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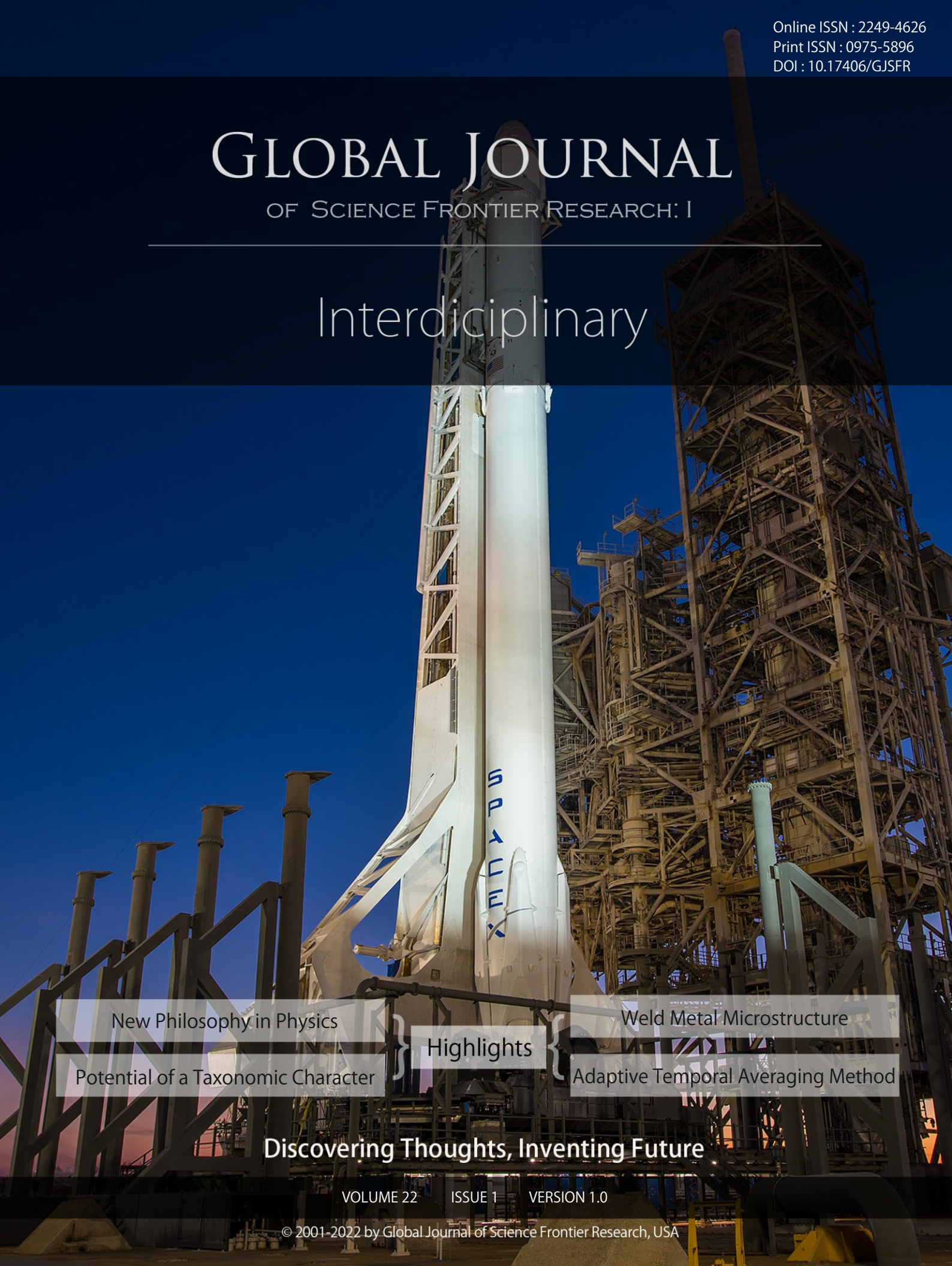

Highlights

New Philosophy in Physics

Potential of a Taxonomic Character

Weld Metal Microstructure

Adaptive Temporal Averaging Method

Discovering Thoughts, Inventing Future

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KAP (Knowledge, Attitude and Practices) Analysis during Two Consecutive Waves of COVID-19 in India

By Ritu Mittal Gupta, Sukhdeep Kaur Mann & Anjali Negi

Abstract- COVID-19 was declared a pandemic by the World Health Organization (WHO) in January 2020. Considering its unprecedented mortality and morbidity, a global lockdown was imposed worldwide which resulted in the halt of all economic and social activity. Most countries including India applied strict prevention and control measures to control the spread of COVID-19, which include general lockdown, obligatory home quarantine, a ban on public gatherings, international flight restrictions, etc. In this regard a KAP analysis was conducted to understand the public knowledge, reactions, adherence to, and acceptance of measures for protection against COVID-19 during first and second wave of Covid 19. Individuals above the age of 15 years were selected as the sample. The data were collected during both waves of the COVID-19 pan India from 500 respondents using a self-administered questionnaire in Google form. The results revealed that the majority of the respondents were knowledgeable regarding the spread, prevention and control of the COVID virus. Most of the respondents had positive attitude regarding control measures imposed by the government which was consistent with their attitude and practices during first wave. However, a negative change in the attitude of the respondents and practices despite rise in knowledge indicates the role of compelling variables like economic crisis, emotional crisis and individual's reduced functioning.

Keywords: *COVID-19, lockdown, knowledge, attitude, practices.*

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KAP (Knowledge, Attitude and Practices) Analysis during Two Consecutive Waves of COVID-19 in India

Ritu Mittal Gupta [α], Sukhdeep Kaur Mann [σ] & Anjali Negi [ρ]

Abstract- COVID-19 was declared a pandemic by the World Health Organization (WHO) in January 2020. Considering its unprecedented mortality and morbidity, a global lockdown was imposed worldwide which resulted in the halt of all economic and social activity. Most countries including India applied strict prevention and control measures to control the spread of COVID-19, which include general lockdown, obligatory home quarantine, a ban on public gatherings, international flight restrictions, etc. In this regard a KAP analysis was conducted to understand the public knowledge, reactions, adherence to, and acceptance of measures for protection against COVID-19 during first and second wave of Covid 19. Individuals above the age of 15 years were selected as the sample. The data were collected during both waves of the COVID-19 pan India from 500 respondents using a self-administered questionnaire in Google form. The results revealed that the majority of the respondents were knowledgeable regarding the spread, prevention and control of the COVID virus. Most of the respondents had positive attitude regarding control measures imposed by the government which was consistent with their attitude and practices during first wave. However, a negative change in the attitude of the respondents and practices despite rise in knowledge indicates the role of compelling variables like economic crisis, emotional crisis and individual's reduced functioning.

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I. Introduction

On 31, December 2019, The World Health Organization (WHO) reported the occurrence of an unknown virus causing respiratory problems. The virus was later named by the International Committee as Severe Acute Respiratory Syndrome Corona virus 2 (SARS-CoV-2) that causes COVID-19 or the Corona virus disease (Li et.al., 2020). Considering unprecedented mortality and morbidity due to COVID-19 and its impact on humankind, WHO declared it as a serious public health emergency of international concern on January 30, 2020 (Zhu et. al., 2020). Since then, COVID-19 has taken a heavy toll on the world, claiming many lives. The virus spreads between humans by coughing discharge that contaminates the surfaces. It can also be highly transmitted by asymptomatic individuals during the virus incubation period. The virus can last on surfaces up to 5 days depending on the type of surfaces, although infected people may be asymptomatic, others may develop flu-like symptoms including fever and coughing, which may deteriorate in some cases (Rothan and Reddy 2020).

To prevent the infection socially, a global lockdown was imposed worldwide which resulted in the halt of all economic and social activity. Most countries applied strict prevention and control measures to control the spread of COVID-19, which include general lockdown, obligatory home quarantine, a ban on public gatherings, international flight restrictions, etc. Also, effective preventive measures were recommended to the public including hand washing, social distancing, mask-wearing, respiratory hygiene (covering mouth and nose while coughing or sneezing), household ventilation and disinfection, and reduction of interpersonal contacts by avoiding visiting crowded spaces (WHO,2020).

India, being one of the largest democratic countries in the world and home to 138 crore people, had its first case as early as 30th January 2020 in the Kerala state (Andrews et. al. 2020). Subsequently, the number of cases drastically rose.On 22 March, 2020 the Indian Government imposed a nationwide lockdown to curb the rising cases of Corona virus. An estimated of 32 lakh people died of Covid-19 from June 1, 2020 to July 2021 in India (The Tribune, 2022). Daily cases peaked mid September 2020 with over 90,000 cases per day dropping to below 15,000 in January 2021. Second wave began in March 2021, was much more devastating than the first with shortage of beds, hospitals, vaccines, oxygen cylinders etc. in different parts of the country. On 30th April 2021, India became the first country to report over 400,000 new cases in 24 hours period.

Amidst pandemics, educating, engaging, and mobilizing the public to become active participants help achieve public health emergency preparedness, reducing the overall population's vulnerability (Lee and You, 2020). Distributing proper information can not only guide society through such events but can also increase epidemic preparedness that might occur in the future. On the other side, negative attitudes and practices towards new infectious diseases can aggravate epidemics which may eventually result in pandemics (Alahdal,2020).When people collectively engage in preventive behaviors, including practicing personal

Author: e-mail: rituhsee@pau.edu

hygiene and maintaining social distance, it is possible to control the spread of the disease. Individual behaviors may dramatically decrease morbidity and mortality rates of COVID-19 (Anderson et.al. 2020). The knowledge, awareness, and practice (KAP) studies, helps to understand the public knowledge, reactions, adherence to, and acceptance of measures that affect psychologically, socially, and physically the daily life of people (Rugarabamu et. al., 2020). The information improves the awareness level of the citizens as well as encourage positive attitudes, which could help in the fight against COVID-19 and similar future threats (Gupta et.al., 2020). Keeping in view the above scenario the present study was conducted to assess the difference in the knowledge and attitude of the people regarding Covid-19 as well the practice adopted by the Indians to fight against the disease during first two waves.

II. Methods and Materials

The study was based on data collected from 500 respondents selected from different zones of India namely North, South, Central, East and West during the years 2020 and 2021. For the study, a web based survey was conducted to evaluate public's knowledge, attitudes, and practices during the COVID-19 epidemic, using a self-administered questionnaire in Google form. Individuals above the age of 15 years were selected as the sample. The questionnaire consisted of four parts. The first part covered the demographic profile of the respondents. The second part was about the knowledge of the respondents about COVID-19. Attitude of the respondents regarding COVID-19was seen in the third part and lastly COVID appropriate practices adopted by the respondents were noted in the fourth part.

Respondents' knowledge about COVID-19 was assessed using a self-structured questionnaire consisting thirteen questions regarding the symptoms, prevention and control of the disease comprising of 6 negative and 7 positive statements. The responses were recorded under three categories as "true", "false" and "I don't know" with score of 3, 2 and 1 respectively for positive statements. The scoring was reversed for the negative statements. The attitude of the respondents was measured using a three point rating scale consisting of 6 statements, the response of which were recorded as "Agree", "Neutral" and "Disagree" with score of 3,2 and 1 respectively for positive statements. The scoring was reversed for the negative statements. To curb the spread of the virus Government suggested several practices for the people to follow. In this regard 10 statements were developed to test the adherence of the population to those practices. The responses were recorded as 'Always', 'Often', 'Sometimes' and 'Never' with the score of 4, 3, 2, and 1 respectively.

Social media platforms such as Facebook, What's App etc., were used to disseminate the questionnaire which was accessible by clicking on the link. The respondents were requested to click on the link and fill in the information. During the first wave, 569 respondents filled the questionnaire. These respondents were again requested to fill the same questionnaire via emails during second wave. Overall 500 questionnaires received back thus the present analysis is based upon 500 respondents.

III. Result and Discussion

The results of the study are discussed under four headings namely demographic profile of the respondents, Knowledge of the respondents regarding Covid-19, Attitude of the respondents towards Covid-19 and practices followed by the respondents during Covid-19 pandemic.

