

# “CRITICAL STATISTICAL LITERACY”, “SOCIAL JUSTICE STATISTICS”, AND “CRITICAL STATISTICAL CONSCIOUSNESS” AS HIGHER EDUCATION IMPERATIVES, AMIDST THE COVID-19 PANDEMIC IN SOUTH AFRICA

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## ABSTRACT

Familiarity with the Covid-19 pandemic-related statistical jargon is a requirement for the layman, who must stay abreast of developments apropos of rate of infection, spread, and mortality rate comprising the pandemic. Such a familiarity, termed statistical literacy (SL) in the related discourse, is increasingly becoming an important aspect of higher education (HE) studentship across universities, internationally. This article offers an extension to the extant theorisations of statistical literacy in the context of Covid-19. Formulation of a solid theoretical rationale for fostering the competency of SL at the HE level is therefore central to this article. The literature offers the notion of critical statistical literacy (CSL) as anchored in a social-justice paradigm. CSL is used here as a starting point for the theoretical extensions proposed in this article. A novel disciplinary idea called “social justice statistics (SJS)” is also introduced. The idea of “critical statistical consciousness (CSC)” as a new proposition for theorising the statistical sensibility of citizens is also put forward. The ways in which CSC rationalises CSL, and foregrounds SJS, are subsequently theorised. CSC, as a broad attribute, quality, or a higher-education trait, is thus positioned in the context of the Covid-19 pandemic. These theorisations have implications for the practice of statistics, both at the levels of “producer” and “consumer” of statistical communications that characterise the way in which the pandemic is understood by the layman.

**Keywords:** statistical literacy, statistical consciousness, social justice statistics

## INTRODUCTION

The Covid-19 pandemic has highlighted the need to explore how educational purposes can be reconceptualised around the notion of social justice (Peters et al. 2020). The pandemic affects

the society in unprecedented ways. The sheer volume of statistical information resulting from monitoring the spread of the disease, with which citizens are bombarded on a daily basis, is an interesting aspect thereof. Persistent exposure to social-media-generated information on Covid-19 may lead to severe stress reactions producing long-term psychological effects (Derek, Majerova, and Machova 2020). The way in which an individual responds to this “information overload”, especially that resulting from data analysed statistically, is guided by familiarity with the terms and ideas that characterise statistics-based communications. The statistical literacy demands of such communications are therefore also significant (Watson 2015). In this context, this article introduces the notion of “social justice statistics (SJS)” as an ideological and disciplinary basis for “critical statistical literacy (CSL)”, both being considered in the context of higher education. Through the theoretical lens of social justice, CSL and SJS are viewed in the illustrative scenario of the Covid-19 pandemic.

The question that is central to this article is: why should there be an increased statistical awareness among higher education (HE) students in the context of the Covid-19 pandemic? In this connection this article firstly deals with the idea of SL, followed by the theorisation of CSL as seen in the literature, with an emphasis on its (CSL’s) significance in the HE sector. CSL is then positioned in the context of the Covid-19 pandemic. How CSL is conceptually linked to the idea of social justice, and how the former is philosophically subsumed within the latter, is then argued for. The article concurrently elucidates how the Covid-19 pandemic has brought about the emergence of a new statistical consciousness, and hence the notion of SJS. It also argues, in conclusion, ways in which the Covid-19-related statistical consciousness can legitimise CSL and SJS; and how both should then become the reason for realigning HE with the new realities. The notion of social justice in HE, however, provides an overarching ideological structure for these arguments.

## **STATISTICAL LITERACY (SL)**

Studies into cognitive processes have stressed that judgemental and chance-related competencies of individuals have an influence on the quality of decisions they make (Gal 2002). The early conceptualisations of SL were characterised by SL’s association with a set of basic statistical skills and concepts. Such conceptualisations have since been altered to a much broader scope covering individuals’ competencies, goal-driven dispositions and habits, and a critical standpoint on issues (Gal 2002, 2). One major contributor to this discourse was Watson (1997), who theorised that SL has three structural aspects that increase in complexity. These aspects are: knowledge of terms characteristically found in statistics and probability, knowledge of contextually embedded statistical ideas, and a critical disposition that helps one question

