

**Visual Analysis of The Kentucky Inventory of Mindfulness Skills (KIMS):
The Use of Data Science as an Aspiring Researcher**

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Author Notes

The following contents are meant to practice combining data science skills with an interest – author is not attending a university.

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Abstract

Mindfulness is the practice of directing one's attention to and from positive and negative phenomena in the present moment of life, leading to a lasting change in neuronal circuitry of the brain. As discussed by Baer (2004), “These skills have been incorporated into several interventions that are now widely available in medical and mental health settings” (p.191). The following project will contain a range of analytical visuals pertaining to the validity and reliability of the Kentucky Inventory of Mindfulness Skills (KIMS).

The KIMS will be analyzed at two different points in time. The first point in time is approximately 2004, when Dr. Baer administered the KIMS to 445 participants. This sample consisted of 277 females and 168 males with an average age of 21. The second point in time is approximately 2012 when openpsychometrics.org, an open-source psychometrics project, administered an online version of the KIMS to 601 random participants. This sample had 301 females, 292 males and 8 gender not specified with a mean age of 39. There was no indication of prior experience in mindfulness training. All project visuals will reflect the 2012 KIMS administration due to the ability to obtain a raw dataset. The raw dataset from the 2004 KIMS administration is not open-access and was therefore not obtainable.

This project resulted in multiple findings in terms of age, gender and tool administration throughout time. The questions asked in the KIMS assessment tool continue to accurately reflect assigned skills of mindfulness eight years after creation. The amount of time between the 2004 and 2012 KIMS administrations also show no reduction in statistical reliability of the assessment tool. Lastly, the age of a person greatly influences the development of mindful skills while gender has no meaningful relationship to this development.

Visual Analysis of The Kentucky Inventory of Mindfulness Skills (KIMS): The Use of Data Science as an Aspiring Researcher

The KIMS was first published in 2004 within a peer-reviewed article called “Assessment of Mindfulness by Self-Report: The Kentucky Inventory of Mindfulness Skills” by Dr. Ruth A. Baer. According to Baer (2004), “It is designed to assess the general tendency to be mindful in daily life, to be understandable to general and clinical populations regardless of meditation experience, and to measure several components of mindfulness.” (p. 193). The KIMS is a 39-item self-report assessment tool. In other words, voluntary participants answer 39 questions or “items” using paper or digital format. The answers to each question are based on a numerical “Likert” scale ranging from 1 to 5. Each number has an assigned label that helps participants answer more affectingly. 1 = “Never or very rarely true”, 2 = “Rarely true”, 3 = “Sometimes true”, 4 = “Often true” and 5 = “Very often or always true”.

Each of the 39 items belongs to a corresponding subscale or “skill” – observe, describe, act with awareness and accept without judgment. These subscales are not visible while the assessment is being administered. Questions 3, 4, 8, 11, 12, 14, 16, 18, 20, 22, 23, 24, 27, 28, 31, 32, 35 and 36 will be “reverse-scored” upon completion of the assessment according to the KIMS scoring instructions. The logic behind specific KIMS item reverse-scoring was described by Baer (2004) – “Some items were direct descriptions of the mindfulness component being measured, whereas others described the absence of that component and were reverse scored.” (p. 194). After reverse-scoring is complete, the proctor averages the answers for the items within each of the four skills. The resulting average is between 1 and 5 for each of the skills and can be interpreted using the previously mentioned labels.

THE FOUR SKILLS

Mindfulness seems to begin by observing (physical or mental, positive or negative) followed by describing (internally or externally). A person skilled in mindfulness will then bring the mind back to baseline through an act of awareness while simultaneously accepting the observation without judgment.

The First Skill – Observe

A person can observe in a variety of settings. As stated in the project summary of mindfulness skills, the act of observation can be physical or mental. For example, attention could be concentrated on a passing car or a passing thought. The mind also has the ability to simultaneously concentrate on the car, the thought, etc.. “All descriptions of mindfulness emphasize the importance of observing, noticing, or attending to a variety of stimuli, including internal phenomena, such as bodily sensations, cognitions, and emotions, and external phenomena, such as sounds and smells (Dimidjian & Linehan, 2003b; Kabat-Zinn, 1990; Segal et al., 2002)” (Baer, 2004, p. 193).

