

EXPLORING THE DETERMINANTS OF THE EXTENT OF ICT TOOLS UTILIZATION AMONG AGRICULTURAL RESEARCH SCHOLARS

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ABSTRACT

ICT tools are used in various sectors and they have gained importance in educational sector during the COVID-19 lockdown, as they were a crucial means for dissemination of educational content during that period. In order to make the utilization of ICT tools better, it is imperative to understand the determinants of utilization of ICT tools. The present study was conducted to identify the determinants of extent of utilization of ICT tools among the post graduate research scholars of State Agricultural Universities in the year 2021 along with their direct and indirect effects on each other. Sample size of 179 post graduate research scholars of two state agricultural institutes namely, Indira Gandhi Krishi Vishwavidyalaya, Raipur and Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, pursuing final year of post-graduation were chosen for the study. Questionnaire developed using google forms were mailed to each of them through e-mail and responses were recorded. Correlation, linear multiple regression analysis and path analysis were conducted for delineation of major determinants of utilization of ICT tools. The findings revealed that cognitive, psychological and infrastructure-related variables were strongly correlated with the extent of utilization of ICT tools. Regression analysis revealed that possession, effectiveness and knowledge about ICT tools, subject matter browsed and interactive apps used were the factors significantly influencing the extent of utilization of ICT tools. The R^2 value was found to be 0.662. Further path analysis approach revealed that the mass media exposure, subjects browsed on internet and effectiveness of ICT tools had a significant effect on usage of ICT tools, thus reinforcing the results provided by the prior regression and correlational analysis. Since the socio-demographic factors were overshadowed by cognitive and psychological variables, attempts should be made to improve these factors with regards to research scholars. Further, policies centred around ICT based training should be developed to improve the cognitive and psychological behaviours of the individuals.

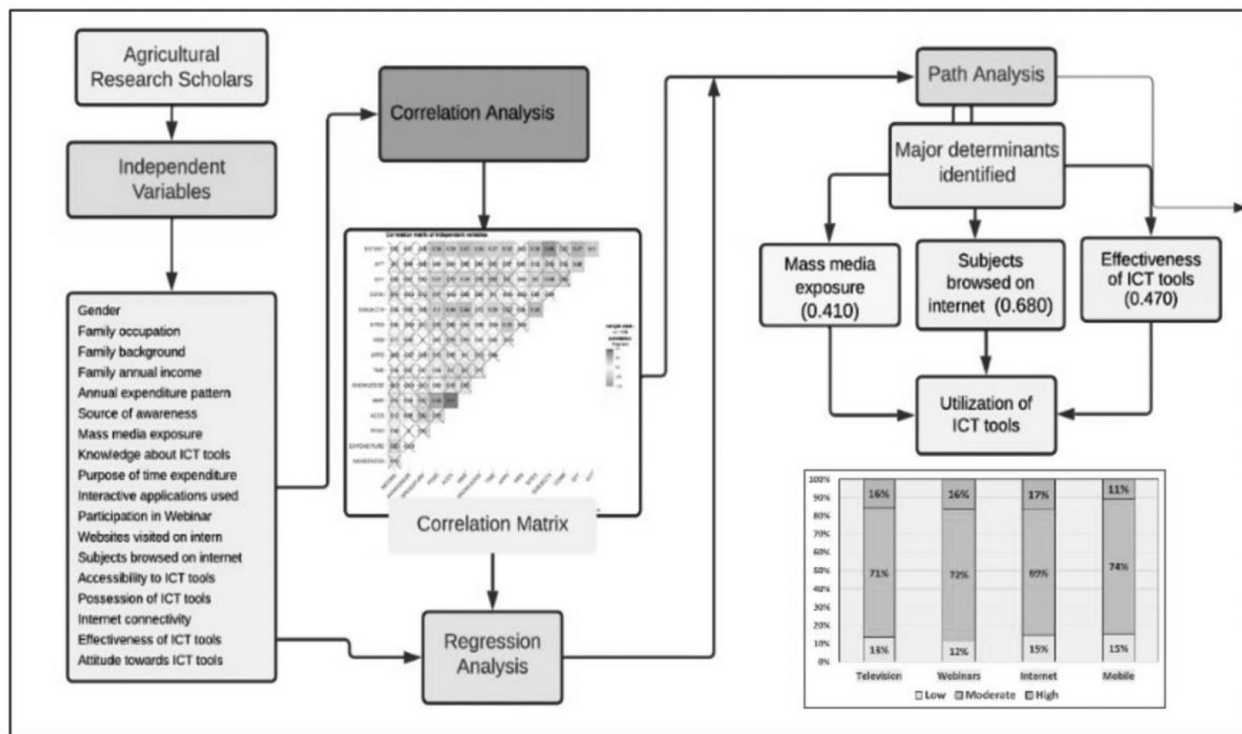
Keywords : determinants, ICT, research scholars, state agricultural universities, utilization