unfounded statistical claims (Watson 1997, 108). Gal (2002) further points out that SL, when considered an attribute of informed citizenry, can have two distinct aspects. Such are: a) interpretation and critical evaluation of statistically communicated information, b) communicative competency that helps to articulate responses to statistical information, opinions, and concerns with regard to such information (Gal 2002, 3). These two aspects explicitly manifest in citizens’ awareness of social phenomena, such as prevalence of crime, pandemics, unemployment, etc. (2002, 3). The notion of “critical evaluation” emphasised by the first aspect is a significant factor of SL. Literacy skills are also fundamental to SL because statistical communications essentially involve “text comprehension skills” and the skills associated with making sense of tabulated data (2002, 7). Pieces of text accompanying a graphical representation might contain presumptions or views, instead of facts, purposefully put forward with unscrupulous intentions. Readers’ familiarity with statistical terms that appear in the media reports are often taken for granted by the writers of such reports. In this context, within the broader notion of SL, the notion of “document literacy” also assumes a significant role (Gundlach, Maybee, and O’Shea 2015).

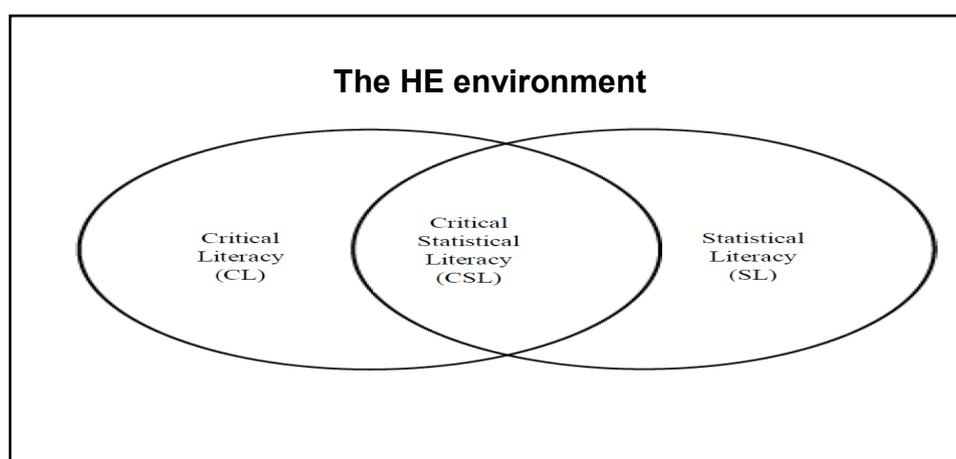
The need for citizens to be critical of statistical messages, is well argued in the related literature (Frankenstein 1983; Freire 2005). Such a need arises owing to the fact that media-generated statistical messages can usually be traced to political or ideological propagandist intentions of their producers. For such intentions, graphical representations come in handy, in that insignificant differences can be made to look significant, and hence made to convey the opposite message, in line with the need for sensationalising news. In the case of reporting of a pandemic, specifically, expressions such as “4500 people are infected with Covid-19” can project an inflated picture; just as “3 in every 3000 people suffer from Covid-19” clearly talks down the gravity of the situation (Gal 2002). An overall need for being critical in the consumption of statistical messages is thus fundamental to being statistically literate (2002, 17). The criticality that SL underpins is significant, and will be discussed further in this article.

### **CRITICAL STATISTICAL LITERACY (CSL)**

SL as theorised by Gal (2002) in terms of a set of “knowledge” and “dispositional” elements is noteworthy here. The conceptualisations of these elements help us foreground the notion of critical statistical literacy (CSL) with extant theoretical positions. This section therefore seeks to advance the idea of “critical stance” that Gal (2002) emphasised, on which CSL is premised. From the simplistic framing as a literacy to the philosophical sophistications of “consciousness”, CSL is considered here in the context of the Covid-19 pandemic. Such embodies the subtle realities that CSL, through its “critical stance”, strives to expose. HE’s

potential for promoting SL is also considered, to the extent that arguments are presented to see CSL as an “HE expectation”, given the Covid-19-related SL demands placed on HE (Hearfield and Boughton 2018). Therefore HE, as an education sector, and Covid-19 as a statistically significant phenomenon, are viewed as two sides of the same rationale, with which this article further clarifies CSL as a novel proposition. The positioning of CSL as an HE literacy and a critical consciousness inherent in such a literacy, needs to be emphasised at this point. An attempt is therefore made to advance the notion of CSL, emphasising “criticality” and “consciousness” as its two dominant constitutive elements. Also, “consciousness” is not considered a natural aspect of “literacy” in this article; rather, it is considered an attribute of citizenry in general, and of HE in particular.