Table 1: Demographic profile of the respondents

Profile	Frequency (f)	Percentage (%)
Zone		
North	242	48.4
South	31	6.2
Central	99	19.8
East	65	13
West	63	12.6
Area of Residence		
Rural	301	60.2
Urban	199	39.8
Gender		
Male	262	52.4
Female	238	47.6
Age		
15-30yearsold	306	61.2
31-45yearsold	160	32
46-60yearsold	24	4.8
above60yearsold	10	2.0
Educational qualification		
Secondary level (10^{th})	10	2.0
Senior secondary(12^{th})	61	12.2
Graduate	281	56.2
Postgraduate	102	20.4
Doctorate	30	6.0
Others	16	3.2
Profession/occupation		
Student	195	39
Home-maker	24	4.8
Business	58	11.6
Unemployed	11	2.2
Service	207	41.4
Farmer	5	1

Table 1 represents the demographic profile of the respondents. The results reveal that nearly half of the respondents (48.4%) were from Northern zone of India followed by Central zone with 19.8% respondents. Approximately equal number of respondent's i.e. 13% and 12.6% were from East and West zone respectively

while only 6.2% of the respondents belonged to South zone. The male population was 52.40% and while women contributed 47.60% of the population. Majority of the respondents (61.2%) were between 15 to 30 years of age followed by 32% in the age group of 31 to 45 years. The data further revealed that majority of the respondents (56.2%) were graduate, followed by 20.4% postgraduate while few (2.0%) respondents had education below secondary level. Majority of the respondents (41.1%) were engaged in service sector while 39% of the respondents were students.

IV. Knowledge of the Respondents Regarding Covid-19

A glance at table 2 depicts the knowledge of the respondents regarding COVID-19 during first and second wave. The data reveals that majority of the respondents were knowledgeable regarding the spread and prevention of the COVID-19 virus. This finding is consistent with the cross-sectional study done across the Saudi population by Al-Hanawi et.al., (2020), where the participants achieved a mean of 81.64% in the knowledge questionnaire.

The data further depicts the positive percentage change in the knowledge of the respondents from 79.28 % in 2020 to 93.69% in 2021 which accounts for 14.41% increase in the knowledge. The similar change in knowledge was seen in the study conducted in 2020 by Nazar et. al., in which, at the beginning of the pandemic many people were not much familiar with disease. News websites and social media were the main sources of knowledge. However in the second wave the respondents indicated using other sources of knowledge such as governmental and science-oriented websites with up to date information and findings presented in scientific knowledge sources.

Table 2: Comparison of knowledge about covid 19 pandemic during first and second wave

Knowledge Statements	First wave f(%)	Second wave f(%)	Percent Change
The COVID-19 virus spreads via respiratory droplets of infected individuals.	449(89.8)	500(100)	+10.2
Wearing a mask will reduce the risk of COVID 19 infection.	325(64.9)	470(94)	+29.1
The main clinical symptoms of COVID-19 are fever, dry cough and Myalgia.	456(91)	500(100)	+9.0
There is currently no effective cure for COVID-19.	417(83.2)	450(90)	+6.8
Early symptomatic and supportive treatment helps the patients to recover from the infection.	364(72.7)	415(83)	+10.3
People of all age groups are susceptible to infection by COVID-19.	448(89.4)	480(96)	+6.6
Hand hygiene is the most important way to prevent the spread of the virus.	474(94.6)	490(98)	+3.4
Isolation and treatment of people who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus.	476(95)	500(100)	+5.0
Eating Vegetarian or Non-vegetarian food has nothing to do with COVID 19 infection.	358(71.7)	425(85)	+13.3
COVID-19 virus remains on different surfaces for more than 10 hours to 3 days.	370(73.9)	450(90)	+16.1
This disease can spread from currency notes, newspapers etc.	389(77.6)	460(92)	+14.4
A person can be infected by COVID-19 for the second time also.	370(73.9)	490(98)	+24.1
COVID-19 will not end even if the weather is warm.	265(52.9)	460(92)	+39.1
Overall knowledgepercent	79.28	93.69	+14.41

Majority of the respondents in both the years had knowledge regarding the mode of transmission of the disease as 89.8% respondents in 2020 and cent percent in 2021 agreed that the "COVID-19 virus spreads via respiratory droplets of infected individuals" nearly 65% of the respondents in 2020 and 94% in 2021 said that "wearing a mask will reduce the risk of COVID 19 infection". This result is congruent with the results of the study conducted by Tran (2020) where the majority of participants displayed knowledge about the "clinical and pathogen characteristics of COVID-19".

As far as clinical symptoms were concerned majority that is cent percent of the respondents in 2021 and 91% in 2020 were knowledgeable about the symptoms of corona virus. Hand hygiene (98% in 2021 and 94.6% in 2020) and Isolation and treatment of people infected with the COVID-19 virus (100% in 2021 and 95% in 2020) were reported as the effective ways to reduce the spread of the virus. Similar results were revealed in the study conducted by Alahdal et. al., (2020) where majority of the respondents were aware that virus could be transmitted from an infected person (99%), through touching contaminated surfaces and shaking hands (98%), using COVID-19-infected personal tools (94.9%) and through coughing (92%). Further in2021, 98% of the respondents agreed that the

person could be re-infected by COVID-19 virus even if he/she has successfully recovered from the first infection.

It was interesting to note that 47.10% of the respondents in 2020 believed that the warm weather will end the COVID-19 virus, however in 2021 (92%) of the people were aware of the fact that corona virus was unaffected by the weather changes. Majority of the respondents (90%) till 2021 said that there was no cure for the corona virus. The study conducted by Weitz et. al., (2020) also revealed the similar results where majority of respondents agreed that there are neither available vaccines (56%), nor the use of antibiotics is sufficient to kill the virus (60%). Further 96% of the respondents in 2021 knew that people of all age groups were susceptible to COVID-19 infection.

V. Attitude of the Respondents Towards Covid-19

The data in Table 3 represents the mean values regarding attitude of the respondents towards COVID-19 during first and second wave. The data shows that the attitude of the respondents became neutral during second wave while it was positive during first wave. This is because second wave was more devastating which resulted in fear about its repercussions. Moreover people were psychologically depressed with the lockdown and suffered financial losses due to lock down. A study conducted by Witteveen and Velthorst (2020) indicated a striking positive relationship between instantaneous economic hardships during the COVID-19 lockdown and expressing feelings of depression and health anxiety.

Table 3: Comparison of the attitudes of the respondents towards COVID-19 pandemic during the two COVID waves

Statements	First wave (Mean score)	Second wave (Mean score)
To fight against this pandemic disease, taking precautions are better than.	2.95	2.86
I will not isolate or quarantine myself if I had fever and cough.	2.55	1.67
India'sdecision of lock-down was correct	2.95	2.25
There is no need to keep a distance of one meter or more from others when coughing or sneezing.	2.77	2.80
COVID-19 will finally be successfully controlled.	2.60	2.56
Donating money to the NGOs who are working against COVID-19 is more beneficial than donating it to the PM/ CM care fund.	1.77	2.12
Overall mean	2.60	2.38

Majority of the respondents agreed on taking precautions against the pandemic with mean scores of 2.95 and 2.86 during first and second wave respectively. A lady, who lost her husband as well as her younger son during pandemic, regretted their families' careless attitude toward preventive measures. Another 23 year old boy, who lost his mother during first wave, said that they initially thought COVID-19 was just a superstition but it ruined his life as his father also could not survive after that. During first wave, the respondents had positive attitude towards isolating themselves if they showed any symptoms of the disease. The results were in line with findings of the study conducted in 2020 in which over 90% of the respondents had favorable attitude in limiting the spread of COVID-19 as "staying at home" and "isolating the infected individuals" ranked first with 99.7% and 99.9% respectively. These measures have been taken by many countries and have shown to be significantly successful in controlling the spread of the virus (Anderson et. al., 2020).

However during second wave attitude towards isolation was not that positive. This could be due to various socio-economic consequences of pandemic. The global impact of the COVID-19 pandemic increased the loans required by people, which was a financial catastrophe for many workers and employees who lost their jobs (Nicola et al., 2020). UNESCO estimated that approximately 900 million learners have been affected due to the disruption in education due to COVID-19 (Viner et al., 2020). People had difficulty in accessing healthcare services, which may increase the risk of chronic disease deterioration (Liu et al., 2020). Many people (17.9%) reported a physical and/or verbal abuse episode from family members, (11.9%) reported abuse outside the family, and (7.9%) reported abuse from enforcers, during the lockdown (Msherghi et. al., 2020).

During first wave participants were also in favor of Government's decision of lockdown during pandemic as indicated by the mean score of 2.95 in first wave. This finding is consistent with the studies conducted in China and Saudi where majority of the participants were

convinced that their Government will combat the disease (Hanawi et. al., 2020, and Zhong et. al., 2020). The agreement to lockdown however reduced drastically during second wave. This is obvious as many people suffered financial crunch due to lock down. As far as social distancing was concerned majority of the respondents said that it was best to keep a distance of one meter or more from others while coughing or sneezing. Majority of the respondents had positive attitude that COVID-19 will be successfully controlled with nearly similar mean score (2.60 and 2.56) for both the years. People had neutral attitude towards donating money to the NGO's working against COVID-19 than donating it to the PM/ CM care fund during both waves.

VI. Practices Followed by the Respondents During Covid-19 Pandemic

The data in Table 4 represented the comparative analysis of the practices followed by the respondents during the pandemic in the years 2020 and 2021. A glance of the table shows that people followed the practices for the prevention and control of the virus more during first wave as compared to second wave.

Table 4: Comparison of the practices followed by the respondents to safeguard themselves from the COVID-19 infection

Statements	First wave Mean value (1-4)	Second wave Mean value (1-4)
Avoid going out during lock-down	2.71	2.43
Wash/sanitize hands after coming back home.	2.94	2.51
Wash hands at least for 20 sec with soaps	2.74	2.32
Wear face mask when leaving home	2.80	2.17
Changed the routine food pattern during lock- down to increase immunity.	2.19	1.85
Sanitize your mobile phones, TV remotes and kids play toys.	2.06	1.72
Increased the consumption of vitamin C rich foods during this lock-down.	2.16	2.40
Take extra care and other precautionary measures while going for grocery shopping.	2.71	2.31
Keep groceries aside for 2-3 days after bringing home.	2.04	1.36
Discard the container/poly bags of groceries in a closed dustbin.	2.56	1.25
Overall mean	2.50	2.03

From the results it is revealed that a greater number of people avoided going out during lockdown during first wave than during second wave as the mean scores went down from 2.71 to 2.43. This could be due to the reduced fear in public as it was impairing their businesses and work. Kelvin (1997) put forward that the amount and severity of anxiety that is faced is important in determining whether it will impair the individual's functioning. Majority claimed to sanitize/wash their hands after coming back to home however its frequency also went down from always to sometimes as indicated by the change in the mean score from 2.94 to 2.51. The frequency of using face mask when going outside also went down from 2.80 to 2.17. The consumption of vitamin C rich foods by the respondents was increased during lock down as indicated by the mean scores of 2.16 and 2.40 while nearly half of the respondents in both the waves reported to have changed their routine food pattern during lock- down to increase their immunity.

Majority of the respondents (2.71 and 2.31) took extra care and precautions while going for grocery shopping while they were not very precautious during second wave. In the year 2020, nearly half of the respondents would keep their groceries aside for 2-3 days after bringing home however this number declined in 2021 as the mean scores went from 2.04 to 1.36. As far as sanitizing mobile phones, TV remotes and kids play toys were concerned half of the respondents said that they always sanitized them. Majority of the respondents (2.56) practiced discarding the container/poly bags of groceries in a closed dustbin.

The study revealed that respondents had knowledge regarding prevention and control of the disease which became apparent in their attitude and COVID- appropriate practices during second wave. This observation was in congruence with the results of the study conducted by Erfani et. al., (2020) in which higher knowledge score regarding COVID-19 was significantly associated with a higher likelihood of having positive

attitude and good practice at the time of COVID-19 pandemic. The results of the current study points towards other intervening compelling variables like economic crisis which may not allow people to comply with knowledge. The results also show that psychological needs are more important than safety needs consistent to Maslow's need hierarchy. Besides it also indicates that fear was reduced during second wave as it was impairing individual's functioning.

VII. Conclusion

As far as practices were concerned majority of the respondents followed the practices strictly in the year 2020 however they seemed reluctant to do so in the year 2021. This was due to their psychological needs, reduction of individual's output due to fear and anxiety. Given the present situation of the pandemic, new strains of the virus are identified every year thus making it highly unpredictable whether the virus could be contained or not there of republic adherence to preventive and control measures and a routine practice of precautionary behaviors must become the new status quo.