The Second Skill – Describe

Description is the act of labeling or simply taking note of something that one observes. Although, a description is not always incorporated into the practice of mindfulness. Some teachers of mindfulness even ask students not to describe what they observe (Baer, 2004, p. 193). Alternatively, mindful description may seem to be a gateway to stereotype or bias but practice may reduce the tendency to label in such a way over time.

The Third Skill – Act With Awareness

The act of awareness is simply concentrating one's full attention on a single physical or mental observation at a time. As fore-mentioned, the human brain has the ability to simultaneously observe multiple phenomena, but a key aspect of mindfulness is to resist dividing the attention between observations. For example, a person may concentrate on their breathing but may also hear cars passing by on a nearby road. A mindful person may temporarily observe and describe the sound of the cars but then redirect full attention back to their breathing [or whatever is being observed at baseline].

The Fourth Skill – Accept Without Judgment

As described by Baer (2004), "Participants are encouraged to bring an attitude of friendly curiosity, interest, and acceptance to all observed phenomena while refraining from evaluation, self-criticism, or attempts to eliminate or change the phenomena they observe (Segal et al., 2002)" (p. 192). The ability to presently accept without judgment is central to mindfulness as this final skill may relieve negative tendencies within and around the practicing person over time.

STUDY ONE: SCALE-COUNT COMPARISON PER ITEM

METHODS

Tools Utilized

The entirety of project content was developed using the python computer programming language which is often used in data science and data visualization among other real-world applications. The Pandas Library was used for all dataset manipulation and analysis. The Seaborn Data Visualization Library was used to develop 39 individual statistical visualizations for Study One.

Data Visualization

The primary purpose of Study One was to “zoom in” on the 2012 KIMS assessment tool administration and present results for individual items. A fresh dataset often requires initial cleaning and organizing prior to presentation. The previously mentioned reverse-score items were reversed as instructed by the KIMS scoring instructions. There were a total of 18 out of 39 reversed-scored items. Next, all 601 numerical answers to the 39 items were re-labeled as the following – “Never or very rarely true (1)”, “Rarely true (2)”, “Sometimes true (3)”, “Often true (4)” and “Very often or always true (5)” in order to improve reader comprehension. These steps prepared the 39 total items to give an “answer count” for each fore-mentioned label. The items were then separated into their respectable skill – observe, describe, act with awareness and accept without judgment.

Note. The following four visualizations are the first items of each skill. All 39 item visualizations are contained within a separate PDF labeled “Item Visualizations”.

