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Trends and usage pattern of SPSS and Minitab Software in Scientific research

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Abstract. Most scientific research generates data. Analysis of the data from scientific research helps create new knowledge or a deep understanding of natural phenomena. Statistical software is used mainly in data analysis. SPSS and Minitab appear to be most popular, especially for those that could neither code nor mathematical inclined to handle advanced software such as R, MATLAB, Maple, etc. Trends and usage pattern of SPSS and Minitab Software in Scientific research was studied in this paper with the data obtained from the Scopus database. In their abstracts or keywords, documents that have mentioned SPSS were extracted for the years 2010 to 2019. Frequency analysis showed that the trend of using SPSS and Minitab is steadily increasing, although the use of Minitab is a fraction of SPSS. Minitab is mostly used in engineering, materials science, and computer science, while SPSS is mainly used in medicine, social science, and engineering. Analysis of the document type showed that SPSS and Minitab are mostly stated in abstracts or keywords of research articles, conference papers, review papers, and books indexed in Scopus.

Keywords: Abstract, keywords, Minitab, research, Scopus, software, SPSS, subject classification, statistics,

1. Introduction

Statistical software (SS) are specialized computer programs designed for statistical data analysis. It comes as a standalone package, extension, programming language, or macros/add-ons. Statistical software can be navigated as a graphical user interface (GUI) or scripting. Statistical software is used to analyze data emanating from a carefully organized scientific process of observation and experimentation. The data analysis can then produce a result that can be interpreted to birth scientific knowledge. The data analysis is often done systematically to ensure adequate evaluation of data [1] and hence, describing the data or making statistical inference from the data. The absence of statistical software implies that most scientific or social science data would not graduate into knowledge that can guide in decision making. Also, statistical tools help to precipitate research findings from proper analysis of data, thereby preserving the data's integrity. Again, data analysis can be used to validate research findings in cases where integrity issues are suspected.



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Statistical software can be in the form of open-source, public domain, freeware, and proprietary. Examples of open-source SS are R, OpenEpi, JASP, PSPP, ROOT, Scilab, Salstat, SciPy, SOFA statistics, Statistical lab, and others. Examples of public domain SS are X-12 ARIMA, Epi info, and CSpPro. Examples of freeware SS are BV4.1, Winpepi, GeoDA, WinBUGS, MINUIT, and MaxStat. Examples of proprietary SS are SPSS, Minitab, Analytica, JMP, LISREL, Maple, Mathematica, MATLAB, OriginPro, SAS, SigmaStat, Statgraphics, Statistica, S-PLUS, and others.

SPSS and Minitab are very common among researchers that do not have competencies in using advanced statistical tools. The two statistical software is easy to use because they are designed mainly to be a graphical user interface, although some coding may be involved for advanced data analysis [2-7]. The two software can handle complex data manipulation with simple predefined steps [8]. SPSS is popularly known as Statistical Package for the Social Sciences or Statistical Product and Service Solutions. SPSS is a widely used statistical software for statistical analysis in social science and market analysis. IBM Inc now owns SPSS. Minitab is a statistics package developed at Pennsylvania State University and distributed by Minitab, LLC, a privately owned company in Pennsylvania. Minitab is often used in process improvement and quality assurance [9-12]. Extensions exist for both software that will enable then to interface with other statistical software or packages in the form of macros or add-ins.

SPSS and Minitab can be used in the following; data transformation, regression analysis, analysis of variance, multivariate analysis of variance, analysis of covariance, t-tests, non-parametric tests, time series, design and analysis of experiments, spatial analysis, survival analysis, dimension reduction, reliability, factor analysis, correspondence analysis, neural network, correlation and others [13-17]. The choice of data analysis will ultimately depend on the suitability of the statistical software [18]. Some selected works that used both statistical software in their data analysis can be assessed in [19-23].

This paper reports the data analysis of the search done on the Scopus database to determine the frequency of the use of SPSS and Minitab across 27 major subject classification of Scopus. The analysis is further extended to the nature of the documents across the subject classifications. The Scopus subject classifications are; medicine (MED), social sciences (SOC), engineering (ENG), business management and accounting (BMA), biochemistry and molecular biology (BMB), computer science (CSC), nursing (NUR), agricultural and biological sciences (ABS), environmental sciences (ESC), pharmacology, toxicology and pharmaceutical (PTP), arts and humanities (AAH), dentistry (DEN), psychology (PSY), health professions (HPR), physics and astronomy (PAA), decision sciences, immunology and microbiology (IAM), economics, econometrics and finance (EEF), energy (ENE), materials science (MSC), earth and planetary sciences (EPS), multidisciplinary (MUL), neuroscience (NEU), mathematics (MAT), chemical engineering (CEN), chemistry (CHE), veterinary (VET) and undefined (UND).

2. Methods

The summary of the materials used and the adopted methodology are outlined.

Data source: Scopus database.

Scope: The research considered only papers whose abstracts or keywords contain the terms 'SPSS' and 'Minitab'. All document types from the search were analyzed.