Let us now turn to see how Weiland (2017) originally conceptualised CSL as involving the notions of “literacy”, “statistical literacy”, and “critical literacy”. The term “literacy” has evolved from its early conceptualisations as mere “reading and writing of words” in the dominant language of the community to which the individual belongs, to its manifestations as “financial, quantitative, digital, media and technological literacies” (Weiland 2017, 35). Statistical literacy can then be considered “in terms of the ability to both understand statistical arguments and to critically evaluate them” (2017, 36). Competencies related to the interpretation and critical evaluation of statistics-based information, engaging with and hence communicating responses to such information, and questioning the validity of the conclusions, were, however, part of earlier conceptualisations of SL (Gal 2002).



**Figure 1:** CSL as an intersecting construct of CL and SL within the HE environment (Adapted from Weiland 2017)

As Figure 1 indicates, Weiland (2017)’s original conceptualisation of of CSL as an intersecting construct of the two literacies can very well be considered relevant in the context of HE. This is because, both CL, and SL by extension, can be considered preferred attributes of HE students

(Hearfield and Bob 2018).

## **CRITICAL STATISTICAL LITERACY (CSL) AND HIGHER EDUCATION (HE) IN THE CONTEXT OF THE COVID-19 PANDEMIC VIEWED THROUGH THE LENS OF SOCIAL JUSTICE**

SL has long been understood as a significant competence for being able to know the world as it presents itself to us (Lancaster 2011). Statistical thinking often comes handy in taking a critical stance when it comes to an “over-sensationalised” depiction of truth by the media (Lancaster 2011, 109). CSL is then considered in the context of citizens critically looking at statistics-based media communications, asking questions regarding the validity of data-collection techniques used, suitability of analytical techniques applied, and whether or not interpretations were correctly produced (Gundlach, Maybee, and O’Shea 2015). This aspect of criticality can even be considered in the case of a university SL course that empowers students to scrutinise statistics-based claims made by experts from the fields of, for instance, medicine, politics, or print media (2015, 2). Basic courses in university statistics have a questionable degree of effectiveness in making students statistically literate (McLauchlan and Schonlau 2016). Students also need to see, as some authors have pointed out, that correlation is not to be taken to mean causation. Such should translate to an awareness that a correlation coefficient may not have the kind of significance that it is often projected to have in communications (Trafimow 2016). This author gives us an example of research establishing a correlation of 0,18 between TV watching and aggressive behaviour, implying that excessive TV watching leads to increased violent behaviour (Robertson, McAnally, and Hancox 2013). However, according to Trafimow (2016), these authors refrain from mentioning “the reliabilities of the TV viewing and aggression measures” that the researchers used, leaving the correlation-related claims with some validity issues (Trafimow 2016, 27). A classic case in this instance is that of an actress arguing that a certain vaccination that her son received led to his autism (McCarthy 2008). From an SL perspective, an isolated incidence of autism being co-related with vaccination cannot be concluded as causation. Such a study may have made errors in analytical routines (McLauchlan and Schonlau 2016). These are typical instances in which CSL-based competencies come in handy for individuals to be appreciative of the significance of “reliabilities of measures”; and hence become “intelligent consumers of co-relational findings” that the media carries (Trafimow 2016, 28). Such competencies help the individual realise how “cause” and “effect” are related, what statistical significance means, and how experimental studies and surveys can be inherently biased (McLauchlan and Schonlau 2016). The competencies also help in realising that certain events may occur which seem improbable otherwise. Conditional probability is

considered only in one direction if not stated otherwise, and “normal and average” differs in the context of “variability in data” (2016, 101). At these levels of statistical familiarity, these authors argue that both producers and consumers of statistics should have statistical literacy competencies, and that most university students enrolled in statistics courses will become consumers as opposed to producers (2016, 101). These authors also argue that students must be guided into an awareness of how limited their statistical knowledge is, and that courses meant for the advancement of statistical literacy as a general competency should be made available to all students (2016, 101). In this context, as a response to media communications with significant SL demands, the American Statistics Association (ASA)’s call for inclusion of statistical literacy as a preferred aspect of educational attainment across all educational sectors, is noteworthy (ASA 2009). This must be seen against the backdrop of findings that completion of introductory university statistics courses do not necessarily lead to SL competencies (Delmas et al. 2007). However, there is a clear need felt by universities for its graduates to be statistically literate, while mainstream statistics courses at universities do not have SL as one of their curricular objectives. SL, as a transdisciplinary competency, is increasingly being advocated for as a commonly desired attribute of all university graduates with a view to having a statistically literate citizenry (McLauchlan and Schonlau 2016). This has to be seen against the backdrop of most social science disciplines having students with considerable numeracy skills deficits, as well as negative preconceptions regarding statistical ideas (Wade and Goodfellow 2009).