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A Numerical Criterion for Assessing the Discriminative or Aggregative Potential of a Taxonomic Character. Part II

By Joaquim Carlos Sena Maia
Universidade Federal do Paraná

Summary- An alternative method to assess the aggregative/discriminative potential of taxonomic characters for continuous variables obtained through measurements.

Keywords: *numerical method: taxonomy; potential, aggregative, discriminative; character.*

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Joaquim Carlos Sena Maia

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Keywords: numerical method: taxonomy; potential, aggregative, discriminative; character.

I. Introduction

The evaluation of the aggregative or discriminative potential of a biological characteristic (anatomical, morphological, behavioral, etc.) allows estimating the contribution of this characteristic in the formation and systematic delimitation of the taxonomic units where it is used. Maia (2021) presented a method for making this assessment, estimating the potential on a scalefrom 0 to 5 and working with discrete variables obtained through attribute counting and morphological variations coding. Similarly, in the present work, we propose a methodology for continuous variables obtained through measurements.

II. Material and Methods

The material used refers to measurements performed on 6 species (n = 6) of the genus Plebeia that occur in southern Brazil: *P. juliani, P. meridionalis, P. droryana, P. emerina, P. remota and P. saiqui,* represented in the tables by the letters J, M, D, E, R, S (Maia, 2017). To exemplify the methodology proposed here, we will use measurements (mm) of the width of the jaws of 5 specimens (m = 5) of each species, as shown in Table 1.

Table 1: Width of the jaw of six species of the genus Plebeia

J	R	S	D	E	M
0.90	1.40	1.20	1.15	1.50	1.00
1.00	1.80	1.30	1.20	1.30	0.90
1.00	1.40	1.50	1.15	1.20	0.90
0.90	1.45	1.30	1.20	1.20	0.70
0.90	1.40	1.30	1.00	1.20	0.80

Initially, the data are subjected to one-way analysis of variance (ANOVA) and we interpret the test value (F=20.50 - P<0.05) noting that there are significant differences among the analyzed samples, as shown in Table 2

Table 2: ANOVA of Width of the jaw of six species of the genus Plebeia

Source of variation	SS	DF	QM	F
Total	1.763	29		
Among groups	1.434	5	0.287	20.50
Within groups	0.324	24	0.014	

In the next step we will calculate the minimum significant difference (msd) using the standard deviation "within groups", $S_E = \sqrt{0.014}$ (also called standard error), and a tabular value (q) of the Tukey Test, in order to assess the significance of the differences between the sample means.

Calculation of msd in this example: $msd = q.(S_E / \sqrt{m})$

$msd = 4.37\ (0.118 / \sqrt{5}) = 0.23$

Table 3: Means of jaw widths and msd

M	J	D	E	S	R
0.86	0.94	1.14	1.28	1.32	1.49
msd = 0.23					

Author: Professor Adjunto do Departamento de Estatística da Universidade Federal do Paraná – Brazil. e-mail: jcsenamaia@gmail.com

The total number of pairs (JM, JD, RS...) is obtained by calculating the combination $\binom{n}{2}$.

In the case of 6 species, we will have 6(6-1)/2 = 15 pairs corresponding to the cells in Table 4.

For example, for the pair JM, we calculate the difference between the means $\overline{X}j$ and $\overline{X}m$ and compare it with the msd. If the difference is less than the msd, we accept that the jaw width is statistically equal for both species. The pair is coded as 0 (zero).

The 15 possible comparisons are shown in Table 4 and the zeros in the crossings of the lines and columns corresponding to the letters (M,J,...,R) show that for those pairs, the jaw width character does not present significant differences. The number of zeros in table 4, that is, the number of pairs whose means do not differ significantly, is represented by the letter Z. In this example

Table 4: Matrix of similar pairs. (0=non-significant difference)

	M	J	D	E	S	R
M						
J	0					
D		0				
E			0			
S			0	0		
R				0	0	

Thus, we can calculate the degree of discrimination (D) of the jaw width character through the formula:

$$D = 5(1 - 2Z/n(n-1))$$

In this example we would have:

$$D = 5\left(1 - \frac{2(7)}{6(6-1)}\right)$$

$$D = 2.67$$

The interpretation of the D value can be done as follows:
0<=D<=1-very aggregative characters
1<D<=2-aggregative characters
2<D<= 3-intermediate characters
3<D<= 4-discriminative characters
4<D<= 5-very discriminative characters

III. Results and Discussions

A traditional taxonomic study, which includes both the identification of species and their grouping, forming taxonomic units of a higher hierarchical level (genera, families, etc.), uses the analysis of characters (morphological, anatomical, behavioral, etc.) that guides this ordering.

Most characters contribute to both aggregate and discriminate, in proportions that vary for each character, as demonstrated by Maia (2021)

Taxonomy has been modernized since the creation of Numerical Taxonomy in the 1950s with the pioneering work of Sneath (1957 and 1958) and Michener and Sokal (1957). After that, with the development of new numerical analysis methods such as Principal Component Analysis, Cluster Analysis and others, taxonomists assimilated these new tools.

Ranjana et all (2013) found that traditional taxonomy based on morphology has often failed to accurately identify species due to the occurrence of cryptic species that are reproductively isolated but morphologically identical. They used Discriminant Function Analysis (DFA) and Cluster Analysis and the results show that DFA is a reliable statistical tool for identification and that Cluster Analysis works effectively for classification and species identification.

More recently, the use of DNA to identify and classify species has been widely used and has shown great superiority over traditional methods.

Pfenninger et all (2006) compared the suitability and effectiveness of traditionally used shell morphology with DNA-based methods to distinguish between species of the freshwater snail genus Radix (Basommatophora, Pulmonata).

They concluded that the taxonomic distinction of species of the genus Radix should not be based on the morphology of the shells, as their variability is: i) continuous, ii) largely overlapping between different species and iii) phenotypically plastic in response to environmental conditions. They stated that the greatest conceptual advantage of DNA taxonomy over morphological methods lies in the direct inheritance of the characters used for identification. Unlike many morphological characters, DNA sequences are not subject to potentially misleading environmental or developmental modifications.

From a taxonomic point of view, a given biological character may have an aggregative or a discriminative potential, which can be quantitatively evaluated.

We believe that a preliminary assessment of the possible taxonomic contributions of each character can

help in choosing the variables that will be later used in more sophisticated and costly analyses.

Maia (2021) developed a method to quantify this potential in discrete variables (attribute counts, coding of morphological variations, etc) on a scale between zero and 5.

In the present work we deal with the evaluation of this potential in the continuous variables obtained through measurements.

The discrete variable has contours clearly established and can be easily interpreted by counting attributes or by coding qualitative properties (colors, shapes, etc). In continuous variables, the limits of possible groups need to be statistically calculated (Maia, 2017).

The analysis of the differences between the arithmetic means of the studied groups and the construction of confidence intervals allow identifying the formation of possible groups of species whose means do not differ significantly. In this work, we used Tukey's test, calculating the minimum significant difference msd = 0.23 (Sokal&Rohlf,1981). When interpreting the ANOVA results, it is common to order the means in ascending order and underline those that do not differ significantly. (Gomes, 1970)

M	J	D	E	S	R
0.86	0.94	1.14	1.28	1.32	1.49

These underlined means are statistically equals and coded with zero in Table 4. In this example, of the 15 pairs of possible comparisons, 7 can be considered similar. The discriminative potential of the jaw width characteristic is represented by the 8 comparisons in which the differences between the means are greater than msd

Direct application of the Tukey test is recommended when the samples have the same size, as in our example, m = 5. If one or more samples do not meet this specification, the Tukey-Kramer test must be used to calculate the msd. It should be remembered that Analysis of Variance should only be used after evaluating the requirements for independence, normality and homogeneity of variances

In order to allow comparisons between similar analyses, the results can be standardized on a scale between zero and five, whose result D is obtained by calculating the variation of an index that uses the minimum and maximum values within the analyzed group. The aggregative potential (D') is calculated complementary, D'= 5 - D, since aggregation and discrimination are complementary concepts. In this example, D=2.67 suggests that the jaw width character belongs to the intermediate type as it both aggregates and discriminates

Table 5: Degree of Discrimination

0 <= D <= 1 - Very little discriminative character
1< D <= 2 - Little discriminative character
2 < D <= 3 - Moderate discriminative character
3 < D <= 4 - Discriminative character
4< D <= 5 - Very discriminative character

Table 6: Degree of aggregation

0 <= D' <= 1 - Very little aggregative character
1< D' <= 2 - Little aggregative character
2 < D' <= 3 - Moderate aggregative character
3 < D' <= 4 - Aggregative character
4< D' <= 5 - Very aggregative character

IV. Character Weighting

The values of D and D' can be used as a weighting criterion (for both discrete and continuous variables) when we want to assign different values to some biological characteristics.

The use of weights to rank character contributions in a taxonomic work is quite controversial. There are those who defend it and those who criticize it, since the times when Numerical Taxonomy was established as an alternative method for zoological and botanical classification, such as:

- Sneath (1973) states that the main conceptual difficulty that retarded the progress of the Numerical Taxonomy was the problem of the weighting of characters.
- Michener and Sokal (1957) conclude that, even if it is desirable, there is no rational way to determine character weights and, in practice, we should assign the same weight to all.
- Burtt(1964) warned that numerical taxonomy need not necessarily assign equal weights to all characters (isocratic classification).
- Farris (1966) suggests that characters that vary little within populations are more reliable indicators of cladistic relationships than characters that vary more, and therefore should have greater weights.
- Goodman (1969) believes that a character should be inversely weighted to the variance within the taxonomic unit.
- We do not intend to go into the merits of the disagreements. We just point out that the value D (and D') can eventually be used as a weighting criterion by those who defend this practice.
- Maia (2021) created tables for the values of D and D', but due to a graphical composition error, the tables only showed the amplitudes of variation of the weights and not the respective limits. This flaw is

now fixed and so we present the two tables as they should have been published.

V. Conclusions

- A methodology is presented to assess the discriminative or aggregative potential of continuous variables.
- Analysis of variance (one-way) makes it possible to identify whether there are significant differences among the samples tested and the contribution of the analyzed character to grouping or separating the species.
- The formation of groups whose species are statistically equals for a given characteristic is done through the Tukey Test applied to the means of the measurements of the samples.
- The discriminative/aggregative potential of continuous variables can be expressed on a scale that varies between zero and 5, just as to discrete variables.
- The values of D and D' can be used as weighting criteria to rank the contributions of characters in taxonomic studies.

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Background Subtraction of an Indian Classical Dance Videos

By Dr. Suvarna Nandyal & Ms. Bhavana R. M
Visvesvaraya Technological University

Abstract- A slew of motion detection methods have been proposed in recent years. The background includes some constraints such as changes in illumination, shadow, cluttered the background, scene change and speed of dance between hand gestures and body gestures are different. One of the most basic methods for background subtraction is temporal averaging. We looked at a new adaptive thresholding approach in this paper. To identify moving objects in video sequences, an adaptive thresholding is used. Depending upon the speed of the technique we proposed a Gaussian distribution technique. Gaussian distribution done background subtraction depending upon active pixels it differentiates whether it is a background or foreground. The background model's update rate has been modified to be adaptive and determined by pixel difference. Our aim is to improve the method's F-measure by making it more adaptable to various scene scenarios. The experiment results are shown and evaluated. The proposed method and the original method's quality parameters are compared.

Keywords: motion detection, background subtraction, gaussian distribution, the adaptive temporal averaging method.

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Dr. Suvarna Nandyal [α] & Ms. Bhavana R. M [σ]

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Keywords: motion detection, background subtraction, gaussian distribution, the adaptive temporal averaging method.

I. Introduction

Analysis and comprehension of video sequences is a growing area of study. The identification of moving objects in the scene is a first step in many applications in this area (video tracking, optical motion capture, multimedia applications).The separation of moving objects, referred to as the foreground, from static data, referred to as the background, is the basic operation required. Background Subtraction is the most commonly used process. Obtaining a background image that does not contain any moving objects is the best way to model the background. The background is not always available in certain environments, but it can always be altered in crucial circumstances such as lighting changes or the addition or removal of items from the scene. As a result, the background representation model must be more adaptable and stable. Every modern video monitoring system includes motion detection.