INTRODUCTION

Globally a myriad of devices and instruments are not only being invented but also the existing ones are being reinvented to fulfil the communications requirement. In general, various ICT tools are being utilised to communicate wherein individuals can share precise and accurate information across various channels without the concern for geographic constraints. ICT tools are being used in all the conceivably possible arenas and domains be it agriculture or livestock or any other crucial fields (Adwe, 2023; Shilpa et al., 2022, Mallick et al., 2023). Moreover, educational institutions and infrastructure are hugely benefitted by using ICT tools. The ICT tools today are available in a myriad of forms finding their utility in a multitude of sectors crossing all international boundaries and creating a common space for mankind to interact and grow by means of the

exchange of information and social networking. Education is an important sector being deeply impacted by the usage of ICT tools around globe and in India. Even affecting the managerial abilities of leaders in agriculture (Samadder et al., 2024, Priyanka et al., 2024). Citing, Singh and Muniandi (2012) it was revealed that willingness of teachers, high level of knowledge and skills, cooperation among teachers, easier and more effective completion of task. Further, high level of trust and confidence placed on teachers were the factors influencing the school administrator's choices in adopting ICT tools in Canadian universities (Rathwa et al., 2023; Sandhu, 2024).

Renukadevi *et al.* (2018) have reported that poor connectivity, enthusiasm, time consumption, incentives to integrate ICT tools in teaching and difficulty in usage of ICT tools were the factors influencing the effective usage of ICT



tools in education and learning. Kumar *et al.* (2019) reported that among different ICT tools, the agricultural university teachers had highest utilization of internet followed by email and that there is no significant difference in usage of ICT tools among teachers of different agricultural universities. Seifu (2020) reported that teacher’s attitude towards the use of ICT, accessibility of ICT facilities, teacher’s self-efficacy, teacher’s competence and technology characteristics highly influenced while technical support, nature of curriculum, administrative support and ICT policy were less likely to influence the ICT-integration in teaching-learning process at Aksum University. Singh *et al.* (2020) and Kumar *et al.* (2023) reported that high cost of ICT tools, lack of awareness about the availability of different ICT tools, internet speed/ connectivity, lack of upgradation of ICT equipment, subscription of relevant journals and resources and lack of training on ICT tools were the constraints faced by students in usage of ICT initiatives in agricultural education. Malik *et al.* (2021) revealed that social networking apps were most frequently visited by students followed by entertainment and educational apps and their mobile usage behaviour was significantly influenced by age, education, medium of schooling, annual expenditure, scientific orientation, mass media exposure, information seeking behaviour and risk orientation. Shreya *et al.* (2022) reported that occupation, education, annual income, farming system/ allied agricultural activities, mass media exposure and extension contact were that factors significantly influencing the accessibility of ICT tools by farmers. Ziaulhaq *et al.* (2022) reported that

almost all the faculty members of CCS Haryana Agricultural University had computer/ laptop, internet, email and mobile/ telephone facilities available at department/ workplace.

But a major breakthrough in the utilization of ICT tools came during the COVID-19 pandemic. In an era in which commotion and social communication, both were hampered, ICT tools found their utility in not only providing timely information but bringing awareness regarding the external situation (Akah *et al.*, 2022; Çaldağ *et al.*, 2021; Vahdat, 2022, Dashora *et al.*, 2022)adaptations, innovations and procedures by innovative human resource (HR. Since education in any country is a crucial sector, it’s quite unaffordable to halt the education system. The lockdown situation brought the Indian Educational institutions to a halt. But after a long pause, the institutions were forced to make decisions to bring the here forth, marginally used ICT tools-based teaching platform.

