

EVALUATION OF AGRO-CLIMATOLOGICAL INSTRUMENTS FOR INSTRUCTIONAL DELIVERY OF AGRICULTURAL EDUCATION IN COLLEGES OF EDUCATION IN NORTH-EAST NIGERIA

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ABSTRACT: *The purpose of the study was to evaluate the agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education in North-East Nigeria. The research design adopted was the survey design. Four research questions guided the study. The area of the study was North-East Nigeria. The population of the study was 185 comprising of lecturers of agricultural education. The instrument for data collection was a structured questionnaire tagged "Evaluation of Agro-climatological Instruments Questionnaire (EIAQ). The instrument was validated by three experts. 185 copies of the instruments were administered on the respondents, 120 were retrieved and used for the study as it was a manageable size, therefore sampling was not required. The data collected were analyzed using descriptive statistical tools such as mean scores and standard deviation to answer the four research questions. The results of the study revealed that out of all the 17 agro-climatological instruments recommended for instructional delivery of agricultural education in Colleges of Education in Nigeria, 11 of them were available, 6 were adequate, 8 were functional and 6 were utilized by lecturers. It was recommended that proprietors of the institutions should make available and adequate all the agro-climatological instruments to the Colleges. Lecturers of agricultural education should attend conferences, workshops and seminars to update the skills and capabilities on instructional delivery with agro-climatological instruments.*

KEYWORDS: evaluation, agro-climatology, instruments, delivery, agricultural education

INTRODUCTION

Agricultural Education programme is a course of study in Universities and Colleges of Education in Nigeria. Osinem (2007) perceived Agricultural Education as a process of imparting knowledge, skills and attitudes in agriculture to the learner at any level. In the view of Ukonze and Olaitan (2010), Agricultural Education is described as a programme designed for preparing or equipping learners with knowledge, skills and attitude in teaching and technical areas of agriculture to enable them impart same to students in Schools and Colleges. In the opinion of Akpomedaye (2011), Agricultural Education is an occupational education design to develop a particular knowledge and skills associated with various farming techniques. In this study, Agricultural Education is a programme in Colleges of Education and other tertiary institutions designed with series of activities for equipping students with knowledge, skills and attitude in

pedagogy in agriculture required for effective teaching of content areas in agriculture to students in tertiary institutions.

Agricultural Education as a course of study is offered in tertiary institutions. Tewarie (2014) asserts that tertiary institutions are those institutions that are involved in teaching and learning processes that occurs following the completion of secondary school education and provide academic credits and competencies that lead to certificates, diplomas and degrees from Universities, Polytechnics, Colleges of Education and similar institutions. Odionye (2014) maintained that tertiary institutions are those higher institutions that provide education after secondary education in Universities, Polytechnics, Colleges of Education, Monotechnics, including institutions offering corresponding courses. A College of Education is a tertiary institution that offers three years minimum training to students in programmes of interest such as Agricultural Education for entry into teaching profession (Federal Republic of Nigeria (FRN), 2004). The objectives of Agricultural Education programme in Colleges of Education (National Commission for Colleges of Education (NCCE), minimum standard, 2012) are to:

1. prepare graduates with right attitudes and knowledge/professional competence in vocational agriculture;
2. produce teachers who will be capable of motivating students to acquire interest in and aptitude for agriculture;
3. develop in the student-teachers the appropriate communication skills for effective transmission of agricultural information and skills to the students in the context of their environment;
4. equip the student-teachers with adequate knowledge and ability to establish and manage a model school farm effectively; and
5. provide a sound background to enhance further academic and professional progression of the students

In order to achieve the above objectives, the National Commission for Colleges of Education in its Minimum Academic Standard clearly listed courses to be offered by students in Agricultural Education to cover: Introduction to agriculture, Poultry production, Fish production, Principles of farm management, Youth organizations in agriculture, Horticulture, Land survey and farmstead planning, Agro-climatology, among others (NCCE, 2012) and Tsojon, (2018) This study is focused on evaluation of agro-climatological instruments for instructional delivery in agricultural education programme.