In computer vision systems, background subtraction is a popular technique for identifying movement regions. It simply refers to the division of the current scene into two parts: the background and foreground. Using a constant model for the background is one of the easiest ways to enforce background subtraction. The moving regions are then distinguished from the background using this model. However, there are several drawbacks to this approach. It is incapable of dealing with changes in lighting, objects being shifted to or removed from the background, shadows, and repeated motion such as the tree leaves, among other things. More intelligent approaches to adapt the background model to the evolving world have been implemented to address at least some of these problems.

Intelligent control systems are capable of distinguishing between moving objects in the foreground and stationary objects in the background, in addition to detecting motion. In recent years, several of these motion detection methods have been proposed. The most widely used techniques for this separation are background subtraction methods [1-3]. Statistical approaches such as Mixture of Gaussians [4-8], Kernel Density Estimation [9], and Eigen backgrounds [10] are more accurate and complex.

The Temporal Averaging Method (TAM) [11-13] is a simple method for background subtraction that is the subject of this article. The original method is shown, and new versions of the algorithm are proposed in this paper. The background model is the first step in the original TAM process. It represents a portion of the scene that is relatively still. algorithm (3). We find the threshold t adaptive to each pixel difference $d_{t_{(a,b)}}$, just as in the first approach

II. Our Approach

When the scene illumination is constant, the original TAM approach is reasonably effective in estimating foreground-background. However, when there are sudden lighting changes or repeating backgrounds, such as waving trees, there are a lot of false positive pixels and the output parameter levels are lower. The original method's flaw is the slowness with which it updates the background model determined by α, (1). For all pixels in the current frame, the method assumes α is equal. When the background is changing rapidly, this is not the best choice. So, if the updating speed could be adjusted to each pixel difference $d_{t_{(a,b)}}$, the algorithm would respond faster to sudden light changes and repeated backgrounds. Furthermore, the above-mentioned solution would be insufficient in very

Author α σ: Visvesvaraya Technological University.
e-mails: sg.bhavana@gmail.com, suvarna_nandyal@yahoo.com

noisy and complex background scenes. An adaptive threshold will be used to reduce the number of false positive pixels in the predicted scene. The threshold T is constant in the original algorithm (3). We find the threshold t adaptive to each pixel difference $d_{t_{(a,b)}}$, just as in the first approach.

III. Adpative Thresholding

For every incoming image a new background model $C_t[x,y]$ is estimated by:

$$c_{t+1_{(a,b)}} = \alpha I_{t_{(a,b)}} + (1-\alpha)c_{t_{(a,b)}} \quad \text{Eq-1}$$

$I_{t_{(a,b)}}$ is the pixel value, *t* is the image number,(*a,b*) is the pixel location in the image and α is learning rate.

The first background is formed by the pixels that have least absolute difference value. Then the absolute difference is calculated by the following equation:

$$d_{t_{(a,b)}} = | I_{t_{(a,b)}} - b_{t_{(a,b)}} | \quad \text{Eq-2}$$

The sum of absolute difference makes pixel by pixel comparison between two consecutive frames. The absolute difference is added up the pixels that have least sum of absolute difference value is the background. To handle variation in background such has color and illumination changes. The rule of updating $\alpha_{t_{(a,b)}}$ is given by:

$$\alpha_{t+1_{(a,b)}} = \beta.\left(\frac{c.d_{t_{(a,b)}}}{n}\right) + (1-\beta).\alpha_{t_{(a,b)}} \quad \text{Eq-3}$$

β is the adaptive learning rate updating $\alpha_{t+1_{(a,b)}}$, c value is given by the user, n is the dynamic range of the signal.

The foreground mask is estimated by the equation:

$$N_{t_{(a,b)=}} = \begin{cases} 0, & d_{t_{(a,b)}} < T1_{t_{(a,b)}} \\ 1, & d_{t_{(a,b)}} \geq T1_{t_{(a,b)}} \end{cases} \quad \text{Eq-4}$$

Where $T1_{t_{(a,b)}}$ is adaptive thresholding.

a) Modeling background pixels using Gaussian distributions

To use K Gaussian probability density distributions to constitute the background of each pixel in the image. The pixel {*a0*, *b0*} is defined as a time series.

$$\{a_1 \text{---------} a_t\} = \{K(a_0, b_0, j): 1 < j < t\}$$

Where *K* refers to the image sequence and a_j is the intensity value of the pixel {*a0*, *b0*} at time instant *j*.

The background pixels are modeled using Gaussian distribution method. The probability of pixel value within the history values of the pixel is determined as

$$f(A_t) = \sum_{j=1}^{K} \omega_{j,t} \eta(A_{t,} \mu_{j,t} \Sigma_{j,t})$$

where *K* refers to the number of Gaussian distributions used. $\omega_{j,t}$ is the weight parameter that is used to describe which part of the data is described by the *i* th Gaussian distribution.η is a Gaussian distribution that has two parameters: $\mu_{j,t}$ is the mean of the Gaussian distribution at time *t* and Σ_t is the covariance matrix at time instant *t*. Any new pixel value is compared to the existing Gaussian distributions for each frame. If a new pixel is within 2.5 standard deviations of the distribution's mean, it is said to fit the distribution. If a pixel matches one of the weighted Gaussian distributions, the distribution's mean and variance are modified.

IV. Results

(a) (b)

Fig. 1: Input frames of Kuchipudi(a) and Kathak(b)

Fig. 2: Segmented frames of Kathak dance

Fig. 3: Segmented the frames of Kuchipudi Dance

Matlab is used to apply the procedures under investigation. The Gaussian distribution approach is contrasted to the Adaptive Temporal Averaging Method.

For two separate videos, kathak and kuchipudi, both methods are used. Each adjustable parameter is expressed as a function of the quality of background subtraction. The F-measure is used to assess the consistency quantitatively. For kathak and kuchipudi, the Gaussian distribution method gives the highest accuracy than the adaptive method, depending on the F-Measure parameter.

Table 1: Comparison Accuracy results of the adaptive and Gaussian distribution method

Method	Parameter	Test Case	
		Kathak	Kuchipudi
Adaptive temporal averaging method	Precision	0.70	0.70
	Recall	0.89	0.89
	F-Measure	0.68	0.79
Gaussian distribution method	Precision	0.75	0.75
	Recall	0.88	0.88
	F-Measure	0.76	0.81

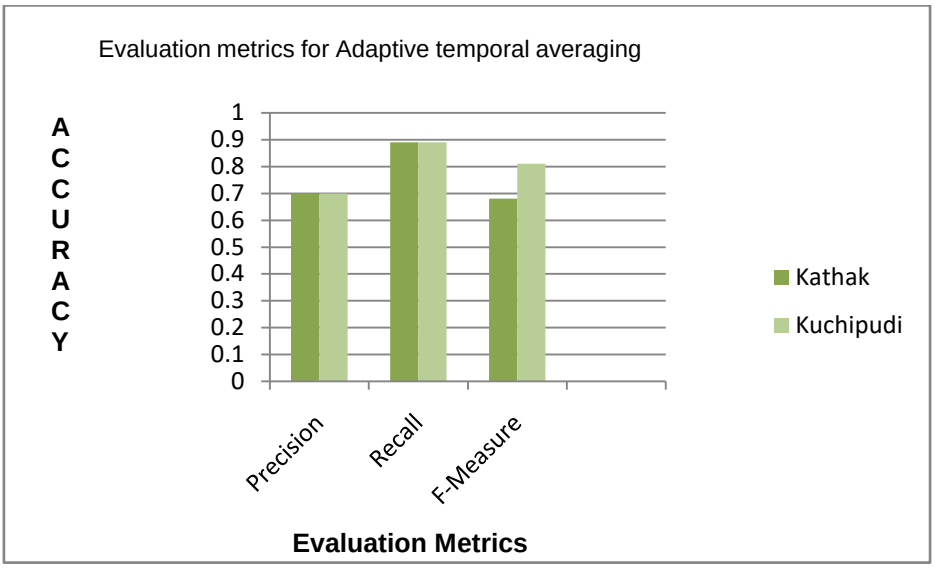

Fig. 4: Accuracy graph of the evaluation metrics for Adaptive temporal averaging

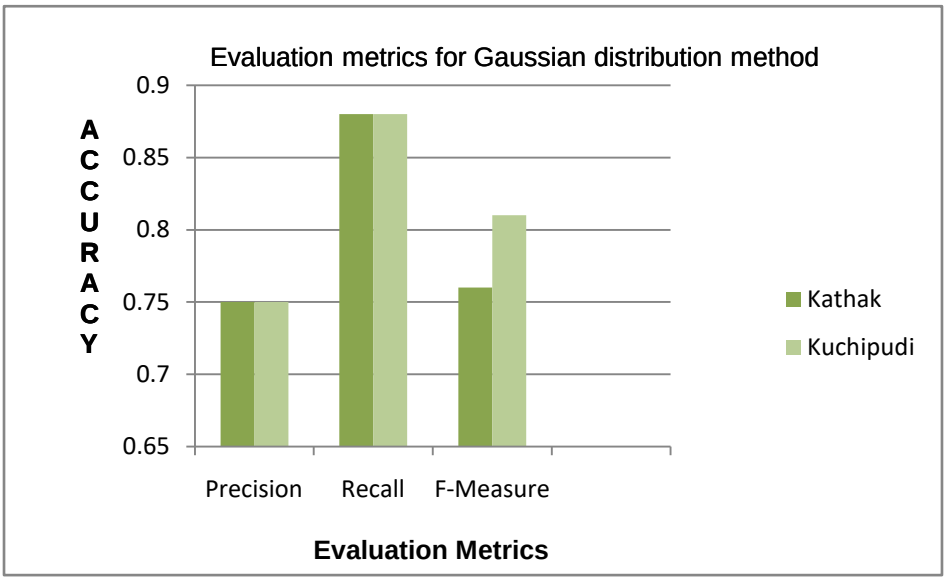

Fig. 5: Accuracy graph of the evaluation metrics for Gaussian distribution method.

V. Conclusion

An adaptive background approach was presented. Gaussian distributions were used to model any other or third pixel in the image in our system. Our process is quicker than the original system, according to the findings. The ability to track moving areas and the amount of noise in the binary motion picture are identical to the original system's properties. Our method can be implemented in a real-world video surveillance framework and run on regular computers due to its speed and robustness. We focused on the algorithm's speed, so some other issues, such as slow learning at first or too quick adaptation of still objects, would need to be addressed in the future.

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Research on the Cultivation of Talents for the Integration of Production and Education of Computer Software Technology Based on the Concept of CDIO

By Xia Shen, Changwei Xie & Zhangjie Yuan
Chongqing City Vocational College

Abstract- According to the development and reform of CDIO concept in China in recent years, we can know that it can greatly improve the scientific quality and systematic quality of talent training mode in China's education industry[1]. At present, the continuous improvement and innovation of computer software technology makes our education industry constantly appear the hope of reform. Some experts believe that the industrial economy of computer software technology has a bright future. According to the application of the combination of industrial economy and education, we can find that in theory, the application of CDIO concept can help the integration of production and education of computer technology and establish a perfect talent training mode. This paper will provide the corresponding conclusions.

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I. Introduction

We often say that the talent training mode refers to the system of talent training objectives, training standards and training process. Through the optimized combination of different components, we can build a lot of different training modes[2] . Computer science is a new technical industry in China in recent years. Relevant experts suggest that we can carry out multiple training of different forms of computer talents by strengthening the management of teaching reform and innovative experiment projects and carrying out extracurricular activities of CDIO project. In order to improve the ability of engineering practice and innovation of college students. At present, China is strengthening the transformation of the new mode of economic progress. Strive for the information technology industry to promote the interaction of industrialization and Industrialization to promote the information technology industry. As a popular information technology major, the emergence of computer science makes the economic progress of information industry faster and faster. With the occurrence of China's education reform and the emergence of CDIO concept, the new mode of talent training of computer professional integration of production and education has emerged. There is no doubt that this will lead to the establishment of a new chapter in the education reform of Computer Science in China.

II. The Main Theory of Production Education Integration based on Computer

a) *Industrial economy and educational ideas*

The integration of industry and education refers to the development of the integration of industrial economy and education concept of an industry[3]. Generally speaking, the object of the concept of integration of production and education is a relatively clear target industry. Moreover, the establishment cycle of its industrial chain can not be too long. We can think that the industry that can obtain the integration of industry and education belongs to the innovative industry in the new era. Generally speaking, this industry will be recognized by the national education department.

b) *The supporting idea of computer industry education integration*

According to the above description, we know that the computer industry economy is an innovative industry with short development cycle in the new period. If it can obtain the support of industry education integration, it will be recognized by the Ministry of education. Then we can think that the development of computer software technology industry economy is prosperous and prosperous. Under the influence of social environment, the progress of computer major in school has also been concerned by people. The combination of industrial economy and educational ideas is essentially the combination of practical requirements and theoretical knowledge. There is no doubt that this combination can implemented (see Figure 1).