Figure 1

Observe – Item One

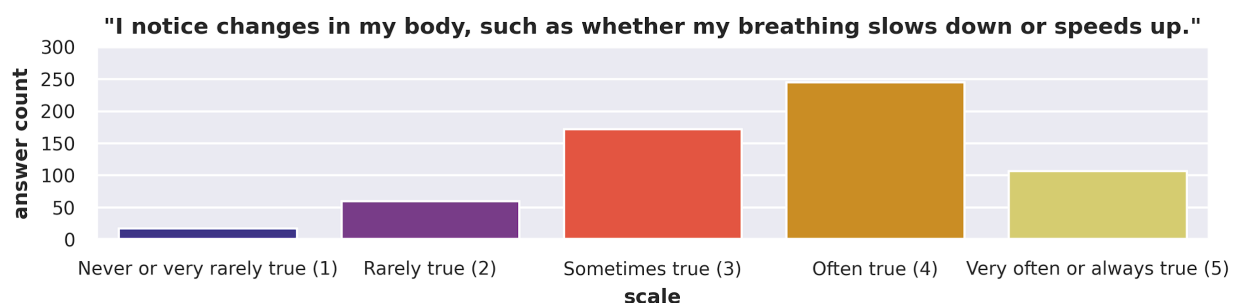
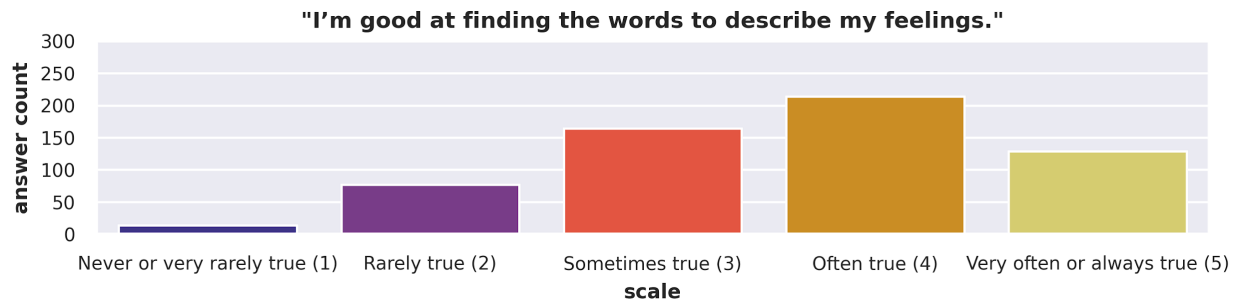
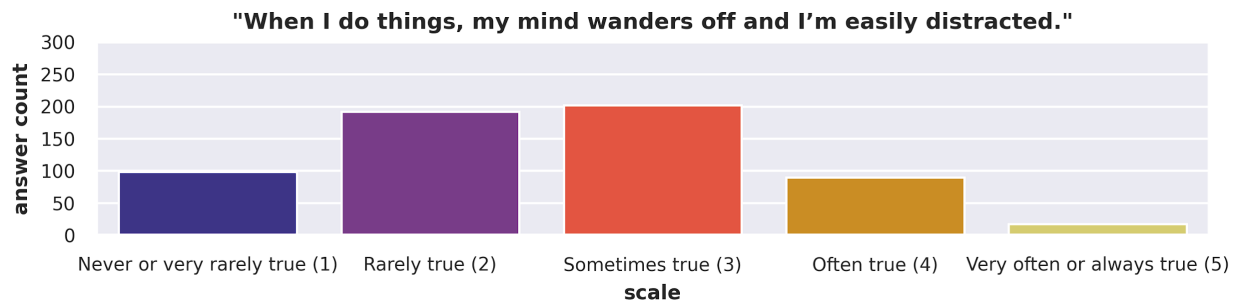
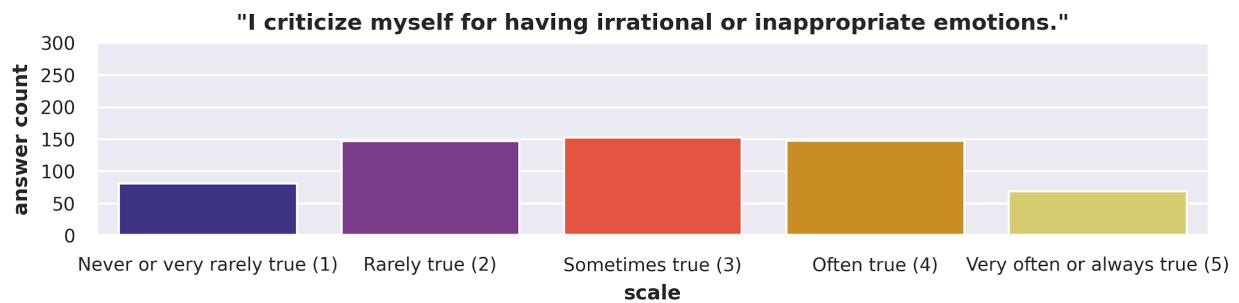


Figure 2*Describe – Item One***Figure 3***Act With Awareness – Item One***Figure 4***Accept Without Judgment – Item One*

RESULTS AND DISCUSSION

All 39 items of the 2012 administration of the KIMS assessment tool were reviewed. The 601 answers to the items within both “observe” and “describe” have the strongest consistency between “Sometimes true (3)” – “Often true (4)”. This result implies that the participants often felt neutral or fairly confident in their ability to observe and describe internal or external stimuli. Answers to items within “act with awareness” have the strongest consistency between “Rarely true (2)” – “Sometimes true (3)”. This result implies that participants sometimes feel confident in their ability to direct their attention but often neutral in terms of control. Lastly, answers to items within “accept without judgment” seem often to be evenly distributed between “Rarely true (2)”, “Sometimes true (3)” and “Often true (4)”. This result implies instability in terms of judgmental control upon observation. The following study also suggests that age may play a role.