The study of climates as applied to their effect on the productivity of plants and animals of agricultural importance is called agro-climatology. In the view of Saravanan (1994), Agro-climatology is defined as the meteorological, climatological and hydrological conditions which are significant for agriculture owing to their integration with the objects and process of agricultural production. Climate Prediction Centre, US report (2006), explained that agro-climatology is the study of climate in relation to its effects on water, soil, crop and livestock. Chang (2013) viewed agro-climatology as the study of climate in relation to the productivity of plants and animals of agricultural importance. The author reiterated that the main aim of agro-

climatology is to obtain necessary information about climate and apply them for the purpose of improving farming practices and increasing agricultural productivity in quantity and quality. In Agricultural Education programme of Colleges of Education, the objectives of agro-climatology as contained in the curriculum of NCCE, minimum standard (2012) and Tsojon, (2018) are to:

- a. prepare graduates with basic knowledge in scope and general principles of agro-climatology;
- b. develop in student-teachers the appropriate skills in operating equipment used in agro-climatology;
- c. produce teachers who will be capable of explaining and predicting the effects of climatic elements on crops, livestock and soil in the ecological zones of Nigeria, and
- d. equip the student-teachers with adequate knowledge and ability to forecast weather for agricultural benefits.

The objectives of agro-climatology are contained in the content which includes the meaning and scope of agro-climatology and equipment used in the study, ecological zones of Nigeria and their effects on distribution of crops, livestock and soil formation and principles underlining weather forecasting (NCCE, 2012) and Tsojon, (2018). The objectives of agro-climatology are achieved with effective use of agro-climatological instruments that serve as instructional materials to teach students of agriculture in Colleges of Education.

Instrument is a device for measuring or displaying something. In the view of Ahrens (2009), instrument is a tool or device used for a particular task, especially for delicate or scientific work. In this study, instruments are those tools and devices used by lecturers of agricultural education as instructional materials to teach agro-climatology to students. The instruments required for the study of agro-climatology include: Stevenson's screen, Thermo hygrographs, Maximum and Minimum thermometers, Rain gauge, Measuring glasses, Wind vane, Anemometer, Evaporation meter, Hygrometers, Sunshine Recorder and Barometers (NCCE, 2012) and Tsojon, (2018). These instruments are recommended to be used by lecturers for instructional delivery of the content of agro-climatology in agricultural education programme in Colleges of Education. These agro-climatological instruments are required in appropriate quantity and quality for instructional delivery in agricultural education in colleges of education of Nigeria.

To achieve effective instructional delivery in agricultural education using agro-climatological instruments, attention must be given to making available, adequate, functional and useable by the proprietors of the colleges of education in Nigeria. Therefore, evaluation of agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education in North-east Nigeria became imperative.

The occupation of the people in North-East, Nigeria is farming. The farming activities are mostly affected by the climatic conditions of the zone, where the average rainfall is under 1000mm and temperature over 23⁰C (Aregheore, 2010). The climatic factors are not static; they fluctuate with the passage of years, which is a global phenomenon. Adakayi (2012) reported in his study that there was lower temperature and rainfall between 1970s and 1980s and higher temperature and rainfall between 1990s and 2000s. Ladan (2014) indicated that daily rainfall records of 30 years

in Northern Nigeria revealed the impact of global climate change in form of increasing number of dry spells during the rainy season leading to drought and desertification. These fluctuations of the climatic factors affect agricultural activities of the populace in North-east Nigeria as they depend on the natural phenomena. The Federal Government of Nigeria perceived the need to improve the agricultural activities of Nigerians to enhance food production, and have introduced the study of Agricultural Education as a course of study in Universities and Colleges. The Colleges of Education through directives of the National Commission for Colleges of Education minimum standard employ qualified lecturers to teach Agricultural Education to students. The lecturers teach agro-climatology to students, which they are evaluated for competence and mastery for the award of Nigeria Certificate in Education (NCE).