Author α σ ρ: Chongqing City Vocational College, China.
e-mail: 290705803@qq.com

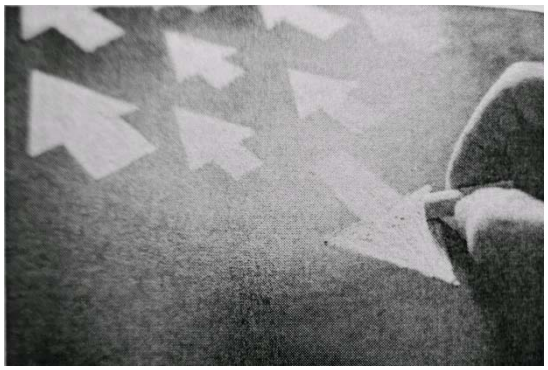

Figure 1: Different thinking modes of CDIO concept

c) *National support for the combination of production and education of computer*

The development of computers makes it obvious to all. Compared with the traditional engineering industry, the progress of computer industry is also very rapid. As its application technology is closely related to our life, its update has also been strongly supported by the state. Similarly, computer related industrial economy has become an important part of China's national economy[4]. Therefore, its national support for the combination of production and education is relatively strong.

III. Problems Existing in the Cultivation of Talents Integrating Production and Education in Computer Software Technology Specialty

Computer software specialty is a branch of science which has the fastest progress in the field of technology. With the development of software technology and the increasing demand for the ability of talents, the traditional talent training mode of computer specialty can not be applied in today's information environment. At present, there are many problems in the computer talent training mode of the integration of production and education in China.

a) *Emphasis on theorization and weaken practice*

According to a lot of research, we can find that there are a lot of software talents in our country. However, the level of their software production is generally low. We know that enterprises need high-level computer software development talents. However, the computer talents trained in Colleges and universities focus on the memory of theory and forget the significance of practice itself. This training mode is not conducive to the growth of computer talents.

b) *The practical conditions can not meet the needs of personnel training*

It can be confirmed that many a small part of the school computer professional students' social practice effect is good. However, the number of students majoring in Computer Science in our country is very large. We can think that most students can not get good social practice training. Of course, more often than not, schools are unable to provide students with mature practical conditions.

c) *Lack of Teachers*

A good teacher makes a good apprentice. The meaning of this proverb is very huge. There is no doubt that the cultivation of talents needs the support of powerful teachers. However, the lack of teachers in many schools is not the lack of teachers but the lack of teachers' level. Although many teachers have strong academic ability, their comprehensive practical ability is not satisfactory. This kind of education will only make students fall into the cycle of focusing on theory but lacking practice once again.

IV. The Construction of Talent Training Mode based on CDIO for Computer Software Technology Specialty

a) *Introduction of CDIO concept*

Before using the concept of CDIO, schools need to have a deep understanding of the specific content and connotation of this concept. In fact, the concept of CDIO inherits the concept of Engineering Education in European and American countries. It systematically puts forward the standard requirements for the cultivation of operational ability. The framework of this concept is divided into four main parts. They include conception, design, implementation and operation. Today's schools should make clear the main contents of these four parts and implement them(see Table 1).

Table 1: CDIO concept of computer software technology professional production teaching integration of personnel training mode

Build steps	Requirement
Introduction of ideas	Clear objectives
Construction of teaching system	The cornerstone of technical level
Practice	The best proof of theory

b) According to the concept of CDIO, the construction of theoretical teaching system should be carried out

The cultivation of talents is inseparable from the construction of teaching mode. A solid professional foundation is an important cornerstone for the improvement of students" level. It is also the foundation of the cultivation mode of CDIO concept[5]. The school should reform the teaching system according to the development of students and the structure of CDIO. This reform does not need to be too deliberate. It can be reformed on the basis of the traditional teaching system. 4.3. The establishment of the practical link of the combination of production and education based on CDIO The combination of industrial economy and education can improve the maximum profit of enterprises. This is a business truth. The school gives students a lot of knowledge theory. Compared with the social CDIO. Only in this way can we ensure the development of the combination of theory and practice.

V. Based on CDIO Concept of Computer Software Technology Professional Industry Education Integration of the Importance of Personnel Training

a) It is conducive to the rapid rise of computer industry economy

At present, the computer industry economy is an important part of our national economy. It can be regarded as a great contribution to the economic development of modern China. Some experts predict that the future development of computer industry is limitless. Its rise should be strongly supported by the state and the people[6].

b) It facilitates the use of CDIO's concept of domestic innovation

In fact, the CDIO concept is a talent training concept invented by European and American countries. In recent years, due to the needs of China's national conditions, we have introduced this concept to China. At present, our use of this concept is in imitation of European and American countries. This paper describes the establishment of the talent training mode of integration of production and education, to a certain extent, innovates the domestic CDIO concept. It is of great significance across the ages.

c) It can help promote the CDIO concept in other industries

The combination of production and teaching of computer and CDIO concept is a relatively new use of skills. Before that, there were few successful cases. In theory, the case of the combination of production and education is successful. Then it will also lay the foundation for the application of CDIO concept in the combination of production and education in other industries.

VI. Conclusion

The combination of production and teaching of computer and CDIO concept is a relatively new use of skills. Before that, there were few successful cases. In theory, the case of the combination of production and education is successful. Then it will also lay the foundation for the application of CDIO concept in the combination of production and education in other industries.

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Nanoscale Modification of Weld Metal Microstructure

By Holovko V. V. & Stepanuk S. M.

Abstract- The are considered possibilities of influencing the a circular ferrite controlling content on welds metal mechanical properties. The method of adding titanium carbides to the welding bath liquid metal is considered. It is established that non-metallic inclusions with a size of 0.3 μm to 0.8 μm and titanium carbides on surface determine the conditions for the microstructure formation and the level of weld metal mechanical properties.

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Abstract- The are considered possibilities of influencing the a circular ferrite controlling content on welds metal mechanical properties. The method of adding titanium carbides to the welding bath liquid metal is considered. It is established that non-metallic inclusions with a size of 0.3 μm to 0.8 μm and titanium carbides on surface determine the conditions for the microstructure formation and the level of weld metal mechanical properties.

I. Introduction

The possibility of welds structure forming process influence on weld metal mechanical properties is significantly limited in comparison with the technology of steel production. The main factors that can increase the weld metal strength and toughness are the solid solution alloying and the of non-metallic inclusions formation with a certain size, composition and morphology.

In order to ensure the production of steel with a circular ferrite (AF) controlled content there is a need to take into account the processes occurring in its manufacture. In 1990, the was [1] introduced the concept of "Oxide Metallurgy", which implies the use of certain non-metallic inclusions as heterogeneous nucleation centers of the structure in the crystallization process. Later, the concept of "Inclusion Engineering" was proposed to develop knowledge about the inclusions number and size distribution control in steel in the ladle processing and casting. Almost a decade later, in 2006, Grong and colleagues [2] combined the two ideas, suggesting that it was possible to use inclusion engineering to optimize the microstructure of steel to improve its mechanical properties. He called inclusions (such as oxides, sulfides, carbides, or nitrites) <1 μm in size that can promote AF formation "dispersoids." They were allocated to a special group because due to their small size they do not cause a negative influence on the reduction of mechanical properties, but affect on the metal microstructure formation.

Therefore, for the formation of a highly toughness welds microstructure it is necessary to ensure that the metal is predicted in terms of volume fraction, composition and size distribution of inclusions. This article was devoted to increase our knowledge in such problem.

II. Material and Experimental Procedure

a) Material

The chemical composition of 20 mm thick plate of HY 85 steel is listed in Table 1. This plate was obtained in the quenched and tempered condition. The yield strength of the present steel is 560 MPa. The chemical composition of the weld metals was determined by spark spectrometer.

b) Weld metal preparation

The material for the weldment used in these experiments is an HY85 steel, although some of its alloy components do not remain at the low alloy level. The chemical compositions of the weld metals and the wire electrodes are shown in Table 1. The HY85 steel plates with 20 mm thickness were welded with single V-shape of weld pool by the Flux-core arc-welding technique with gas M21 shield process. The microstructural overview of the weldment is given in Fig. 1. Nineteen weld passes were applied to complete the joining. Their profiles are shown in Fig. 2a. The voltage and the current of the welding are 35 V and 500 A, respectively.

The basic alloying system C – Mn – Cr – Ni – Mo – Si – Cu, implemented in the №0 variant, was aimed at forming weld metal with a bainitic structure with mechanical properties corresponds to low-alloy steels of strength category K75. The alloying weld metal effect with titanium was investigated on weld metal samples №4, and the introduction of titanium carbide on weld metal samples №6. Titanium compounds were introduced into the welding pool through a flux-cored wire with alloying particles no larger than 1 μm in core.

Author: e-mail: v_golovko@ukr.net

Table 1: Experimental joints weld metal chemical composition

№ weld	tensile testing				Charpy impact test at temperature °C				
	Tensile Strength,	Yield Strength,	Regarding Elongation, %	Relatively Narrowing, %	+20	0	– 20	– 40	– 60
0	774,9	738,4	16,1	54,4	92,5	87.5	74,2	63,3	58,8
4	787,5	737,1	16,1	51,0	60,0	58,12	57,08	52,08	56,3
6	715,6	643,9	19,4	62,9	112,6	93,7	84,6	73,1	64,4

c) Mechanical testing

In order to determine the impact of heat treatment on the basic mechanical and plastic properties of the tested steel, tensile testing was conducted at ambient temperature, based on the valid standard ISO 6892-1:2010 (metallic materials—tensile testing). The research was carried out on an Instron 8800 machine (Instron, High Wycombe, UK) using an extensometer to measure elongation. Proportional rectangular samples were tested with an original gauge length of L0 = 35 mm. Testing rates were based on stress rate (Method B according to the ISO Standard 6892). Within the elastic and plastic range up to the yield strength, the strain rate was 0.002 1/s; after the yield strength, the stress rate exceeded 25 MPa/s until fracture occurred. In order to determine the value of the absorbed energy (KV), the notched impact strength (KCV), a Charpy impact test was performed. The study was performed in accordance with Standard ISO 148-1:2010 (Metallic materials—Charpy pendulum impact test) on ta pendulum hammer using an initial energy of 300 J. Standard samples, V-notched to a depth of 2 mm, were tested. The tests were carried out after the samples were cooled to +20; 0; - 20;−40 and -60 (± 0,5) °C and conditioned for 15 min in a mixture of liquid nitrogen and isopropanol. The temperature was monitored using a digital thermometer, and the transfer time for all samples was less than 5 s.

Table 2: Experimental joints weld metal mechanical properties

№ шва	Зразки МИ–12 тип II				Зразки МИ–50 при температурі °C				
	$\sigma_в$, МПа	$\sigma_{0,2}$, МПа	δ, %	ψ, %	+ 20	0	– 20	– 40	– 60
0	774,9	738,4	16,1	54,4	92,5	87.5	74,2	63,3	58,8
4	787,5	737,1	16,1	51,0	60,0	58,12	57,08	52,08	56,3
6	715,6	643,9	19,4	62,9	112,6	93,7	84,6	73,1	64,4

d) Metallography and Microscopy

Weld metal samples for metallography and microscopy were prepared by traditional method, including mechanical grinding, polishing techniques and etching in 3% nital solution before being investigated by a NEOPHOT 30 Optical Microscope (OM). A JSM35CF field emission Scanning Electron Microscope (SEM) was also applied for observation. Volume fraction and size distribution of microstructural constituents were measured by quantitative metallography. For Electron Backscattered Diffraction (EBSD) test, the samples were electro-polished in a solution consisting of 12.5% perchloric acid, 87.5% absolute ethyl alcohol at 25°C under a potential of 20 V for 20 s.