Furthermore, the items seem to represent their respectable assigned skill group – a sign of exceptional content validity. The collection of items per skill also reflect the study of both introspection and extrospection. Finally, all items of the KIMS assessment tool are “clear and well-written” as also described in the original KIMS study (Baer, 2004, p. 195).

STUDY TWO: MINDFULNESS SKILLS, AGE GROUPS AND GENDER

METHODS

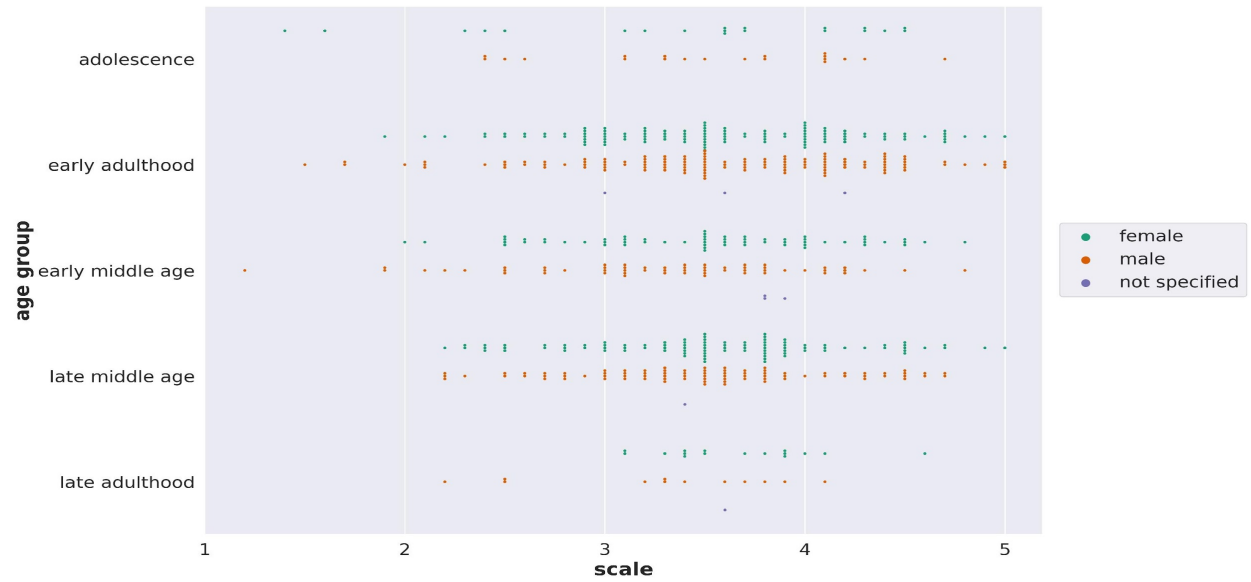
Tools Utilized

The Pandas Library was used to assist in relabeling and re-categorizing target data prior to the product. The Seaborn Library was used to develop four individual statistical visualizations for study two.