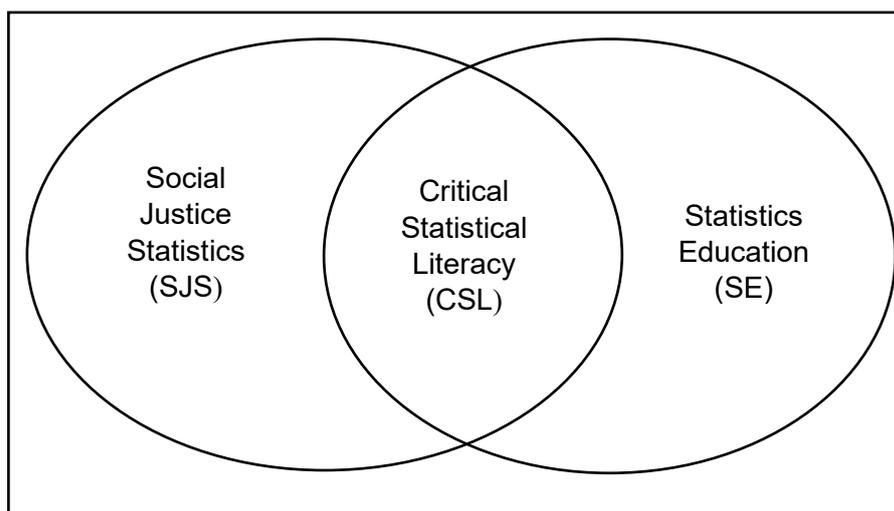
This essay now attempts to place SL in the context of the Covid-19 pandemic. SL leads to an increased awareness of the ways in which social phenomena, such as the spread of a pandemic, unfold (Cimpoeru and Roman 2018). Covid-19, in this context, has highlighted the significance of data at a far greater level than any other phenomenon in recent history (Watson and Callingham 2020). The pandemic, in spite of the untold misery that it has brought about, has thus invigorated the calls for empowering citizenry to become informed consumers of statistical claims made in the context of the pandemic (2020, 16). These authors further point out that the “practice of statistics” on which statistical literacy is based can have curricular emphases at the levels of formulating questions, being aware of variation, and hence being able to account for it, and an ability to develop insights from the data (2020, 17). The practice of statistics thus moves beyond mere arithmetic to contextual sense-making which is fundamental to SL as an educational enterprise. Within the overarching theme of Covid-19, Watson and Callingham (2020) talk about how seamlessly SL links to the notion of data across multiple disciplines. Rate of infection and morbidity data from medical science, vaccine-related data from science, Covid-19’s socio-economic impact, and the related social scientific data, together

with data from physical and mental fitness, lend themselves to SL (2020, 19). Covid-19’s SL-related relevance, thanks to the sheer quantity and types of data produced on a daily basis, albeit unintended, as an avenue for empowering citizenry to become informed data consumers, is therefore indisputable. Familiarity with graphical representations carried by the media, ability to scrutinise the title, labelled axes referring to “overlaid comparisons of different variables” which include “time, frequency, percentage, daily totals, moving averages”, etc., are thus critical aspects of Covid-related SL (Watson and Callingham 2020, 19). Pie charts and stem-and-leaf plots and maps with superimposed representations of new infections or deaths are also instances that demand SL competencies from citizens. An awareness of the context to which the population sample belongs, the duration for which data were collected, and the methods used, are all important aspects that determine the credibility of statistical claims. Added to this will be the need for explicit references to the level of uncertainty with which statistical claims are made by researchers (Trkulja and Hrbač 2020). The notion of an expanded critical literacy intersecting with SL therefore assumes significance (Ball 2020). The intersectional area of the two domains, i.e., critical literacy and SL, can therefore be termed critical statistical literacy (CSL), as theorised in this article.