III. Results

As a result of metallographic analysis, it was found that the weld metals microstructure consists phases which are austenite grains decay products and contains a number of non-metallic inclusions. The most common structures observed in the weld metal were grain boundary allotriomorphic ferrite (GAF); intragranular polygonal ferrite (IPF), which is formed in the form of upper and lower bainite; Widmanstett ferrite (WF); intragranular acircular ferrite (AF); upper and lower bainite (UB and LB); phase containing martensite, austenite and carbides (MAC). The content of the individual components of the weld metal microstructure are given in table. 3.

Table 3: Weld metal microstructure components percentage

№ weld	Weld metal microstructure components (%)				
	GAF	IPF	WF	AF	MAC
0	14	26	9	48	3
4	22	16	7	53	2
6	9	9	3	77	2

The basic alloying weld metal system (variant №0), such as titanium alloying weld metal, provides high strength level thanks to formation a microstructure with a high content of intragranular polygonal ferrite and a allotriomorphic ferrite layers formation along the grain boundaries (Fig. 1).

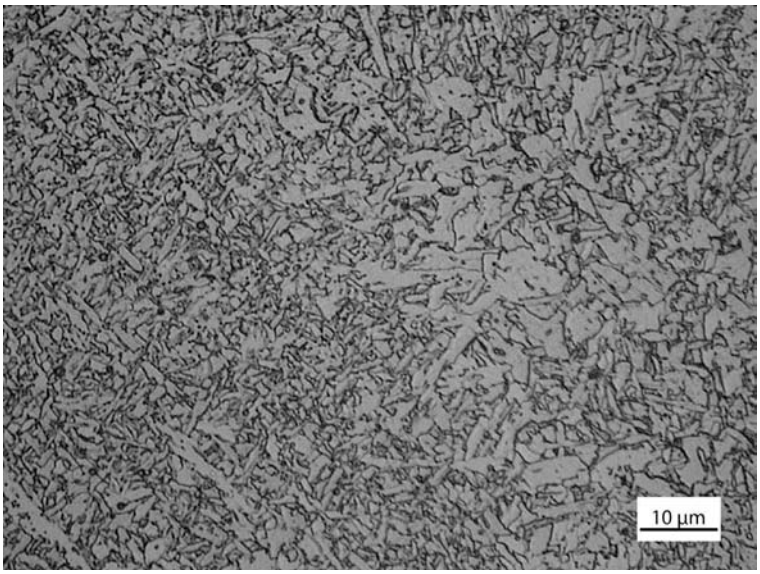

Fig. 1: Weld metal microstructure optical metallography of specimen №0

Intragrain ferrite is formed both in the form of bainite phase and in the form of massive ferrite, and grain boundary ferrite is released both in the form of acircular ferrite and Widmanstett ferrite. Non-metallic inclusions contain oxides of aluminum and silicon, which contain sulfur-based emissions. This structural composition, which has a high content of bainite phase and a relatively low content of acircular ferrite, is characterized by low plasticity (variants №0 and №4 (Fig. 2)).

The introduction of titanium particles in the form of carbides into the welding pool (variant №6) leads to a slight increase in the content of inclusions from 0.3 to 0.8 µm. In the weld microstructure allotriomorphic ferrite is released at the grain boundaries not in the form of grain boundaries layers, but as separate discrete blocks (Fig. 3). Intragrain ferrite is formed mainly in the form of upper bainite, but a decrease in grains content due to an increase in acircular morphology, which leads to increased plasticity and viscosity. The proportion of Widmanstett ferrite is somewhat reduced, but it does not grow from layers of allotriomorphic ferrite, but in the body of grains.

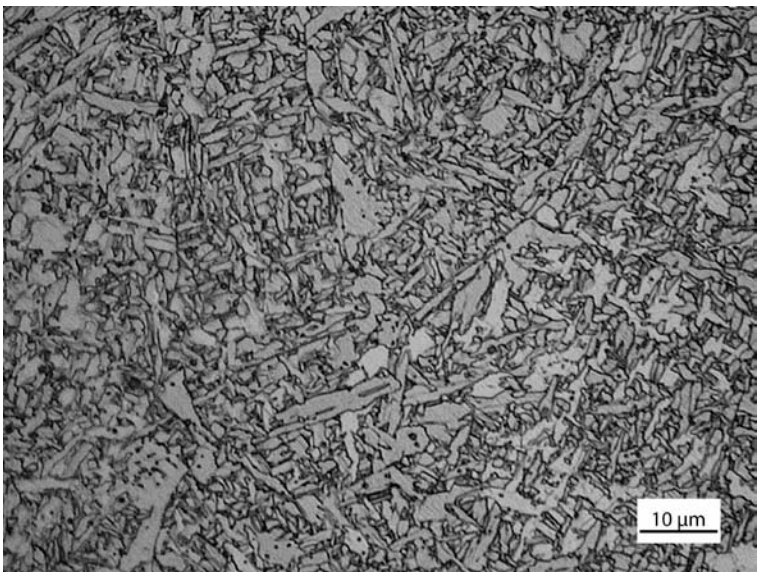

Fig. 2: Weld metal microstructure optical metallography of specimen №4

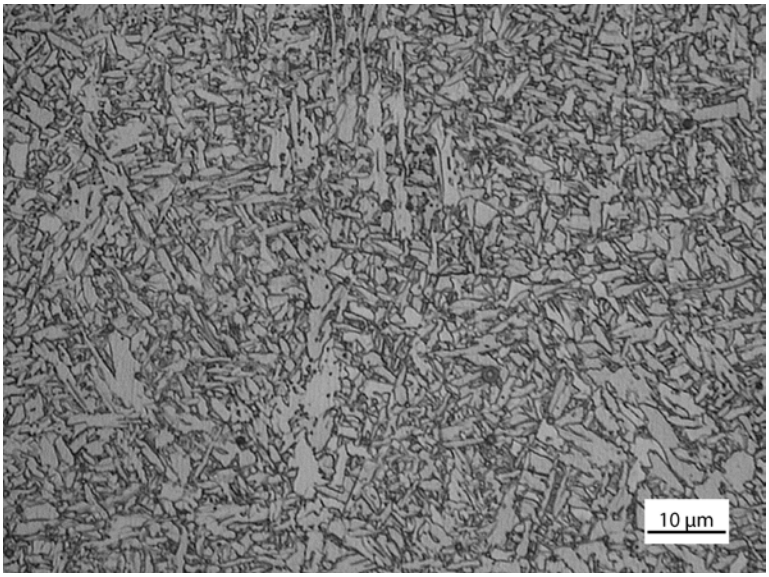

Fig. 3: Weld metal microstructure optical metallography of specimen №6

Comprehensive analysis of inclusions (morphology, dispersion, composition) showed the influence of non-metallic inclusions on the weld metal microstructures. This influence on microstructures depends not only due to inclusions chemical composition, but also their size and distribution density in the metal matrix. Computer processing the results of the non-metallic inclusions distribution of by size and composition allowed to distinguish from the general data set three main groups on these grounds. Triple diagrams of the inclusions chemical composition up to 0.3 µm, 0.3–0.8 µm, and more than 0.8 µm, which are part of these groups, are shown in Figs. 4–6 for samples №0, №4 and №6.

It has been found that inclusions up to 0.3 µm in size most often contain individual compounds of aluminum or titanium, sometimes such compounds are included in one. In inclusions ranging in size from 0.3 to 0.8 µm, the bulk is composed of aluminum and titanium compounds, a small amount of manganese and silicon compounds is also possible, and sulfur compounds are found. Inclusions larger than 0.8 µm consist of compounds of aluminum, titanium, manganese, silicon and sulfur, and the total content of manganese and silicon may exceed 50% of the inclusion total mass.

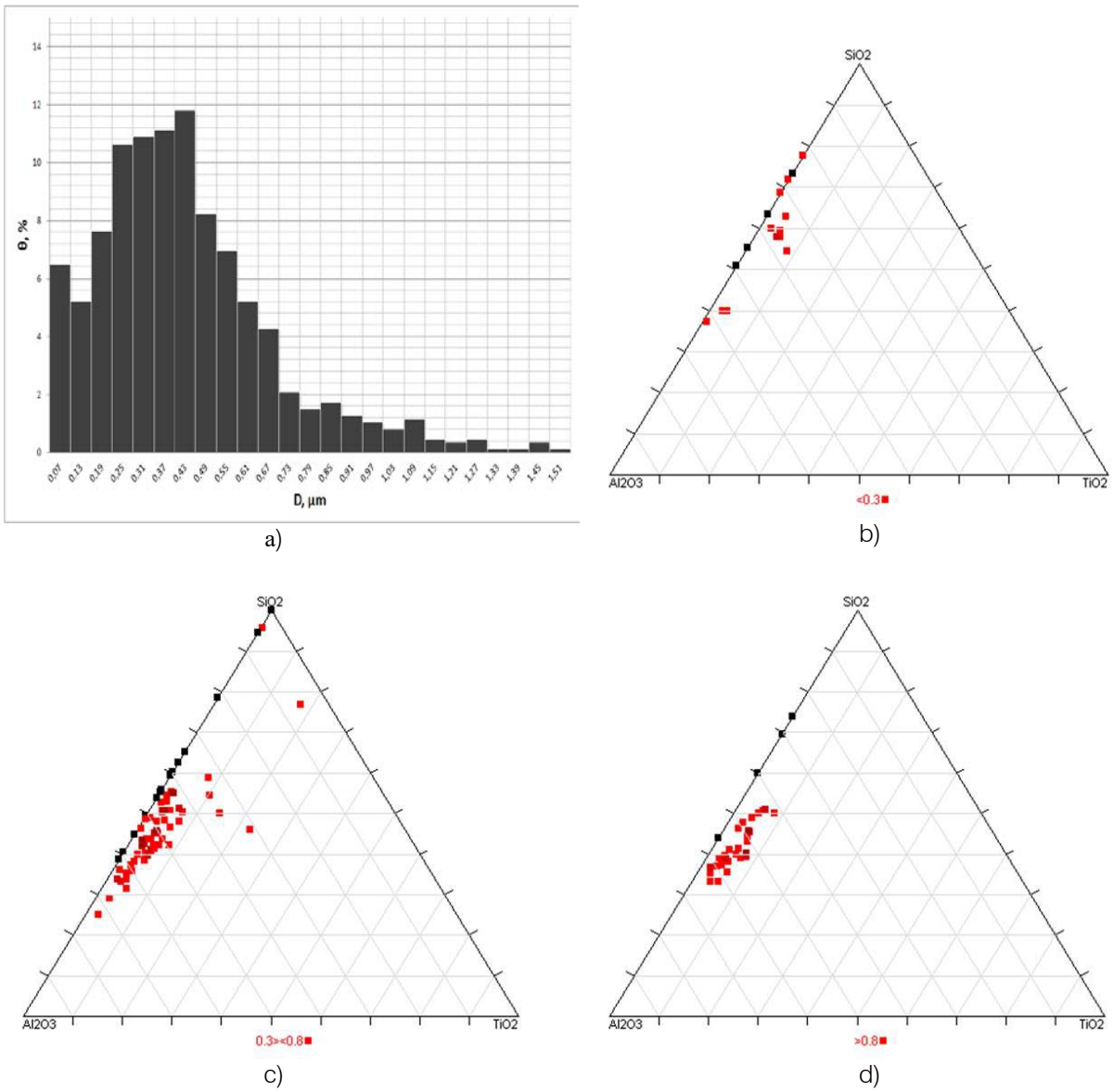

Fig. 4: Size distribution histogram (a) and ternary diagrams of nonmetallic inclusions composition in specimen #0 (b, c, d)

As a result of the study, it was found that single-phase inclusions type of simple oxides (Al_2O_3, TiO_2 and SiO_2) with a size not more than 0.3 μm do not affect on acircular ferrite formation. The inclusion of this size range contributes to hardening structures such as Widmanstett ferrite and upper bainite formation. Multiphase inclusions larger than 0.8 μm, containing manganese silicates, aluminum and titanium oxides, actively promote the polygonal structural components formation in the weld metals of low-alloy high-strength steel (Fig. 7–10).