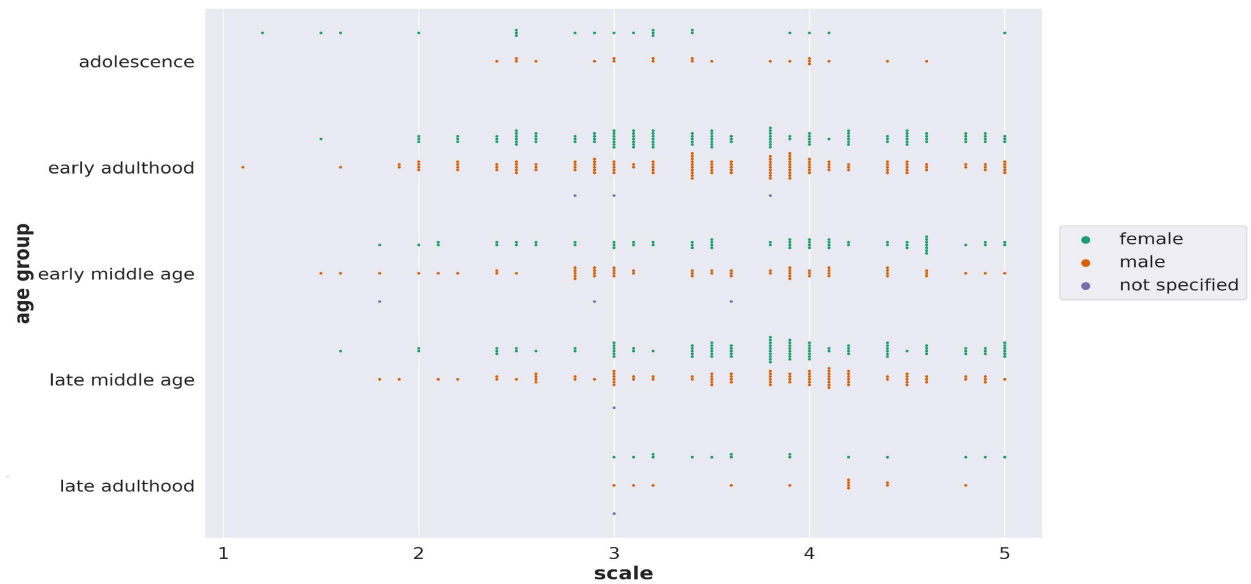
Data Visualization

Study Two was created in order to depict average skill scores in comparison to age group and gender. The initial variables of gender indication were “1” or “2”. These numerical values were re-labeled with “male” or “female” to improve reader comprehension. A small number of participants did not declare gender and were relabeled as “not specified”. There were 301 females, 292 males and 8 gender not specified. Next, score averages were made for each of the skills containing their respectable items. These averages were created by adding the item scores together for each skill and dividing by the number of items per skill.

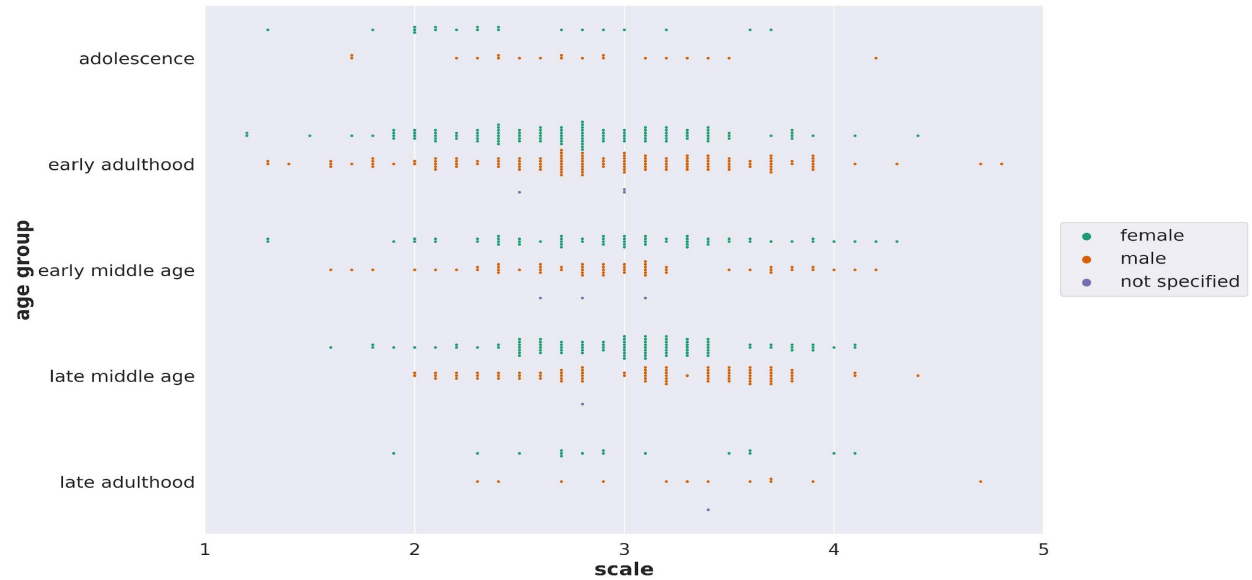
Lastly, age groups were created. The average age of the 601 participants was 39. The minimum recorded age was 14 while the maximum recorded age was 99. Ages 14 – 18 were categorized as “adolescence”. Ages 19 – 34 were categorized as “early adulthood”. Ages 35 – 44 were categorized as “early middle age”. Ages 45-65 were categorized as “late middle age”. Ages > 66 were categorized as “late adulthood”. 40 participants were in adolescence, 233 participants were in early adulthood, 121 participants were in early middle age, 178 participants were in late middle age and 29 participants were in late adulthood.