Search method: The terms "SPSS" and "Minitab" were searched independently, and the number of times the terms appeared either in the abstracts or keywords or indexed keywords was extracted. Papers in the undefined status were classified as a subject. The search terms were able to bring out results because it is ethical for scholars to report the software they used in their data analysis either in the abstracts or the body of their research works.

Data range: The displayed results from 2010 to 2019 were extracted.

Search period: This query was done on May 30, 2020.

Data extraction: Raw data were retrieved manually from the Scopus database.

Raw data format: Excel.

Data analysis: This was done using Microsoft Excel, SPSS 23.0 and Minitab 17.0.

Statistical analysis: Frequency table, trend plot and Spearman rank correlation. T test was not used because the frequency varies significantly from the frequency analysis.

Data availability: The data is available on request from interested researchers.

3. Result

The search yielded different results for SPSS and Minitab for the years 2010 to 2019, and these are presented in Tables 1 and 2. Medicine (MED), social sciences (SOC), engineering (ENG), business management and accounting (BMA), and biochemistry and molecular biology (BMB) are the top 5 subject areas where SPSS has been used for data analysis in papers indexed in Scopus from 2010 to 2019. On the other hand, mathematics (MAT), chemical engineering (CEN), chemistry (CHE), veterinary (VET) and undefined (UND) are the least five subject areas that make mention of SPSS in their abstracts or keywords.

Table 1: Frequency of the use of SPSS from 2010 to 2019

SUBJECT	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	Total
MED	4741	4464	4006	3702	3138	3046	2691	2167	1784	1422	31161
SOC	1254	837	665	567	446	430	309	275	311	238	5332
ENG	893	561	473	378	319	323	278	208	217	161	3811
BMA	761	465	396	351	186	146	115	94	100	82	2696
BMB	656	797	638	713	553	523	498	355	244	153	5130
CSC	649	436	409	279	215	164	139	135	161	153	2740
NUR	567	481	371	351	298	301	255	208	160	168	3160
ABS	418	392	294	272	247	402	249	166	133	130	2703
ESC	393	325	239	169	140	293	149	105	93	61	1967
PTP	385	422	306	442	306	221	157	123	106	71	2539
AAH	328	157	108	91	151	156	83	62	38	25	1199
DEN	324	361	279	215	169	131	116	109	93	70	1867
PSY	223	143	128	100	61	52	65	77	124	83	1056
HPR	195	168	119	116	93	82	74	89	54	54	1044
PAA	182	129	59	68	29	33	21	22	17	30	590
DEC	178	131	106	74	49	31	36	19	26	44	694
IAM	150	157	102	153	90	108	95	70	44	37	1006
EEF	146	159	230	159	161	138	60	47	28	18	1146
ENE	118	102	124	54	48	34	23	18	15	10	546
MSC	116	127	100	62	47	45	28	41	38	33	637
EPS	115	109	49	40	28	39	27	34	43	22	506
MUL	115	145	72	165	121	82	132	105	93	22	1052
NEU	114	124	110	91	58	55	57	41	32	45	727
MAT	112	125	163	86	68	37	47	53	59	47	797
CEN	58	94	51	67	60	41	23	23	13	13	443
CHE	57	85	38	59	47	33	35	27	15	14	410
VET	47	36	51	35	31	24	31	31	14	16	316
UND	0	1	0	0	1	2	0	0	0	0	4
Total	8733	7947	6719	6437	5211	5114	4459	3554	3018	2323	53515

Table 2: Frequency of the use of Minitab from 2010 to 2019

SUBJECT	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	Total
MED	15	22	20	18	18	18	18	18	15	7	169
SOC	4	9	3	8	3	9	5	2	0	4	47
ENG	112	112	88	77	51	62	59	40	37	36	674
BMA	17	17	14	12	7	8	5	2	3	2	87
BMB	11	14	14	14	14	10	6	6	7	2	98
CSC	35	30	25	10	11	12	11	8	8	8	158
NUR	5	3	0	0	1	2	1	2	1	0	15
ABS	29	20	14	21	12	14	10	10	14	4	148
ESC	22	30	16	15	13	19	15	6	7	9	152
PTP	5	6	10	15	13	8	3	4	5	2	71
AAH	0	1	1	1	1	1	1	2	0	1	9
DEN	1	3	1	0	0	3	1	2	2	0	13
PSY	0	0	0	0	0	0	0	0	0	1	1
HPR	0	1	0	1	0	1	1	0	1	0	5
PAA	28	24	13	14	7	10	10	9	8	10	133
DEC	6	10	12	7	1	4	1	1	0	2	44
IAM	2	4	4	6	4	6	1	2	5	2	36
EEF	0	2	2	1	1	3	1	1	0	0	11
ENE	18	13	14	8	12	7	5	3	8	5	93
MSC	55	75	41	34	29	14	15	24	15	14	316
EPS	6	12	6	2	3	3	3	3	4	4	46
MUL	7	5	1	7	4	1	2	4	5	3	39
NEU	1	0	1	0	0	0	1	0	0	1	4
MAT	8	12	8	8	9	10	6	10	9	5	85
CEN	28	27	16	16	13	14	13	11	10	10	158
CHE	16	23	18	15	16	11	9	11	5	8	132
VET	3	5		4	3	3	3	2	1	1	25
UND	0	0	0	0	0	0	0	0	0	0	0
Total	252	267	183	176	147	149	136	116	99	83	1608