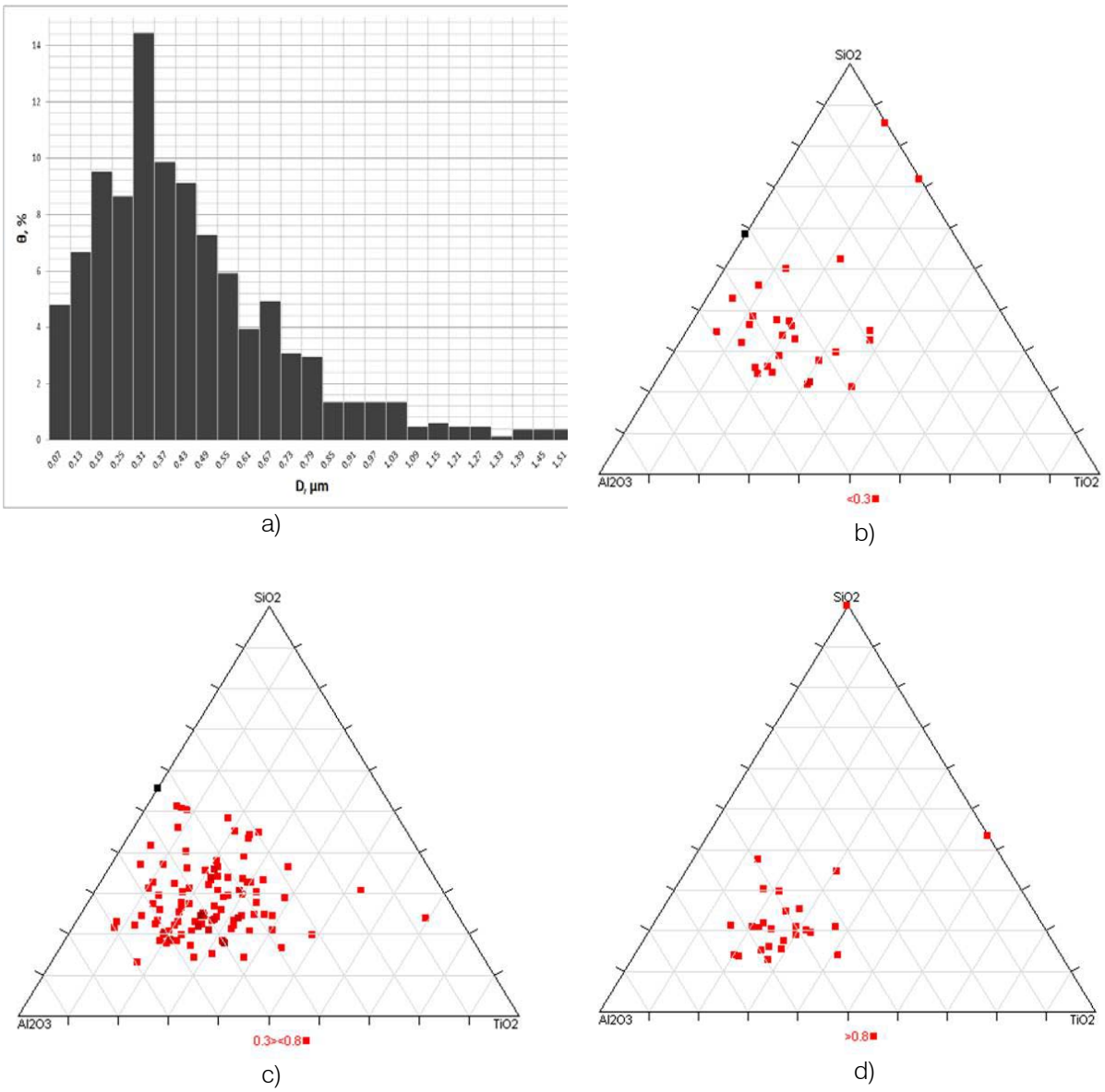

Fig. 5: Size distribution histogram (a) and ternary diagrams of nonmetallic inclusions composition in specimen #4 (b, c, d)

Complex inclusions (multiphase inclusions) are more efficient centers for the formation of acircular ferrite compared to simple oxides and nitrides. In weld metal of low-alloy high-strength steels in non-metallic inclusions containing two or more phases, the phase composition varies from the center to the inclusion surface.

Their influence is most noticeable in those cases when the carbide phase nanoscale formations are located on the outer surface of a multiphase inclusion 0.3–0.8 μm in size. Such morphology inclusions were noted when the titanium carbides introduce into the liquid pool outside the action zone of the welding arc (weld variant №6).

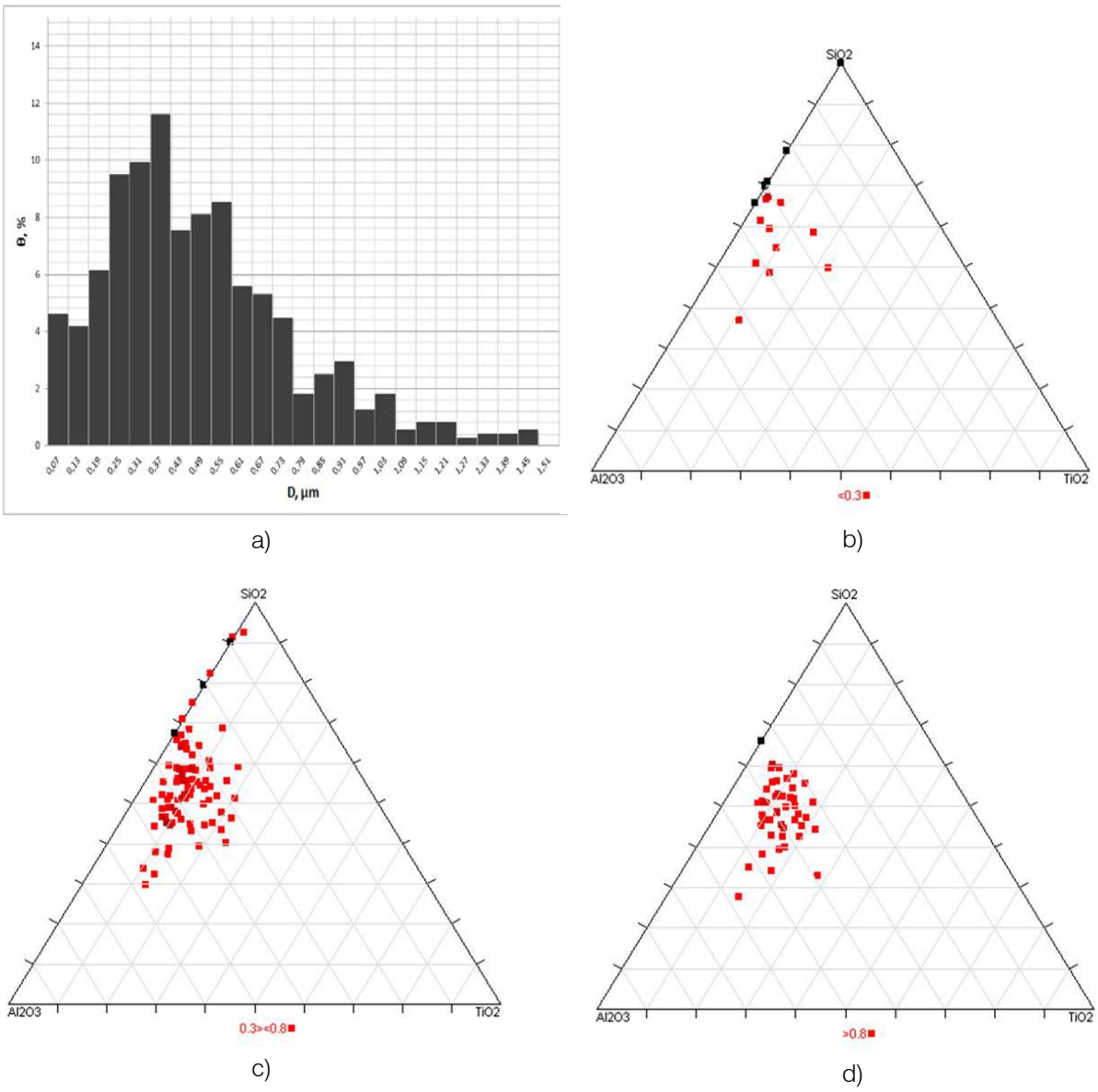

Fig. 6: Size distribution histogram (a) and ternary diagrams of nonmetallic inclusions composition in specimen #6 (b, c, d)