Even though these ICT enabled educative instruments were present for many years, COVID-19 became a ‘cue to action’ to bring the ICT teaching platforms into use. Not only this, various social networking platforms and basic ICT facilities like TV, Radio, Computers etc., became alternatives to disseminate the educational curricula among a variety of audience from students to teachers. Moreover, research scholars from various fronts were found to exclusively use the ICT facilities but with some perceived constraints (Mukherjee *et al.*, 2023). So, it was perceived to be imperative to understand the determinants

which affect the usage of ICT tools among research scholars to facilitate them to make effective and efficient usage of the ICT tools. So, in this paper, an effort has been made to explore the determinants of utilization of ICT tools and the extent to which they affect the utilization of these tools. Not only limiting to a mere correlational approach, an elaborated attempt was made to investigate the causality by use of regression analysis and this analysis was further coupled with the path analysis in order to explore the direct and indirect effects of the independent variables on the usage of ICT tools. This approach will help us to establish a sound relationship between the determinants of ICT usage and extent of usage of ICT tools. This will further aid in development of effective policies and activities that would lead to an overall improvement of quality of utilization of various tools.

OBJECTIVE OF THE STUDY:

- (1) To delineate the determinants of utilization of ICT tools with respect to agricultural research scholars.
- (2) To ascertain the direct and indirect effects of determinants on utilization of ICT tools

METHODOLOGY

A study was conducted choosing two universities

RESULTS AND DISCUSSION

Extent of utilization of ICT tools among the research scholars

Table 1. Extent of utilization of ICT tools among agricultural research scholars

(n=179)

Category	ICT tools under study								Total score for extent of utilization of ICT tools	
	Television		Webinars		Internet		Mobile			
	F	%	F	%	F	%	F	%	F	%
Low	24	13.41	21	11.73	26	14.53	27	15.08	28	15.64
Medium	127	70.95	129	72.07	123	68.72	133	74.31	127	70.95
High	28	15.64	29	16.20	30	16.75	19	10.61	24	13.41
Index Value	60.33333		61		60.33333		58.33333		59	

Note: F=Frequency

Based on the numerous questions presented in the questionnaire in the form of schedules, a detailed analysis was carried out in order to delineate the extent of utilization tools among the agricultural scholars. It is evident from the Table 1 that a large chunk of respondents (70.95%) utilized ICT tools on a moderate level followed by 15.64 per cent with low usage and 13.41 per cent with high usage. By making use of index wherein, low, medium and high category were

randomly namely Indira Gandhi Krishi Vishwavidyalaya, Raipur and Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, offering post graduate programmes in various disciplines of Agriculture. An ex-post-facto research design was used in order to understand the cause and effect. Disproportionate stratified random sampling was carried out for selection of final respondents. The respondents chosen for the study were Agricultural Post Graduate Research Scholars, pursuing their final year indulged in research work. A sample of 179 post graduate research scholars was chosen from various disciplines of both the institutes pursuing their final year purposively as they were found to be indulged in research work. An online questionnaire developed using Google forms was mailed personally to all the respondents through Gmail and were personally contacted for further assistance in completing the survey. In order to calculate the extent of utilization of ICT tools low, medium and high category were assigned the weights of 1, 2 and 3 respectively; followed by calculation of weighted mean for each ICT tool and overall usage. Further Correlation analysis, regression analysis and path coefficient analysis were employed to clarify the mediating effects of the independent variables on the extent of usage of ICT tools. All statistical analyses and visualizations were performed using various statistical packages within the R programming environment.

assigned the weights of 1, 2 and 3 respectively; followed by calculation of weighted mean for each ICT tool and overall. It is quite evident from the index value given in the Table 1 that webinars were utilized slightly higher (61.00) than television (60.33), internet (60.33) and mobiles (58.33). Overall, the index values for usage of ICT tools were found to be 59. Thus, the utilization of ICT tools was in general moderate among the research scholars.

Correlational Analysis

Table 2. Correlation between determinants of utilization of ICT tools and extent of utilization of ICT tools (n= 179)

Sr. No.	Independent variables	Correlation coefficients
X ₁	Gender	0.022
X ₂	Family occupation	-0.044
X ₃	Family background	0.041
X ₄	Family annual income	0.023
X ₅	Annual expenditure pattern	-0.023
X ₆	Source of awareness	0.013
X ₇	Mass media exposure	0.411**
X ₈	Knowledge about ICT tools	0.340**
X ₉	Purpose of time expenditure	0.275**
X ₁₀	Interactive applications used	0.316**
X ₁₁	Participation in Webinar	0.384**
X ₁₂	Websites visited on internet	0.383**
X ₁₃	Subjects browsed on internet	0.684**
X ₁₄	Accessibility to ICT tools	0.292**
X ₁₅	Possession of ICT tools	0.383**
X ₁₆	Internet connectivity	0.216**
X ₁₇	Effectiveness of ICT tools	0.473**
X ₁₈	Attitude towards ICT tools	0.302**

** (at 1% level of significance),

*(at 5% level of significance)

A total of 18 variables were chosen for the present study which were hypothesized to have some correlation with the dependent variable, extent of utilization of ICT tools. A correlation was found which has been presented in the Table 2 and Fig. 2.