Let us now turn to the notion of CSL as an attribute of critical citizenship viewed through the social-justice lens. The proponents of “teaching mathematics for social justice” (TMfSJ) have made significant strides in linking social justice with mathematical practice (Gutstein 2003; Stinson and Wager 2012). By extension, the notion of TMfSJ is also worthy of our consideration, because citizens’ affordances of a variety of literacies are often considered characterising a just society (Edward 2019). Literacies thus result in the “rational person” who wants “fair distribution of rights, liberties, powers, opportunities, wealth and self-respect” (2019, 3). Edward (2019, 5) further argues that “it is easy to distort truth with statistics”, especially in the contexts of issues of social justice. The notion of statistics-based indexes as used in communications to indicate a measure of some entity, quantity, or a position on a scale, is significant here. The recent emergence of a variety of indexes can be attributed to an unprecedented need for information felt at both formal and informal sectors of government. Such indexes can generally be considered “empowering citizens to shape and reshape their world” (Ingram 2019, 124). However, some aspects of indexing remain questionable, in that certain indexes have the implicit agenda of advancing the interests of a few over those of others. The social justice dimension of interest in this scenario is that only entities, quantities, and phenomena that have a certain degree of measurability are worthy of recognition as far as indexes are concerned. This disparity manifests clearly in opinion polls and empirical studies, leading to divergent understandings of the social aspect that is under study. Also, there is an

inability of resulting indexes to be of any significance in terms of social change with which the indexes are conceptualised (2019, 124). Representing social reality through mere statistics-based affirmations only helps trivialise the notion of citizenship to consumerism, at the expense of informed participation. A CSL-based perspective is critical for citizens in this context, because of the assumptions of what is and is not worthy of being measured statistically determining the nature and purpose of these indexes. Such a perspective takes statistics not as mere “tools of the state”, but as “means for effectively empowering the people” (Ingram 2019, 132). SL is thus often considered “a core competency like reading and writing” within this perspective (Baniyas 2017, 980).

### **POSITIONING CSL AS AN INTERSECTING CONSTRUCT OF SOCIAL JUSTICE STATISTICS (SJS) AND STATISTICS EDUCATION (SE) WITHIN THE HE ENVIRONMENT**



**Figure 2:** CSL as a conceptual intersection of SJS and SE

As an extension of Weiland (2017)’s notion of CSL and the social justice connotations that it inherently carries, CSL is proposed here as a conceptual intersection of SJS and SE. “Social justice mathematics” as a disciplinary manifestation of the idea of “teaching mathematics for social justice”, is derived originally from Freire’s conceptualisation of “critical education” and the enabling of “critical citizenship” (Skovsmose 1994). The emphasis is therefore on mathematics education becoming a platform for the advancement of the ideals of equality, protection of human rights, and equitable access to resources (Wright 2016). Skovsmose’s emphasis on “critical mathematics education” as that which helps students “reflect through, with and on mathematics” is significant here (Wright 2016, 106). By “reflecting through

mathematics”, what Skovsmose (1994) meant is that students undertake authentic mathematical explorations by formulating their own questions and taking mathematical decisions in communication with others (1994, 106). “Reflecting with mathematics” meant that students’ critical consciousness of socio-political issues is raised by the use of mathematics. Skovsmose (1994) also noted that “reflecting on mathematics” refers to an awareness of “the nature and privileged position of mathematics” and its use in the decision-making process related to their day-to-day lives (1994, 106). As a further extension of this point, and drawing from the notion of critical mathematics education, students’ use of mathematics to critique social injustices and inequities has also been emphasised elsewhere (Gutstein 2006).

In line with the notion of “social justice mathematics” indicated above, let us now turn to the idea of “social justice statistics (SJS)”. Statistics, as a branch of mathematics, has far greater applications (than mathematics as a mere field of study), and hence relevance in the context of the socio-political issues such as the Covid-19 pandemic. Its relevance is also underscored by the unprecedented level of statistical knowledge demands that statistics-based Covid-19-related communications, intended as updates on tallies and trends in the pandemic’s spread and fatalities, place on citizens. In this context, SJS can be considered a platform for social and cultural, yet statistically grounded, engagement with students’ lived experiences. SJS also facilitates an increased understanding of the socio-economic conditions, for the advancement of which students are afforded a sense of agency. Such an agentive nature helps them move from “an awareness of injustices towards analysis of injustices” and to bring about change through increased statistical awareness (David 2014). SJS is therefore considered the field of study that emphasises the use of statistical knowledge, attained through formal training, for the advancement of social justice.