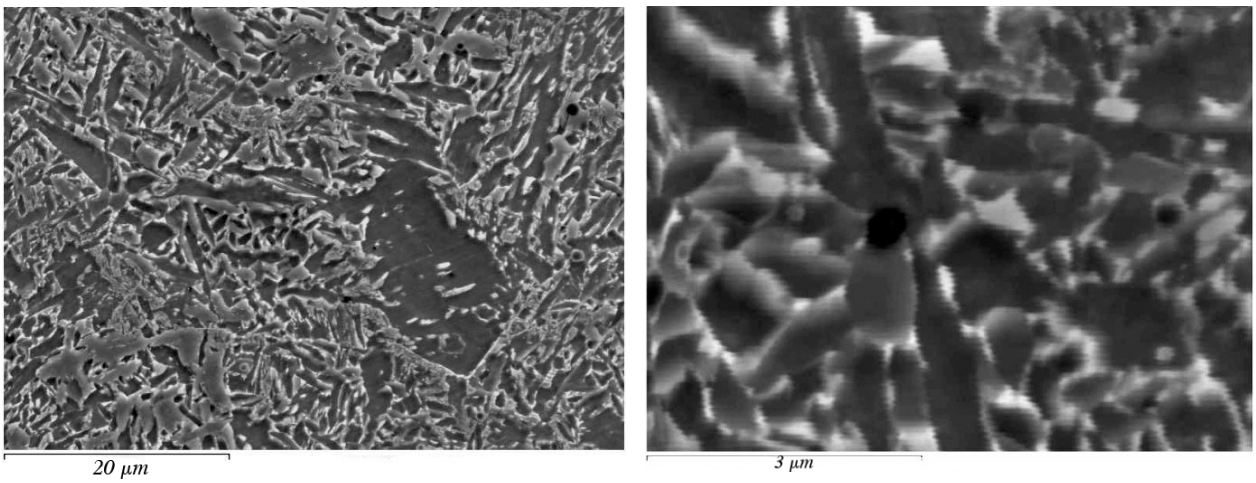

Fig. 7: Electronic image of specimen №0 weld metal microstructure

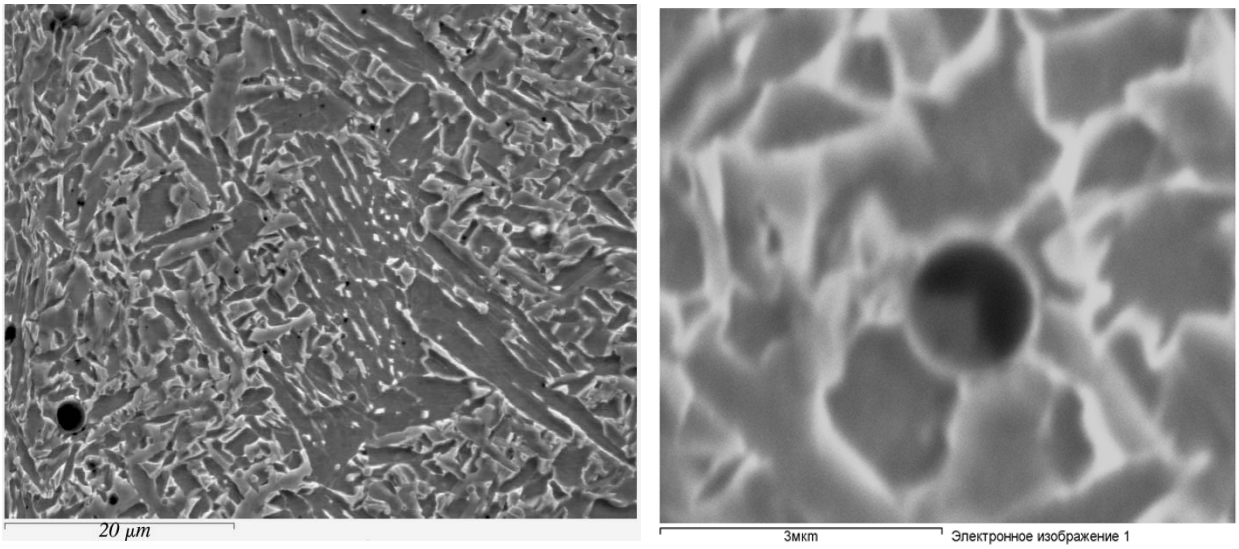

Fig. 8: Electronic image of specimen #4 weld metal microstructure

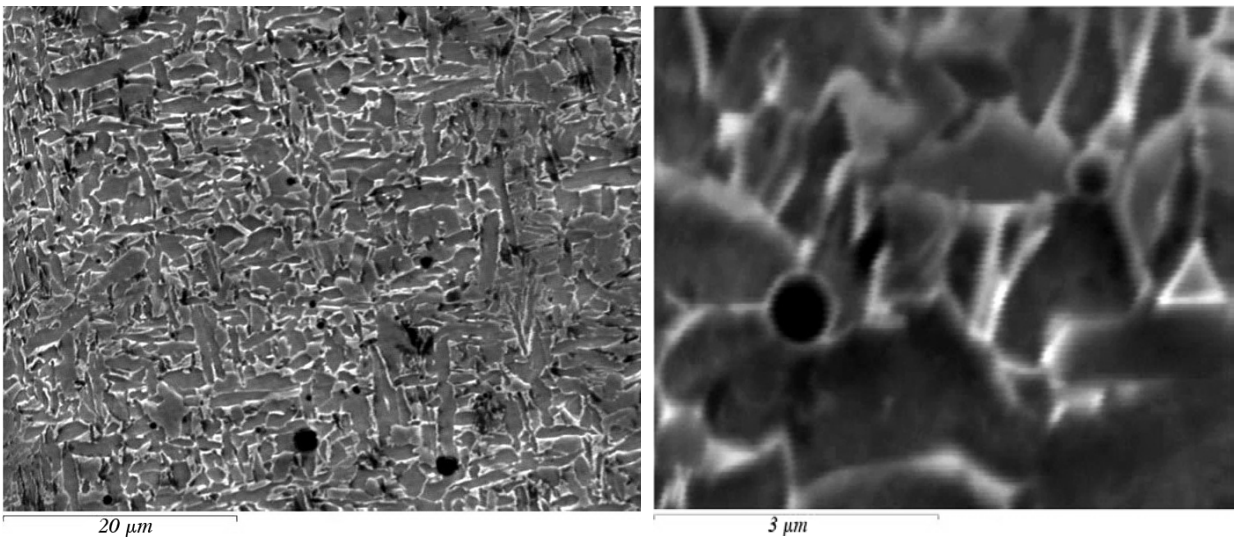

Fig. 9: Electronic image of specimen #6 weld metal microstructure

Figure 10 shows the results carbon content scanning of two adjacent non-metallic inclusions and a metal matrix in the structure the weld metal №6. The results show the carbide phase presence on the periphery of the inclusion influences on the fine ferrite structure formation.

Such inclusions are the complex, which composition is differ in the center and on the surface. If in the center, as a rule, the oxide is located, then on the inclusion surface there are islands of carbides.

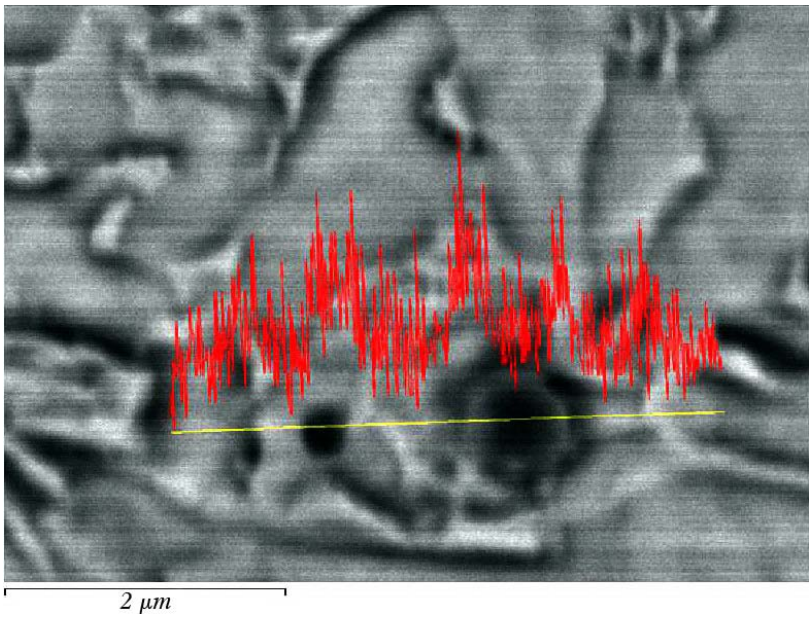

Fig. 10: Carbon distribution in non-metallic inclusion and nearby areas of solid solution in specimen №6

In fig. 10 it can be seen that on the inclusion surface there are carbides with a size of no more than 100 nm. There are no such carbides on the inclusions surface in the metal of welds No. 0 and No. 4. Consequently, these are refractory titanium carbides and they could be fixed on the inclusions surface during the metal crystallization. Such nano-sized inclusions can influence the formation of both the primary and secondary weld metal structure.

Based on this inclusions morphology, we can assume that their center is formed at the crystallization stage, and another mass in the carbides (type TiC) form is deposited on their surface from a supersaturated solution in the interdendritic volume of metal during its further cooling.

The nanosized carbides modifying effect an increase in the acicular ferrite content in the weld metal No. 6 microstructure (Table 3) and an increase in its toughness and plasticity (Table 2). It should be noted that the carbon content in the weld metal, when modified with TiC particles, practically does not differ from the weld No. 4 alloyed with titanium, and the titanium content is lower, which leads to a slight decrease in the strength of the metal.

IV. Conclusions

It is established that the presence a certain number of non-metallic inclusions in the weld metal is a necessary condition for obtaining a microstructure with high strength, ductility and toughness of the metal. Obtained data analysis showed the positive effect of inclusions ranging in size from 0.3 to 0.8 μm on the structure and mechanical properties metal formation. Such inclusions have a multiphase morphology and contain nanoscale carbides on the outer layer. Such inclusions have a core, usually of alumina, an outer multilayer mantle, which is based on compounds such as galaxite and titanium oxides, and on the outer surface are carbide phases. The presence of nanosized titanium carbides in the liquid metal of the welding pool has an effect on the weld metal microstructure formation. Modification of the weld metal with nanosized titanium carbides allows to increase the level of its toughness and ductility without changes in the chemical composition of the welds.

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Memberships

Fellows/Associates of Science Frontier Research Council

FSFRC/ASFRC Memberships

Introduction

FSFRC/ASFRC is the most prestigious membership of Global Journals accredited by Open Association of Research Society, U.S.A (OARS). The credentials of Fellow and Associate designations signify that the researcher has gained the knowledge of the fundamental and high-level concepts, and is a subject matter expert, proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice. The credentials are designated only to the researchers, scientists, and professionals that have been selected by a rigorous process by our Editorial Board and Management Board.

Associates of FSFRC/ASFRC are scientists and researchers from around the world are working on projects/researches that have huge potentials. Members support Global Journals' mission to advance technology for humanity and the profession.

FSFRC

Fellow of Science Frontier Research Council

FELLOW OF SCIENCE FRONTIER RESEARCH COUNCIL is the most prestigious membership of Global Journals. It is an award and membership granted to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Fellows are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Fellow Members.

Benefit

To the institution

Get letter of appreciation

Global Journals sends a letter of appreciation of author to the Dean or CEO of the University or Company of which author is a part, signed by editor in chief or chief author.

Exclusive Network

Get access to a closed network

A FSFRC member gets access to a closed network of Tier 1 researchers and scientists with direct communication channel through our website. Fellows can reach out to other members or researchers directly. They should also be open to reaching out by other.

Career | Credibility | Exclusive | Reputation

Certificate

Receive a print ed copy of a certificate

Fellows receive a printed copy of a certificate signed by our Chief Author that may be used for academic purposes and a personal recommendation letter to the dean of member's university.

Career | Credibility | Exclusive | Reputation

Designation

Get honored title of membership

Fellows can use the honored title of membership. The “FSFRC” is an honored title which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., FSFRC or William Walldroff, M.S., FSFRC.

Career | Credibility | Exclusive | Reputation

Recognition on the Platform

Better visibility and citation

All the Fellow members of FSFRC get a badge of "Leading Member of Global Journals" on the Research Community that distinguishes them from others. Additionally, the profile is also partially maintained by our team for better visibility and citation. All fellows get a dedicated page on the website with their biography.

Career | Credibility | Reputation

Future Work

Get discounts on the future publications

Fellows receive discounts on future publications with Global Journals up to 60%. Through our recommendation programs, members also receive discounts on publications made with OARS affiliated organizations.

Career | Financial

GJ Internal Account

Unlimited forward of Emails

Fellows get secure and fast GJ work emails with unlimited forward of emails that they may use them as their primary email. For example,
john [AT] globaljournals [DOT] org.

Career | Credibility | Reputation

Premium Tools

Access to all the premium tools

To take future researches to the zenith, fellows and associates receive access to all the premium tools that Global Journals have to offer along with the partnership with some of the best marketing leading tools out there.

Financial

Conferences & Events

Organize seminar/conference

Fellows are authorized to organize symposium/seminar/conference on behalf of Global Journal Incorporation (USA). They can also participate in the same organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent. Additionally, they get free research conferences (and others) alerts.

Career | Credibility | Financial

Early Invitations

Early invitations to all the symposiums, seminars, conferences

All fellows receive the early invitations to all the symposiums, seminars, conferences and webinars hosted by Global Journals in their subject.

Exclusive

Publishing Articles & Books

Earn 60% of sales proceeds

Fellows can publish articles (limited) without any fees. Also, they can earn up to 60% of sales proceeds from the sale of reference/review books/literature/ publishing of research paper. The FSFRC member can decide its price and we can help in making the right decision.

Exclusive | Financial

Reviewers

Get a remuneration of 15% of author fees

Fellow members are eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get a remuneration of 15% of author fees, taken from the author of a respective paper.

Financial

Access to Editorial Board

Become a member of the Editorial Board

Fellows may join as a member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. Additionally, Fellows get a chance to nominate other members for Editorial Board.

Career | Credibility | Exclusive | Reputation

And Much More

Get access to scientific museums and observatories across the globe

All members get access to 5 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 10 GB free secure cloud access for storing research files.

ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL

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Associates can publish articles (limited) without any fees. Also, they can earn up to 30-40% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.

Exclusive | Financial

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Financial

And Much More

Get access to scientific museums and observatories across the globe

All members get access to 2 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 5 GB free secure cloud access for storing research files.

Associate	Fellow	Research Group	Basic
$4800 **lifetime designation**	$6800 **lifetime designation**	$12500.00 **organizational**	APC **per article**
Certificate, LoR and Momento **2** discounted publishing/year **Gradation** of Research **10** research contacts/day **1 GB** Cloud Storage **GJ** Community Access	**Certificate,** LoR and Momento **Unlimited** discounted publishing/year **Gradation** of Research **Unlimited** research contacts/day **5 GB** Cloud Storage **Online Presense** Assistance **GJ** Community Access	**Certificates,** LoRs and Momentos **Unlimited** free publishing/year **Gradation** of Research **Unlimited** research contacts/day **Unlimited** Cloud Storage **Online Presense** Assistance **GJ** Community Access	**GJ** Community Access

Preferred Author Guidelines

We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

Before and during Submission

Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct,* along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

Declaration of Conflicts of Interest

It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

Policy on Plagiarism

Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

- Words (language)
- Ideas
- Findings
- Writings
- Diagrams
- Graphs
- Illustrations
- Lectures

- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

Authorship Policies

Global Journals follows the definition of authorship set up by the Open Association of Research Society, USA. According to its guidelines, authorship criteria must be based on:

1. Substantial contributions to the conception and acquisition of data, analysis, and interpretation of findings.
2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

Copyright

During submission of the manuscript, the author is confirming an exclusive license agreement with Global Journals which gives Global Journals the authority to reproduce, reuse, and republish authors' research. We also believe in flexible copyright terms where copyright may remain with authors/employers/institutions as well. Contact your editor after acceptance to choose your copyright policy. You may follow this form for copyright transfers.

Appealing Decisions

Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

Declaration of funding sources

Global Journals is in partnership with various universities, laboratories, and other institutions worldwide in the research domain. Authors are requested to disclose their source of funding during every stage of their research, such as making analysis, performing laboratory operations, computing data, and using institutional resources, from writing an article to its submission. This will also help authors to get reimbursements by requesting an open access publication letter from Global Journals and submitting to the respective funding source.

Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for Writing a Good Quality Science Frontier Research Paper

Techniques for writing a good quality Science Frontier Research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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