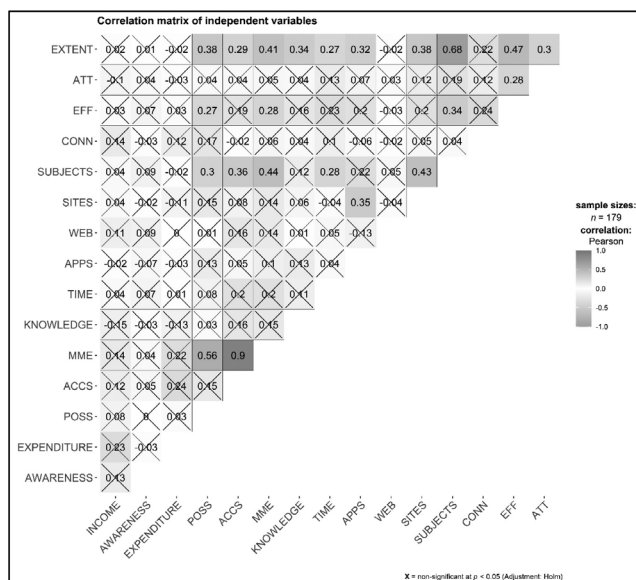


Fig. 2 : Correlogram depicting the correlation among the various ICT related variables. Abbreviations: Family annual income (INCOME), Annual expenditure pattern (EXPENDITURE), Source of awareness(AWARENESS), Mass media exposure(MME), Knowledge about ICT tools (KNOWLEDGE), Purpose of time expenditure(TIME), Interactive applications used(APPS), Participation in Webinar(WEB), Websites visited on internet (SITES), Subjects browsed on internet (SUBJECTS), Accessibility to ICT tools(ACCS), Possession of ICT tools (POSS), Internet connectivity (CONN), Effectiveness of ICT tools(EFF), Attitude towards ICT tools (ATT) and Extent of utilization of ICT tools(EXT)

Regression analysis of the determinants with the extent of utilization of ICT tools

For determination of combined effects in the form of variation caused by determinants of utilization of ICT tools on the extent of utilization of ICT tools by Post Graduate Research Scholars, linear regression was done using SPSS (Statistical Package for Social Sciences).

From the study, the R² value for this model was

found to be 0.662. This suggests that 66.2 per cent of the variation in extent of utilization of ICT tools by Post Graduate Research Scholars, was explained from the 18 determinants considered in the study while, remaining 33.8 per cent of the variance was due to the variables not included into the study, hence due to the external environmental factors. Also, the values of Regression coefficients (b), t- values and standard errors were obtained from the regression analysis as presented in Table 3.

Path analysis

Table 3. Regression analysis of the determinants with the extent of utilization of ICT tools

(n=179)

Sr. No.	Independent variables	Regression coefficients	t-value	Standard error
X ₁	Sex	-0.050	-0.993	1.693
X ₂	Family occupation	0.031	0.482	1.079
X ₃	Family background	0.090	1.614	1.127
X ₄	Family annual income	0.012	0.185	0.000
X ₅	Annual expenditure pattern	-0.006	-0.123	0.000
X ₆	Source of awareness	-0.025	-0.518	0.751
X ₇	Mass media exposure	-0.006	-0.123	0.000
X ₈	Knowledge about ICT tools	0.226**	4.646	0.201
X ₉	Purpose of time expenditure	0.032	0.622	1.000
X ₁₀	Interactive applications used	0.118*	2.306	0.447
X ₁₁	Participation in webinar	-0.042	-0.886	0.525
X ₁₂	Websites visited on internet	0.052	0.927	0.303
X ₁₃	Subjects browsed on internet	0.488**	8.001	0.189
X ₁₄	Accessibility to ICT tools	0.019	0.360	0.321
X ₁₅	Possession of ICT tools	0.144**	2.888	0.579
X ₁₆	Internet connectivity	0.112*	2.255	0.951
X ₁₇	Effectiveness of ICT tools	0.126*	2.330	0.208
X ₁₈	Attitude towards ICT tools	0.130*	2.643	0.144
** (at 1% level of significance), *(at 5% level of significance)				

