reverse-scoring an item is: $((\text{Number of scale points}) + 1) - (\text{Respondent's answer})$. For example, Q1 is a 7-point scale. If a respondent answered 3 on Q1, you would re-code their answer as: $(7 + 1) - 3 = 5$. In other words, you would enter a 5 for this respondents' answer to Q1.

To calculate subscale scores for each participant, sum respondents' answers to each subscale's items. Higher scores mean higher levels of psychological well-being.

Instructions: Circle one response below each statement to indicate how much you agree or disagree.

1. I like most parts of my personality.
2. When I look at the story of my life, I am pleased with how things have turned out so far.
3. Some people wander aimlessly through life, but I am not one of them.
4. The demands of everyday life often get me down.
5. In many ways I feel disappointed about my achievements in life.
6. Maintaining close relationships has been difficult and frustrating for me.
7. I live life one day at a time and don't really think about the future.
8. In general, I feel I am in charge of the situation in which I live.
9. I am good at managing the responsibilities of daily life.
10. I sometimes feel as if I've done all there is to do in life.
11. For me, life has been a continuous process of learning, changing, and growth.
12. I think it is important to have new experiences that challenge how I think about myself and the world.
13. People would describe me as a giving person, willing to share my time with others.
14. I gave up trying to make big improvements or changes in my life a long time ago.
15. I tend to be influenced by people with strong opinions.
16. I have not experienced many warm and trusting relationships with others.
17. I have confidence in my own opinions, even if they are different from the way most other people think.
18. I judge myself by what I think is important, not by the values of what others think is important.

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Appendix D. Kaufman Domains of Creativity Scale (K-DOCS)

Instructions: Compared to people of approximately your age and life experience, how creative would you rate yourself for each of the following acts? For acts that you have not specifically done, estimate your creative potential based on your performance on similar tasks.

1 = Much less creative

2 = less creative

3 = neither more or less creative

4 = more creative

5 = much more creative

1. Finding something fun to do when I have no money.
2. Helping other people cope with a difficult situation.
3. Teaching someone how to do something.
4. Maintaining a good balance between my work and my personal life.
5. Understanding how to make myself happy.
6. Being able to work through my personal problems in a healthy way.
7. Thinking of new ways to help people.
8. Choosing the best solution to a problem.

9. Planning a trip or event with friends that meets everyone's needs.
10. Mediating a dispute or argument between two friends.
11. Getting people to feel relaxed and at ease.
12. Writing a non-fiction article for a newspaper, newsletter, or magazine.
13. Writing a letter to the editor.
14. Researching a topic using many different types of sources that may not be readily apparent.
15. Debating a controversial topic from my own perspective.
16. Responding to an issue in a context-appropriate way.
17. Gathering the best possible assortment of articles or papers to support a specific point of view.
18. Arguing a side in a debate that I do not personally agree with.
19. Analyzing the themes in a good book.
20. Figuring out how to integrate critiques and suggestions while revising a work.
21. Being able to offer constructive feedback based on my own reading of a paper.
22. Coming up with a new way to think about an old debate.
23. Writing a poem.
24. Making up lyrics to a funny song.
25. Making up rhymes.
26. Composing an original song.
27. Learning how to play a musical instrument.
28. Shooting a fun video to air on YouTube.
29. Singing in harmony.
30. Spontaneously creating lyrics to a rap song.
31. Playing music in public.
32. Acting in a play.
33. Carving something out of wood or similar material.
34. Figuring out how to fix a frozen or buggy computer.
35. Writing a computer program.
36. Solving math puzzles.
37. Taking apart machines and figuring out how they work.
38. Building something mechanical (like a robot).
39. Helping to carry out or design a scientific experiment.
40. Solving an algebraic or geometric proof.
41. Constructing something out of metal, stone, or similar material.
42. Drawing a picture of something I've never actually seen (like an alien).
43. Sketching a person or object.
44. Doodling/Drawing random or geometric designs.
45. Making a scrapbook page out of my photographs.
46. Taking a well-composed photograph using an interesting angle or approach.
47. Making a sculpture or piece of pottery.
48. Appreciating a beautiful painting.
49. Coming up with my own interpretation of a classic work of art.
50. Enjoying an art museum.

Appendix E. Divergent Thinking Task based on the Alternative Uses Test

By J. P. Guilford, 1967.

Instructions: You have two minutes to come up with as many alternative uses for this object as possible. For example, for the object “Coffee Cup” alternative uses could be “a percussion instrument you hit with a drumstick” or “a template to draw a perfect circle”

1. Paper clip
2. Handcuffs