The Lecturers of Agricultural Education in Colleges of Education and other tertiary institutions are generally prepared in technical and pedagogical areas of agriculture from Nigerian Universities and are obliged to work in any College of Education in North-east Nigeria where opportunities exist (Isiwu & Okonkwo, 2013). However, Umar and Ma'aji (2011), Anyakoya (2013) and Ahmed Mursali (2015) posited that instructional facilities for instructional delivery for vocational and technical education, which agricultural education is one, are poor, inadequate and obsolete. Based on the foregoing, this study intends to evaluate agro-climatological instruments for instructional delivery of agricultural education in colleges of education in North-east Nigeria.

The purpose of the study was to evaluate the agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education in North-East, Nigeria. Specifically, the study intends to determine:

- i. The availability of agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education;
- ii. The adequacy of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education;
- iii. The functionality of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education and
- iv. The utilization of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education.

Research Questions

The following research questions guided the study:

1. What is the availability of agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education?
2. What is the adequacy of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education?
3. What is the functionality of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education? and
4. What is the utilization of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education?

METHODOLOGY

The study adopted the survey research design. The design was appropriate for the study because data was collected through questionnaire from the respondents (Subjects) (Uzoagulu, 2011) to determine the availability, adequacy, functionality and utilization of agro-climatological instruments for instructional delivery in Colleges of Education. The area of the study was North-East, Nigeria comprising of Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe States. North-East, Nigeria falls within the Guinea Savannah Ecological zone of Nigeria (Ishaku & Majid, 2010) with annual rainfall ranging from 400mm - 1500mm (Amaza, Olayemi, Adejobi, Bila & Iheanacho, 2007; Ati, Stigter, Iguisi & Afolayan, 2009 and Ishaya & Majid, 2010). Abaje, Ati and Iguisi (2012) explained that the zone is located between latitude 8°N and 14°N and longitude 7°E and 14°E . The average annual rain fall in North-east Nigeria varies between 500mm in the extreme north and 1000mm in the southern sub-region. Educational institutions in this area range from primary to tertiary with most of the students from farming families as well as teachers and lecturers.

The population of the study was 185 Lecturers of Agricultural Education in the Colleges of Education, all from North-East, Nigeria. The sample for the study was 120 which was the retrieved questionnaire from the population of the respondents. There was no sampling for the study due to manageable size of the population. Therefore, all the 120 questionnaire retrieved was used for the study. The instrument for data collection was a structured questionnaire named "Evaluation of Agro-climatological Instruments Questionnaire" (EAIQ). The questionnaire was developed using NCCE minimum standard requirement on agro-climatological instruments for data collection. The questionnaire was divided into 4 sections (A - D). Section A with 10 items soliciting information on availability of agro-climatological instruments for instructional delivery in colleges of education. Section B has 10 items soliciting information on adequacy of available agro-climatological instruments. Section C has 10 items soliciting information on functionality of available agro-climatological instruments. Section D with 10 items soliciting information on utilization of available agro-climatological instruments. All the items in sections A – D were rated on a four (4) point rating scale. Section A was rated highly available (HA) =4, available (A) =3, moderately available (MA) =2 and not available (NA) =1. Section B, highly adequate (HA) =4, adequate (A) =3, moderately adequate (MA) =2 and inadequate (IA) =1. Section C, highly functional (HF) =4, functional (F) =3, moderately functional (MF) =2 and not functional (NF) =1. Section D, highly utilized (HU) =4, utilized (U) =3 moderately utilized (MU) =2 and not utilized (NU) =1.

The instrument was face and content validated by 3 experts; 2 from Agricultural Education Department and 1 from Geography Department. These experts were required to read the questionnaire items thoroughly and correct wrong spellings, wrong information and unclear or ambiguous statements on the questionnaire items. They were requested to remove any information that was not necessary and or add any missing information that was needed. The corrections and suggestions by the experts were used to develop the final copy of the instrument for data collection. Face validation judges at the face value the appropriateness of a measuring instrument (Jen, 2002 & Uzoagulu, 2011). Emaikwu (2011) added that face validity refers to

whether tests of instrument appear valid on the 'face of it'. Also that it was the extent to which a test seems to measure what it purports to measure. Content validity on the other hand was the degree to which the sample of test items represents the content that the test was designed to measure.