Figure 5*Observe*

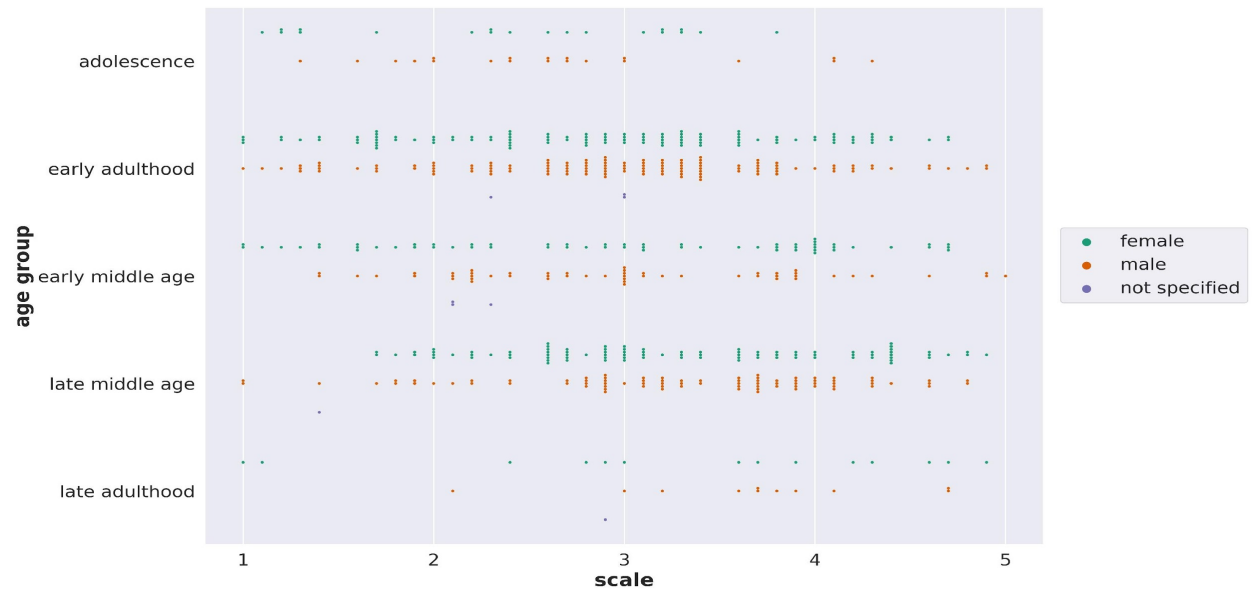
Note. 1 = “Never or very rarely true”, 2 = “Rarely true”, 3 = “Sometimes true”, 4 = “Often true” and 5 = “Very often or always true”.

Figure 6*Describe*

Note. 1 = “Never or very rarely true”, 2 = “Rarely true”, 3 = “Sometimes true”, 4 = “Often true” and 5 = “Very often or always true”.

Figure 7*Act With Awareness*

Note. 1 = “Never or very rarely true”, 2 = “Rarely true”, 3 = “Sometimes true”, 4 = “Often true” and 5 = “Very often or always true”.

Figure 8*Accept Without Judgment*

Note. 1 = “Never or very rarely true”, 2 = “Rarely true”, 3 = “Sometimes true”, 4 = “Often true” and 5 = “Very often or always true”.