Path analysis was performed to explore the direct effects of numerous independent variables on the dependent variable (extent of utilisation of ICT tools) along with the indirect effects of the variables through the mediation of certain variations on other independent variables which thereby leads to the overall effect of the variables on the dependent variable. It is evident from the table 4 that

accessibility of ICT tools had the greatest indirect effect on the usage of ICT tools (0.353) followed by the effectiveness of ICT tools (0.3452) and websites visited on the internet (0.3251). As far as the direct effects are concerned, mass media exposure (0.7499) had the highest impact followed by subjects browsed on the internet (0.4852) and possession of ICT tools (0.464).

Discussions

Table 4. Path analysis between independent variables and extent of utilization of ICT tools

(n=179)

Sr. No.	Independent Variables	Indirect effect	Direct effect	Total effect	Variable with highest indirect effect
X ₁	Family annual income	-0.00313	0.023127	0.020	Accessibility of the ICT tools
X ₂	Source of awareness	0.04281	-0.03281	0.010	Subjects browsed on internet
X ₃	Annual expenditure pattern	-0.02466	0.004661	-0.020	Accessibility of the ICT tools
X ₄	Possession of the ICT tools	-0.0844	0.464396(3rd)	0.380	Subjects browsed on internet
X ₅	Accessibility of the ICT tools	0.35301(1st)	0.34301	0.290	Mass media exposure
X ₆	Mass media exposure	1.15998	0.74998(1st)	0.410 (3rd)	Accessibility of the ICT tools
X ₇	Knowledge about ICT tools	0.110991	0.229009	0.340	Accessibility of the ICT tools
X ₈	Purpose time expenditure	0.233591	0.036409	0.270	Subjects browsed on internet
X ₉	Interactive applications used	0.207181	0.112819	0.320	Subjects browsed on internet
X ₁₀	Participation in Webinar	0.011329	-0.03133	-0.020	Accessibility of the ICT tools
X ₁₁	Websites visited on internet	0.325174(3rd)	0.054826	0.380	Subjects browsed on internet
X ₁₂	Subjects browsed on internet	0.194741	0.485259(2nd)	0.680(1st)	Effectiveness of ICT tools
X ₁₃	Internet connectivity	0.099988	0.120012	0.220	Effectiveness of ICT tools
X ₁₄	Effectiveness of ICT tools	0.345216(2nd)	0.124784	0.470 (2nd)	Subjects browsed on internet
X ₁₅	Attitude towards ICT tools	0.172003	0.127997	0.300	Subjects browsed on internet

Note: (Ranks of importance of the variables in terms of their effects on the dependent variables has been given in parenthesis)

The determinants identified by correlational analysis were further clustered into few constructs based on their similarity with respect to nature and properties. These were presented as follows:

Demographic determinants

Correlation of demographic factors with the extent of utilization of ICT tools: The three demographic factors namely, gender, family occupation and family background were found to have very low and non-significant correlation with the usage of ICT tools. This suggests that demographic attributes had no effect on usage or alternatively the research scholars regardless of demographic factors, used ICT tools more or less equally. The probable reason for this might be the higher penetration of ICT among all social groups. Moreover, since both the institutes had a Majority of hosteller scholars, which might have facilitated the enjoyment of equal ICT-based benefits like availability of free internet, easy access to computers through libraries and kiosk centres available within the institute as well as in the vicinity of them. So, despite being from different demographic backgrounds, the usage was same.

Financial determinants

Family annual income and Annual expenditure of

the students had no significant correlation with the usage of ICT tools. This means that students despite of having a difference in financial situations had equal access to and usage of ICT tools. The main reason might be the vast diffusion of devices like mobiles, and computers; affordable internet connections available at their disposal and the greater utility of ICT tools for their research purpose (Ali and Jan, 2020). Since the availability of ICT-related devices and tools is imperative for carrying out quality research, research scholars have to procure the ICT devices and subscribe to the ICT services invariably. Almost all of the communications and research-related updates can only be accessed through the ICT tools. Thus, ICT tools have turned into a necessity rather than a luxury. Also, the financially weaker students can access relatively less expensive ICT devices like computers at their respective institute libraries for free or at kiosks at reasonable prices (Buabeng-Andoh, 2015). These factors explain the equal usage of ICT tools among students from different financial backgrounds.