Twenty five copies of the EAIQ was administered (trial tested) on 25 lecturers sampled from College of Education, Gidan Waya in Kaduna State. This was based on the research rule to trial test outside area of study to avoid any study bias. The data collected was analyzed using Statistical Package for Social Sciences (SPSS) and a Cronbach Alpha reliability coefficient 0.94 was obtained which indicated the internal consistency of the instrument. The reliability coefficient of 0.94 was considered high enough indicating that the instrument (EAIQ) was reliable to elicit data for the study. The researcher employed the services of research assistants to help in the administration of the EAIQ on the respondents in the respective States in the North-East Nigeria. A total of 185 copies of the questionnaire were administered on the respondents through the research assistants who retrieved 120 questionnaires after having checked the responses on each questionnaire item. The data collected from the respondents were analyzed using weighted mean and standard deviation to answer the 4 research questions. The decision was based on the real limits of numbers. Questionnaire items with a mean value of 2.50 to 4.00 was considered as available, adequate, functional or utilized while any item with a mean value below 2.50 was regarded as not available, inadequate, not functional or not utilized.

RESULTS

The results for the study were obtained from the research questions answered and through data collected and analyzed in Table 1 to 4.

Table 1: Mean Rating of the responses of Respondents on availability of agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education

S/N	Agro-climatological instruments	\bar{X}	S	Remark
1.	Weather Station	3.308	.707	Available
2.	Stevenson Screens	2.858	.862	Available
3.	Earth Thermometers	2.050	.951	N/Available
4.	Grass Minimum Thermometer	2.108	.964	N/Available
5.	Celsius Temperature Scale	3.008	.974	Available
6.	Maximum and Minimum Thermometers	3.233	.827	Available
7.	Rain Gauge and Measuring Glass	3.358	.786	Available
8.	Evaporation Pan	2.933	.950	Available
9.	Measuring evaporation from the Pan	2.266	.810	N/Available
10.	Barometer	2.983	1.012	Available
11.	Barograph	2.041	.854	N/Available
12.	Thermograph	2.066	.752	N/Available
13.	Sensitive card with trace of burnt line	2.750	.963	Available
14.	Campbell-stokes Sunshine Recorder	2.800	.922	Available
15.	Hygrometers	2.083	.875	N/Available
16.	Wind anemometer	3.216	.801	Available
17.	Wind vane	3.083	.912	Available

\bar{X} = mean, S = Standard deviation, N = Number of respondents (120), Sig $\geq .05$.

Table 1 revealed that 11 instruments had their mean scores range from 2.86 to 3.36 and were above the cutoff point of 2.50 while 6 instruments had their mean scores range from 2.05 to 2.27 below the cut-off point of 2.50 of a 4-point scale. This indicated that the respondents agreed that the 11 agro-climatological instruments were available while the 6 instruments were not available for instructional delivery of agricultural education in Colleges of Education. The standard deviation ranged from .75 to 1.01 indicating that the respondents were close to the mean and one another in their mean responses on the availability of agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education.

Table 2: Mean Rating of the responses of Respondents on adequacy of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education

S/N	Agro-climatological instruments	\bar{X}	S	Remark
1.	Weather Station	2.900	.956	Adequate
2.	Stevenson Screens	1.925	1.013	Inadequate
3.	Celsius Temperature Scale	2.841	1.061	Adequate
4.	Maximum and Minimum Thermometers	2.100	.883	Inadequate
5.	Rain Gauge and Measuring Glass	3.058	1.031	Adequate
6.	Evaporation Pan	2.758	.943	Adequate
7.	Barometer	1.775	.911	Inadequate
8.	Sensitive card with trace of burnt line	1.883	.918	Inadequate
9.	Campbell-stokes Sunshine Recorder	1.958	.999	Inadequate
10.	Wind anemometer	3.150	.816	Adequate
11.	Wind vane	3.050	.887	Adequate