SE, as indicated in Figure 2, is conceptualised as the totality of the domains of academic knowledge and practice in statistics, and the associated scholarship of teaching and learning. It predominantly involves the formal disciplinary learning in statistics. CSL can therefore be considered a competency and a preferred outcome in SE. CSL is also a quality of critical citizenship for which SJS advocates. Its positioning as a common attribute of both SE and SJS, as indicated in Figure 2, is significant. This is because SE encompasses a broad spectrum of pedagogical principles and practices characterised by a unique set of philosophic foundations, just as in mathematics education. SJS, on the other hand, is best understood as that which embodies a purposeful social-cum-educational enterprise aimed at addressing injustices through the use of statistics, considered in its formal and informal dimensions. CSL, as an intersecting construct between SE and SJS considered in the overarching context of HE (as opposed to “Basic Education” referring to school education in South Africa), is therefore

equally significant.

Let us now return to Weiland (2017)’s original conceptualisation of SL as appearing in Figure 1, and see how it relates to the one proposed in Figure 2. CL is conceived as that which helps individuals identify discriminatory or prejudicial texts that reinforce society’s tolerance of power imbalances often inadvertently carried by the media (Lankshear, McLaren, and McLaren 1993). Weiland (2017)’s reliance on these aspects of CL underpins his idea of CSL. Weiland thus merges the notion of CL with that of SL, leading to his formulation of CSL as that which borrows “criticality” and “critical stance” from the former, and “statistical exposure and awareness” from the latter. Weiland (2017)’s CSL framework can thus be considered a pragmatic ideation of a critical stance that he uses to link CL with SL. In other words, Weiland (2017) articulates how CSL evolves in practice with tangible end-results in the realisation of a just society, as a broad ideological goal through the adoption of a critical stance. This is very much in line with what critical pedagogy advocates for (Freire 2018). In contrast, the framework proposed here, is anchored in the ideology of social justice as an overarching theoretical position. This means that the CSL is considered more as a viewpoint, a world view, or a particular way in which contemporary socio-economic and political issues of a “statistical nature” are dealt with as an empowering facet of critical citizenship. In this sense, the framework proposed here goes beyond the prescriptive practicalities of Weiland’s notion. It delves into the realm of ideations that are fundamental to the existence of individuals, societies, and the values that foreground such an existence.

## **CSL AS A HIGHER EDUCATION IMPERATIVE AMIDST THE COVID-19 PANDEMIC**

As a concluding section, this article now focusses on the placing of the conceptual intersection of CSL in the context of HE, as indicated in Figure 2. The purpose is to establish how the Covid-19-related “statistical consciousness” can rationalise the need for CSL and SJS in the HE context. The purpose is also to argue for fostering statistical consciousness as a qualitative attribute of students in HE, across disciplines, as an effort towards realigning HE with the new realities brought about by the Covid-19 pandemic.

A *Wall Street Journal* report in 2020 explained how Covid-19-related statistical misrepresentation leads to undue fear among the population (Rose 2020). The report refers to the claims made by “WHO and others” that the fatality rate in Covid-19 infections is 2 per cent to 4 per cent (2020, 19). Rose (2020) asserts that this claim is unfounded. This is because a fatality rate should be the percentage of all infected people who die, and not the percentage of those with confirmed infections eventually dying (2020, 19). The contrast is between mortality

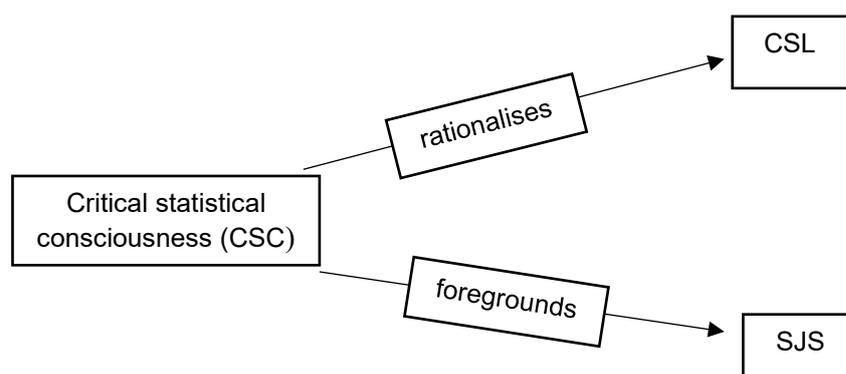
rate in the conventional sense, which is the “case fatality rate” defined as the probability of an infected person dying from that infection, and an “overall population rate” (Edwards and McDonald 2020, 18). Another statistically relevant point here that readers often miss is that Covid-19’s mortality is often correlated with concomitant pathological conditions, meaning that the rate will gradually reduce (2020, 19). Sensitive statistics of this nature usually lead to baseless hearsay, which results in increased levels of anxiety among consumers (Bratu 2020). However, “coronavirus is a human story” and “numbers as well as words” remain the tools with which we explain the associated phenomena as it unfolds, meaning that statistics remains the single most powerful tool at our disposal for understanding the dynamics of the pandemic (David 2020a, 30).