RESULTS AND DISCUSSION

All four skill visualizations were analyzed in terms of gender and age group. A gender comparison reveals that there is not a substantial difference in mindfulness skills when comparing male to female. Although, the largest variance in gender seems to take place in late middle age (45-64); life expectancy may play a role. Regardless of gender, a notable phenomenon is the scale variance in early adulthood compared to late middle age. Participants in late middle age seem to not only vary less on scale but also answer closer to “5”. This result may reflect a gradual increase in mindful tendencies throughout life.

STUDY THREE: AGE GROUPS AND COMBINED SKILLS OF MINDFULNESS

METHODS

Tools Utilized

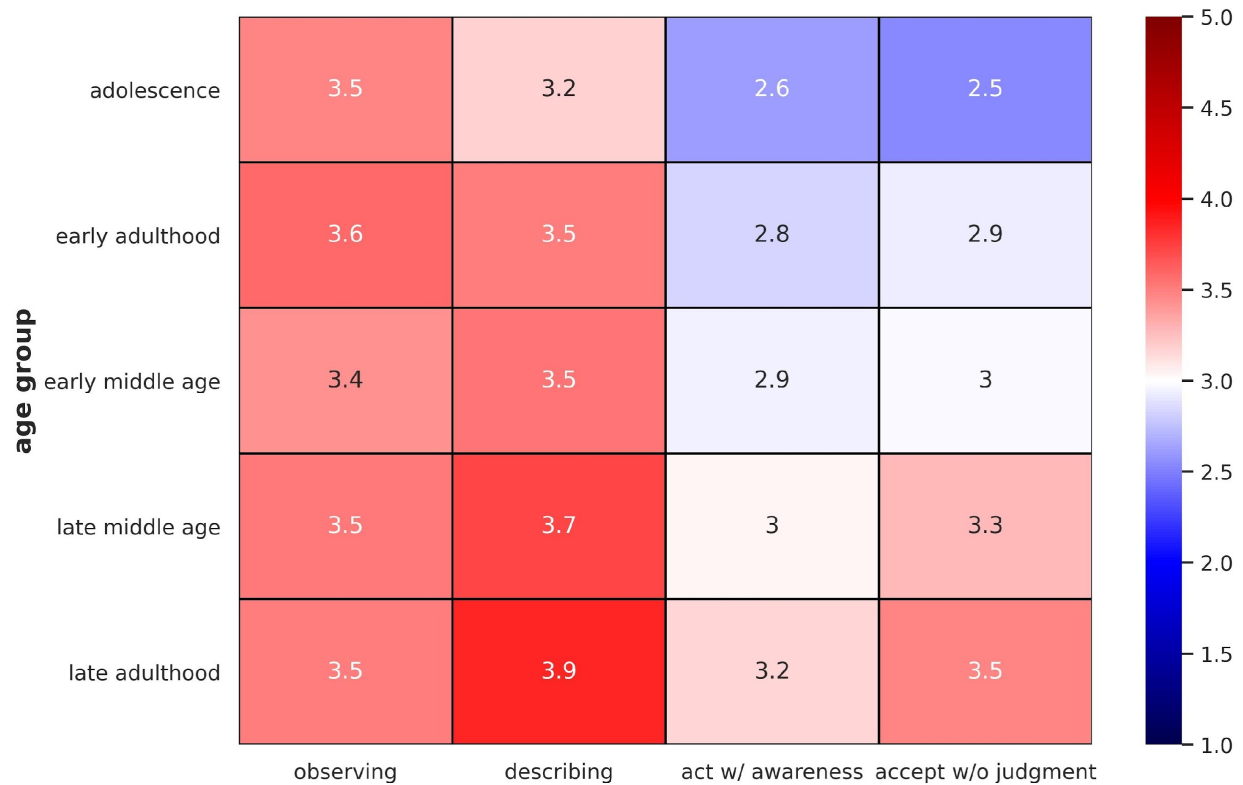
The Pandas Library was used to assist in isolating and manipulating data prior to visualization. The Seaborn Library was used to develop one statistical visualization for study three.