\bar{X} = mean, S = standard deviation, N = Number of respondents (120)

Table 2 revealed that 6 instruments had their mean scores range from 2.75 to 3.15 and were above the cutoff point of 2.50 of a 4-point scale while 5 instruments have their mean scores range from 1.78 to 1.96 below the cutoff point of 2.50. This indicated that the respondents agreed that the 6 available agro-climatological instruments were adequate while the remaining 5 instruments were not adequate for instructional delivery of agricultural education in Colleges of Education. The standard deviation ranged from .82 to 1.06 indicating that the respondents were close to the mean and one another in their mean responses on adequacy of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education.

Table 3: Mean Rating of the responses of Respondents on functionality of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education

S/N	Agro-climatological instruments	\bar{X}	S	Remark
1.	Weather Station	2.991	.991	Functional
2.	Stevenson Screens	2.025	.930	Not functional
3.	Celsius Temperature Scale	3.216	.881	Functional
4.	Maximum and Minimum Thermometers	2.033	.943	Not functional
5.	Rain Gauge and Measuring Glass	2.933	1.026	Functional
6.	Evaporation Pan	1.866	1.068	Not functional
7.	Barometer	3.116	.790	Functional
8.	Sensitive card with trace of burnt line	2.741	1.033	Functional
9.	Campbell-stokes Sunshine Recorder	2.991	.939	Functional
10.	Wind anemometer	2.983	1.020	Functional
11.	Wind vane	3.091	.925	Functional

\bar{X} =mean, S=standard deviation, N = Number of respondents (120),

Table 3 revealed that 8 instruments had their mean scores range from 2.74 to 3.22 and were above the cutoff point of 2.50 of a 4-point scale while 3 instruments had their mean scores range from 1.87 to 2.03 below the cutoff point of 2.50. This indicated that the respondents agreed that the 8 available agro-climatological instruments were functional while the 3 instruments were not functional for instructional delivery of agricultural education in Colleges of Education. The standard deviation ranged from .79 to 1.02 indicating that the respondents were close to the mean and one another in their mean responses on functionality of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education.

Table 4: Mean Rating of the responses of Respondents on utilization of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education

S/N	Agro-climatological instruments	\bar{X}	S	Remark
1.	Weather Station	2.825	1.026	Utilized
2.	Stevenson Screens	1.716	.831	Not utilized
3.	Celsius Temperature Scale	2.775	.691	Utilized
4.	Maximum and Minimum Thermometers	1.816	.697	Not utilized
5.	Rain Gauge and Measuring Glass	2.858	.872	Utilized
6.	Evaporation Pan	1.908	.809	Not utilized
7.	Barometer	2.783	.871	Utilized
8.	Sensitive card with trace of burnt line	1.583	.903	Not utilized
9.	Campbell-stokes Sunshine Recorder	1.608	.862	Not utilized
10.	Wind anemometer	2.875	.845	Utilized
11.	Wind vane	2.941	.791	Utilized

\bar{X} =mean, S=standard deviation, N = Number of respondents (120)

Table 4 revealed that 6 instruments had their mean scores range from 2.78 to 2.94 and were above the cutoff point of 2.50 of a 4-point scale while 5 instruments had their mean scores range

from 1.58 to 1.91 below the cutoff point of 2.50. This showed that the respondents agreed that the 6 available agro-climatological instruments were utilized while 5 instruments were not utilized for instructional delivery of agricultural education in Colleges of Education. The standard deviation ranged from .69 to 1.03 indicating that the respondents were close to the mean and one another in their mean responses on utilization of the available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education.