Within the context of Covid-19, the R number, defined as “the average number of people that someone infects” and the “risk of dying from Covid” are also SL concepts that are confusing to the layman (David 2020b, 3). This author further notes the report by the Office for National Statistics in England that the Black, Asian, and Minority Ethnic groups were “twice as likely to die from Covid” that meant that such groups were at a higher risk of being infected and dying from it (2020, 3). However, a BBC news bulletin subsequently carried the message that such ethnic groups had a 90 per cent higher likelihood of dying from Covid-19, which was a distorted version of the original message. A casually quantified likelihood of fatality thus communicated leads to unintended trauma among those with low SL levels. David (2020b) gives us another example related to Covid-19 diagnostic test results that inherently carry SL related ideas. The report in question was written on the “sensitivity” of a certain Covid test that claimed to have “70% sensitivity”, meaning that it will incorrectly give a negative report for 30 per cent of the people with Covid (David 2020b, 3). However, if we take, for instance, that about 6 per cent of the people tested are infected, and we assume that the test incorrectly shows a positive result in 1 per cent of those who are not infected, then calculations will tell us that the correct percentage of wrong occurrences of results is 2 per cent instead of the 30 per cent (David 2020b, 4). Instances of this nature place significant demands on the CSL levels of the consumers of such information. University students being such consumers, the level of SL at which most students operate is very low (Valentini 2016). There is a clear need for such students to be empowered into thinking critically of statistically significant issues about which media may produce inadvertently biased reports (Everson 2017). CSL and critical statistical consciousness remain fundamental preferred attributes of such students’ post-university life or career. A certain degree of fostered critical statistical consciousness among HE students is therefore an ancillary quality to critical studentship.

The phrase “statistical consciousness” needs to be understood in a particular context here.

Consciousness can be what the “conscious self” experiences in a world that is objective in nature, with reference to the coordinates of space, time, and causation of such experiences (Van Gulick 2018). Consciousness is therefore the totality of one’s awareness of personal internal and external existence, its meaning and purpose in the context of one’s experiences. One’s experiences being central to this consciousness, and “phenomenal consciousness” in particular, the chronological space-time organisational order in which our experiences, and our agentiveness thereof add up to this totality, have been of particular interest to philosophers (Husserl 1913/1931). The time and space in which this consciousness evolves influences the agentiveness the individual assumes in various fields of involvement. This is because consciousness has a characteristic association with both one’s experience and with one’s agentiveness in that experience. Statistical consciousness, as a construct coined here in the context of CSL, therefore is considered a cultivated attribute of critical citizenship, very much in line with the notion of “phenomenal consciousness” and the associated statistical experiences (Klausen 2020). Statistical consciousness thus refers to a particular dispositional reference point, that evolves from one’s experiences, from which the individual offers sound critiques of phenomena and discourses of a statistical nature confronted by the individual.

This essay now focusses on some concluding arguments on how Covid-19-related critical statistical consciousness (CSC) can become the rationale for fostering CSL as a cross-disciplinary competency. Some arguments in defence of such a consciousness underpinning SJS as a disciplinary idea in higher education will also be provided.



**Figure 3:** Placement of critical statistical consciousness in relation to CSL and SJS

The power of CSL in positioning students as critical citizens and hence as agents of socio-political changes is well established (Weiland 2016). Critical consciousness and the “redemption of reason” are also fundamental to democracy, freedom, and critical citizenship (Ted 2012, 3). University education in this context, as Ted (2012) argues, should then focus on

“a critique of ideology” as fundamental to its practice (2012, 12). A critically conscious generation of HE students is thus conceived of as an overarching aim for which its fostering at disciplinary and cross-disciplinary levels is imperative. Critical statistical consciousness is thus a cross-disciplinary attribute or a qualitative common factor applicable to a broad spectrum of students. It is in this context that we need to view Covid-19-related critical statistical consciousness as an attribute of studentship in higher education. The emphasis here is on the students’ becoming aware of their situation, and of mechanisms to transform such situations, all considered in a statistically relevant context (Maria et al. 2018). The Covid-19 pandemic happens to be one such context. Let us now turn to Figure 3 in this connection.