Cognitive determinants

Mass media exposure (0.411) and Knowledge (0.340) were found to have a significant relationship with the usage of ICT tools. Since more exposure to the mass media through devices like television, mobile phone and laptop facilitated the upgradation of information regarding latest

technologies and packages related to education and research, it might have significantly affected the utilization pattern qualitatively and quantitatively (Akah et al., 2022). Higher knowledge about the usage of ICT tools makes it easier for research scholars to use them efficiently (Sajeev, 2023). Also new features can be better used leading to effective handling of collected data and precise communication of the same, further.

Psychological determinants

Perceived effectiveness determined by quality of content disseminated, clarity of thought, video quality, sound quality etc. of the information provided through the tools by various mentors and teachers showed a significant and positive relationship with the utilization of ICT tools. With high effectiveness of dissemination of information, students are motivated to use the tools which increases the fidelity of the sources (Ohei, 2023).

Infrastructure related determinants

Possession of ICT showed a strong correlation with extent of utilization. The full possession of devices like laptop, mobile and internet routers enable research scholars to carry out research and learning independently regardless of the location in which they are situated. Research scholars can work on their devices at any time and any place, thus removing hurdles in research.

Regression Analysis

It could be inferred from the data (presented in Table 1) that out of all the 18 determinants selected in the study, three determinants namely Possession of ICT tools, Knowledge about ICT tools and Subject of information browsed on the Internet were positively significant at 1 per cent level of significance. Interactive apps utilized, Effectiveness of ICT tools, Internet connectivity and Attitude towards ICT were positively significant at 5 per cent of the level of significance. In general, it could be inferred that the ICT based variables pertaining to cognitive and behavioural attributes had a greater overall effect on the utilization extent among the agricultural research scholars. Similar results were obtained by Ali and Jan (2020), Bolaji et al. (2022) and Suleiman et al. (2020).

Path Analysis

As it is evident from the Table 4, in general, the variables namely, subjects browsed on the internet, mass media exposure and effectiveness of ICT tools had a greater overall impact on the usage of ICT tools. It was further highlighted from the analysis that the subjects browsed and accessibility of ICT tools inflicted greater indirect effects on the majority of variables thereby affecting the utilisation of

ICT tools. Thus, to gatekeep the usage of ICT tools among the research scholars it is imperative to assess their accessibility of ICT tools along with their interests and needs towards the numerous subjects (Bolaji et al., 2022; Ohei, 2023). Further attempts need to be made to improve the effectiveness of ICT tools to improve the ease of usage and timeliness of information (Buruah, 2023; Ghavifekr and Rosdy, 2015.) Communication, and Technology (ICT).

CONCLUSION

ICT teaching platform was always available for use, but gained predominant importance during the COVID-19 lockdown. This can be treated as a positive outcome of the lockdown, as it led to better utilization of the otherwise under-utilized ICT teaching platforms for research scholars. This teaching platform can always be used as a supplementary tool to classroom teaching and can be a future of higher education, if its nature and determinants of usage are understood clearly. The present study throws a light on the determinants of utilization of ICT tools by the research scholars wherein it was duly highlighted that the demographic attributes do not have a significant effect on the usage of ICT tools among the agricultural research scholars. Further, the variables like effectiveness of ICT tools, accessibility of scholars and possession of ICT tools had a significant effect on accessing digital applications as well as ICT tools (Pratik and Vinaya, 2021 and Praneeth et al., 2024). Further the nature of browsing of the individuals in terms of subject matter accessed also was found to have a significant effect. These findings will have similar implications in all the other universities as well, with indistinguishable structure and functioning. Further, studies can be conducted on the nature of ICT tools, their determinants of usage and extent of utilization in the universities of other fields as well, to enhance the usage of ICT teaching platforms all over the country.

POLICY IMPLICATIONS

- (1) Since ICT centred behavioural and cognitive constructs intricately structure and shape the utilization of ICT tools among the research scholars, the curricula should be framed such that it focusses on the behavioural and cognitive growth of scholars pertaining to utilization of ICT tools.
- (2) Hands-on sessions regarding the usage of ICT tools with respect to the academic utility should be streamlined in the educational framework so that the scholars are able to better use the ever growing potential of the instruction of ICT tools.

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CONFLICT OF INTEREST

All the authors hereby declare that they have no conflict of interest.

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