DISCUSSION OF FINDINGS

The findings on Table 1 revealed that out of the Agro-climatological instruments recommended by National Commission for Colleges of Education (NCCE, 2012) for instructional delivery of agricultural education in Colleges of Education, 11 of them were available: Weather Station, Stevenson Screens, Maximum and Minimum Thermometers, Wind anemometer, Wind vane, Rain Gauge and Measuring Glass among others were available while 6 of the instruments were not available, such as Earth Thermometers, Barograph, Campbell-stokes Sunshine Recorder, Thermograph among others. This finding is in agreement with the findings of, Asogwa, Onu and Egbo (2013), Nwafor and Eze (2014), Tuimur and Chemwei, (2015), Adimugu (2017), Dhakal (2017) and Juliana and Ezeudu (2018) who found out in their separate studies that not all instructional materials required for instructional delivery, in fish production, basic science, chemistry, mathematics, geography, and conflict and conflict resolution respectively were available. The implication is that those instructional materials that were lacking were either improvised, were possible or learners were taught theoretically without the practical aspect which does not really impart the required knowledge in the learners.

The findings in Table 2 showed that out of the 11 available agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education in North-East Nigeria, 6 were adequate while 5 were not adequate. This in line with the findings of Okwelle, John and Adeyemi in Kwami, Manabete and Onuh (2018) who found out in their study that quite a number of tools and equipment were not adequate in Technical Colleges in North-East Nigeria. The result of this study is also in agreement with the findings of Tuimur and Chemwei (2015) who revealed in their study that 60% of teachers indicated that there were inadequate instructional materials for instructional delivery in conflict and conflict resolution in high schools and that teachers resorted to theoretical method of teaching only without practical which does not really give the desired learning by the learners. In addition, the study is in consonance with the findings of Dhakal (2017) who found out that audio, visual and audio-visual instructional materials were not adequate for teaching geography in secondary schools.

The result in Table 3 revealed that 8 of the 11 available agro-climatological instruments for instructional delivery in agricultural education in the study area were functional while the remaining 3 were not functional. This means that not all the available agro-climatological instruments were functional. This finding is in tune with the findings of Okwelle, John and Adeyemi in Kwami, Manabete and Onuh (2018) who found out in their study that not all the available instructional materials were functional in Technical Colleges in Nigeria.

Table 4 revealed that 6 agro-climatological instruments were utilized while the remaining 5 were not utilized for instructional delivery of agricultural education in North-East Nigeria. This finding is in agreement with the findings of Asogwa, Onu and Egbo (2013) who found out that 8 of the instructional materials for effective teaching of fish production to students in secondary schools in Benue State were often utilized, Dhakal (2017) who also found out that audio, visual and audio-visual instructional materials for teaching geography in secondary schools were not adequately utilized and Adimugu (2017) who found out that audio-visual instructional materials were not utilized for chemistry instructions in secondary schools where they are available. This finding is also in consonance with the findings of Okute and Enang (2018) who found out that student underutilize social media for researches.

CONCLUSION AND RECOMMENDATIONS

The National Commission for Colleges of Education (NCCE, 2012) approved the teaching of the course agro-climatology in agricultural education in Colleges of Education in Nigeria. This course can be taught by qualified lecturers in either department of agriculture or geography. The instructional materials for teaching the course, among others include: Stevenson screen, minimum and maximum thermometers, rain gauge, wind vane, etc. (NCCE, 2012). The need for lecturers to make use of these agro-climatological instruments for instructional delivery of agricultural education cannot be over emphasized considering the fact that instructional materials contribute immensely to students' academic achievements (Ikutal, Abanyam and Onabe, 2017). It is imperative therefore to evaluate the agro-climatological instruments for instructional delivery of agricultural education in Colleges of Education in North-East Nigeria. The study found out that out of the 17 agro-climatological instruments recommended for instructional delivery of agricultural education in Colleges of education only 11 of them were available, 6 out of the 11 available were adequate, 8 were functional and 6 were utilized. Based on the findings of this study the following recommendations were made:

- i. Proprietors of the colleges (Public and private) should make available and adequate these agro-climatological instruments for lecturers to use.
- ii. College authorities should make the available agro-climatological instruments functional for effective instructional delivery by lecturers.
- iii. Lecturers should be given regular orientation/workshop on the utilization of the agro-climatological instruments.
- iv. Lecturers should, as a matter of importance, embark on self-development by attending conferences and seminars on the utilization of agro-climatological instruments to update their skills and capabilities.

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