Data Visualization

As gender did not prove to show substantial variance for each skill, the final visualization is an age group comparison to combined skill averages. The primary purpose of this study was to combine all substantial project calculations and create a final visualization with optimal readability. This was accomplished by isolating the dataset to reflect age group and pre-calculated skill averages.

Figure 9

A Comparison of Age Group to Skills of Mindfulness



Note. “act w/ awareness” = act with awareness. “accept w/o judgment” = accept without judgment. 1 = “Never or very rarely true” ... 5 = “Very often or always true”.

Results and Discussion

All age groups were analyzed according to each skill. More variance in average skill scores take place in early life. This result is likely due to certain skills being more easily attainable than others. For example, acting with awareness and accepting without judgment may take more time to develop compared to observing and describing. Overall, an increase in age is proportional to a higher scale score in all skills but observe. This result may due to the innate ability to observe regardless of the development of other skills of mindfulness.

STUDY FOUR: COMPARISON OF RELIABILITY

METHODS

Tools Utilized

PSPP, a statistical analysis tool, was used as an open-source alternative to SPSS (Statistical Package for the Social Sciences) in order to calculate measures of reliability. The Numpy Library was used to create a two-dimensional data array. The Pandas Library was used to create a presentable data frame.

Data Visualization

PSPP was used to calculate Cronbach's Alpha for each of the average scale scores of the 2012 KIMS administration in order to compare past calculated Cronbach's Alpha values for the 2004 KIMS administration. Cronbach's Alpha is a measure of "Internal Consistency" – how well items within an assessment measure specific characteristics (observe, describe, act with awareness and accept without judgment) of a tool (KIMS). In other words, Cronbach's Alpha is a measure of assessment tool reliability, which ranges from 0 to 1 in value. There were a total of eight calculated Cronbach's Alpha values. Each of these values was represented in a 2x4 Numpy Library array. The Numpy Library array was then recreated into the following data frame.

Figure 10

Comparison of Reliability

	observe	describe	act with awareness	accept without judgment
2004	0.84	0.91	0.83	0.87
2012	0.86	0.89	0.81	0.91

Note. alpha more than or equal to .9 = excellent internal consistency.

Note. alpha more than or equal to .8 but less than .9 = good internal consistency.

Note. alpha more than or equal to .6 but less than .7 = questionable internal consistency.

Note. alpha less than .5 = unacceptable internal consistency.

Result and Discussion

When comparing the 2004 and 2012 KIMS administrations an eight year difference was observed. This result implies that the KIMS assessment tool has increased in reliability when measuring both “observe” and “accept without judgment” skills. Although, this growth in reliability is counterbalanced by the decrease in reliability when measuring “describe” and “act with awareness”. All fluctuations in reliability may be explained by a lack of knowledge of participant prior experience in mindfulness training. Regardless, the KIMS assessment tool has maintained overall good-excellent internal consistency over a considerable amount of time.

General Discussion

The totality of all performed project analyzations and visualizations has led to multiple conclusions about the assessment of mindfulness and of the concept in itself. First, gender holds no meaningful relationship in the scoring of mindfulness skills. Second, the life of a person may lead to a slow development of mindful skills. Although, these skills may develop much earlier in life with the practice of mindfulness. Lastly, the KIMS items continue to accurately reflect their respectable skills after an eight year gap in two independent administrations.

There were multiple limitations during the formation of this project. Mainly, the 2012 dataset did not create an initiative to gauge previous experience in mindfulness training for individual participants. Also, The original KIMS study had an average approximate participant age of 21. This average did not supply as much insight pertaining to age as the 2012 dataset with an average age of 39. Lastly, the 2012 KIMS administration was conducted online, meaning that

participants may have resided anywhere in the world. The online accommodation eliminates the possibility of useful geographical inferences.

Progress in research is best made when there is a plan for the future. The next analyzation of mindfulness skills will be personally orchestrated while paying special attention to voluntary disclosure of participant location and pre-existing level of mindfulness. This initiative will allow a study potential differences in collectivist and individualist cultures while learning about skill improvement throughout levels of experience.

References

Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The kentucky inventory of mindfulness skills. *Assessment*, 11(3), 191-206.

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