Engineering (ENG), materials science (MSC), computer science (CSC), agricultural and biological sciences (ABS), physics and astronomy (PAA) and chemical engineering (CEN) are the top 6 subject areas where Minitab has been used for data analysis in papers indexed in Scopus from 2010 to 2019. On the other hand, arts and humanities (AAH), psychology (PSY), health professions (HPR), economics, econometrics and finance (EEF) and undefined (UND) are the least five subject areas that make mention of Minitab in their abstracts or keywords.

A further look at **Tables 1** and **2** shows that Minitab's usage pattern is a fraction of SPSS, which implies that researchers used SPSS more than Minitab.

The frequency analysis is depicted on a trend plot to show the two statistical software trends and can be seen in **Figures 1** and **2**.

It could be seen from **Figure 1**, that the trend of the use of SPSS is increasing steadily. The trend of the use of Minitab is increasing steadily, although, there is a downward trend from 2018 to 2019.

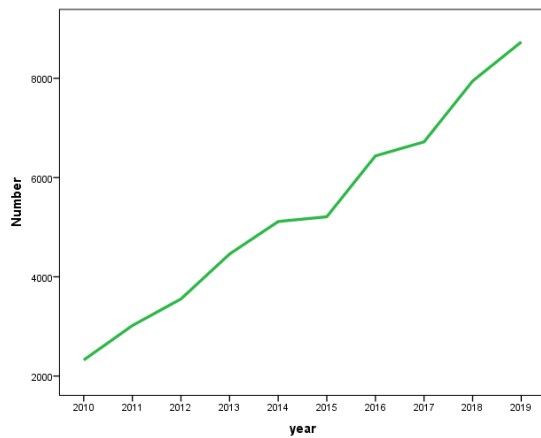


Figure 1: The trend of SPSS usage in scientific research

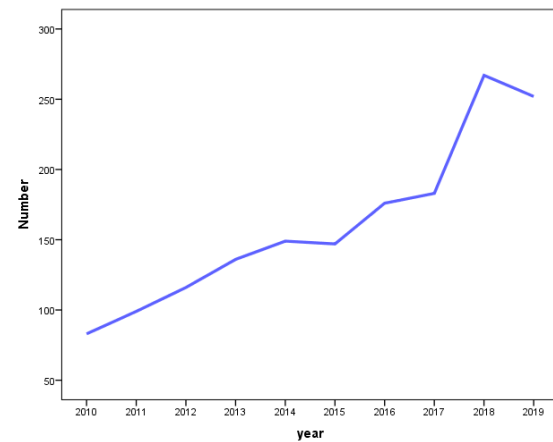


Figure 2: The trend of Minitab usage in scientific research

Table 3: Document type that have mentioned SPSS in their abstracts or keywords

Document type	Frequency
Article	49104
Conference Paper	3141
Review	741
Book Chapter	229
Undefined	84
Data Paper	68
Book	57
Note	35
Erratum	31
Retracted	20
Letter	15
Editorial	11
Short Survey	9
Conference Review	6
Abstract Report	1

Table 4: Document type that have mentioned Minitab in their abstracts or keywords

Document type	Frequency
Article	1131
Conference Paper	420
Book	21
Book Chapter	15
Review	9
Data Paper	4
Undefined	3
Conference Review	2
Short Survey	1
Note	0
Erratum	0
Retracted	0
Letter	0
Editorial	0
Abstract Report	0

The breakdown of the document type from **Table 3** showed that article, conference paper, review, and book chapter are the ones with the most frequency in decreasing order for SPSS. According to Minitab, the most top document type is article, conference paper, book, and book chapter (**Table 4**).

Spearman rank correlation was performed to show the relationship between the SPSS and Minitab data from 2010 to 2019. The result presented in **Table 5** showed no significant correlation between the pair for years, as mentioned above. The pattern of Tables 1 and 2 are different for SPSS and Minitab.

Table 5: Correlation between the documents that have stated their use of SPSS and Minitab in their papers.

Year	Correlation
2019	0.223
2018	0.169
2017	0.180
2016	0.255
2015	0.257
2014	0.351
2013	0.207
2012	0.221
2011	0.225
2010	0.044

4. Conclusion

SPSS and Minitab will continue to be most sought statistical data analysis tools, especially for those with low statistical or mathematical competencies. The trend analysis showed that SPSS is utilized more than Minitab, and no correlation exists between the two. Hence, further research works are needed to show if competency in one software affects the other. The extent to which the two statistical software is to be used will greatly depend on the nature of the analysis. SPSS and Minitab will continue to be patronized by researchers, the areas of application notwithstanding. Adequate awareness is needed to educate researchers on the use of Minitab since the present work has shown that it is far less utilized than SPSS.

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