As Figure 3 indicates, CSC as a quality, is the rationale behind the need for fostering the competency of CSL at higher education level. It also foregrounds the disciplinary area of SJS. Covid-19 thus offers us an avenue for envisaging CSC as a philosophical basis for the propositions of CSL and SJS. Statistical practice considered within the context of critical citizenship as envisaged in the Covid-19 scenario should thus be strengthened by both SJS and CSL, both being philosophically anchored to the notion of CSC. SJS, CSL, and CSC together, thus give us a sufficiently strong basis to realign HE with the new reality of the Covid-19 pandemic.

The notion of CSC seems to offer an answer to the question as to why Covid-19 warrants an increased level of statistical awareness among HE students. CSC also seems tell us why HE students should look at Covid-19 from a statistically informed perspective. Consciousness does not merely refer to an awareness or understanding of the prevalence of a phenomenon such as Covid-19, but rather, denotes a heightened sense of agentiveness in concrete action following such an awareness. Consciousness therefore equips the individual to come to terms with a certain reality, entity or a phenomenon. In this sense CSC reinforces the individual’s resolve to critique extant statistical propositions that seem to obscure truth. As to why Covid-19 should be considered an opportunity for HE to initiate a discourse in defence of this consciousness is worth exploring as well. Such an exploration will guarantee the emergence of this truth that is often submerged in convoluted statistical jargon, beyond the reach of the layman. Along the same vein, SJS should inaugurate a new approach to the learning of “literacy level statistics”. Also, Covid-19 offers the right scenario for SJS to be launched as an alternative disciplinary concept i.e., alternative to the ways in which the theory and practice of statistics are conventionally understood in HE. Such a disciplinary concept, as a vehicle for social justice, is likely to be influenced by the degree to which social inequalities have been exposed by the Covid-19 pandemic in our society (Dlamini and Ndzinisa 2020). Such a concept may also embody a set of social imaginaries that the Covid-19 pandemic has helped evolve among HE students.

## CONCLUSION

The idea of CSL as a qualitative attribute of HE studentship, in the context of the Covid-19 pandemic, has been central to the arguments in this article. Weiland (2017)’s seminal theorisation of CSL as an intersecting construct of CL and SL was considered a conceptual basis. Using CSL as a starting point, the notions of SJS and *critical statistical consciousness* are presented as novel propositions in the context of HE. In this connection, an attempt has been made to raise Weiland (2017)’s notion of CSL to a higher level of theoretical sophistication, with the incorporation of SJS and *critical statistical consciousness*. *Critical statistical consciousness* is theorised as providing a convincing rationale for CSL as an HE competency. The consciousness is also considered foregrounding the disciplinary idea titled SJS (in the same vein as “social justice mathematics”). CSL and SJS are thus presented as the two aspects that form the basis of *critical statistical consciousness*.

The Covid-19 pandemic is considered an illustrative scenario in which these propositions, *critical statistical consciousness* in particular, are positioned. A critically and statistically conscious studentship is argued for as a worthwhile expectation in HE in the context of the Covid-19 pandemic. The practice of fostering a set of basic skills and competencies is prevalent in SL courses in HE institutions (Valentini 2016). However, a complex, yet subtle statistical awareness that subscribes to social justice as an overarching educationally guaranteed affordance, is what is expected by *critical statistical consciousness*. The notion of SJS is therefore to be considered a disciplinary manifestation of this consciousness in the context of the Covid-19 pandemic. In other words, the “social pathology” of Covid-19 inadvertently provides us with an opportunity of repositioning HE in alignment with this consciousness (Hearfield and Boughton 2018, 480). This consciousness can also be considered foregrounding the capacity for “participation in critical discourse”, which is the essence of being a literate critical citizen (Mezirow 1996, 121). The idea of *critical statistical consciousness* manifesting concretely in SL as a competency and as a disciplinary outcome in SJS, in the context of the Covid-19 pandemic, can thus lead to the fostering of such a citizenship at the HE level.

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