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Effectiveness of Mobile Learning Implementation in Increasing Student Competence and Preventing the Spread and Impact of COVID-19

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Abstract—To prevent the spread and impact of COVID, and effective learning, one attempt is to conduct m-learning. The purpose of this study is to analyze: student supporting and inhibiting factors, the effectiveness of m-learning, preventing the spread and impact of COVID-19. The research was conducted through quasi-experimental. A sample of 116 Surabaya State University students. Data on supporting and inhibiting factors, data on the prevention of the spread-impact were obtained through online surveys, and data on the effectiveness of M-Learning using the pretest-posttest results. The data analysis used descriptive, t-test, gain tests. The novelty of this research involves supporting and inhibiting factors, and variables preventing the spread-impact of COVID-19. The results of the study: Supporting factors the suitability of m-learn RPS-material-video-interactive modules-evaluation-time duration have adequate supporting tools, the ability to access information-online materials and use collaborative software, the discipline of the COVID-19 protocol, parental support, happy, e-learning platform compatible with mobile phones, smooth internet, mobile screen size, ability to communicate via email-WhatsApp, accuracy in completing assignments-evaluations, relax, ability to plan-use time policies, conducive environment. Factors that hinder the ability to understand English content; M-learning can prevent the spread and impact of COVID-19, 100% of students are not exposed and are not affected by COVID-19; M-Learning is effective in improving student competence in terms of the gain is quite high 0.49, the mean pretest 38.41 is significantly different from posttest 76.38. The research results can contribute to developing a distance-learning model in abnormal conditions.

Keywords—COVID-19, m-learning, effectiveness, competence

I. INTRODUCTION

COVID-19 is a contagious disease due to the coronavirus. According to [1] the common symptoms of COVID-19 are fever, feeling tired and dry cough. The patient may experience pains and aches, runny nose, nasal congestion, sore throat, or diarrhea, the symptoms are mild and appear gradually. Transmission can be through other people who are infected with this virus. There are two main ways people can spread COVID-19, namely: 1) the infection can spread to people nearby within 1 m by inhaling cough drops from someone who is infected with COVID-19, and 2) people can become infected by touching a surface or the contaminated object then touches his eyes, nose or mouth.

To prevent the possibility of being infected with COVID-19 according to [1]: a) regularly and clean all hands by rubbing with alcohol or washing with soap and water, b) maintaining minimum distance of 1 meter between people, c) avoiding going to crowded places, d) avoid touching the eyes, nose and mouth, e) ensure that people around follow good respiratory hygiene, f) stay at home and isolate themselves if you have to leave the house wearing a mask, g) if you have a fever, cough and difficulty breathing, seek medical assistance, and h) always update information from reliable sources, such as WHO or national-local health authorities.

Data on the number of COVID-19 cases in Indonesia on April 22, 2020 [2], were positive, only 283 patients, total positive 7,418 patients, recovered 913 people and died 635. Data update [3] on the same date the number of positive cases in the world 2,573,143, 177.602 died, and 688,129 recovered. The massive spread of COVID-19 has made all universities including the State University of Surabaya change the lecture process from face-to-face to remote learning.

Based on the understanding, symptoms, transmission, prevention, and massive spread of COVID-19, one way to prevent its spread-impact for students, lecturers, education personnel is to implement remote learning and comply with health protocol. The existence of COVID-19 requires individual e-learning with various types of computer technology, including using m-learning, which is a form or learning model utilizing the capabilities of mobile devices. M-learning includes many features, such as multimedia content, communication between students, between students and lecturers, is unique in the flexibility of time and place, characteristics, and student psychological conditions.

Its implementation requires the readiness of education service providers, lecturers, students, and adequate and easily accessible technology. Implementing m-learning is expected to have more free, flexible learning time so that obstacles can be minimized, learning is more effective, learning outcomes are more optimal, and can prevent the spread and impact of COVID-19.

Definition of: [4] m-learning is a provision of any education and or the dominant technology is handheld or palmtop devices. M-learning can perhaps be defined as any educational provision where the sole or dominant technologies are handheld or palmtop devices. According to [5] m-learning there are four perspectives: technocentric, learning that uses mobile devices (PDAs, cell phones, iPods, tablet PCs, and others); relationship to e-learning, part of sub-set of e-learning; augmenting formal education, as an extension of formal education; and [6] learner-centered, this perspective has emerged based on recent studies and m-learning projects conducted in Europe, Australia, and the United States. [7] student-centered perspective, technological mobility, learning mobility, and learner mobility.

Individual learning e-learning with various types of computer technology [8]; [9], and using m-learning, which is a form or learning model that utilizes the capabilities of mobile devices [10]; [11]; [12].

Characteristics of mobile devices [13]; [14]; [15] include: portability, mobile devices can be brought to different location; fast connectivity, can be used to access various information anywhere and anytime; and context-sensitivity, which can be used to find and collect real or simulated data. These three characteristics make the learning experience unique. [16]; [17]) Mobile devices also have a better ability to manage, manipulate, and construct information for the learning process.

Based on the features of m-learning, mobile devices can support individual learning, distance learning, collaborative learning, informal learning. [18] The use of these technologies appears to bind the disparate threads of much urban movement together, both filling the spaces in between communication or meetings and structuring the spaces thus occupied. The use of these mobile sound technologies informs us about how users attempt to inhabit the spaces within which they move.

Steps to transfer lectures online during the COVID-19 period according to [19]: 1) design based on your learning objectives, 2) promote inclusivity, 3) impart clear rules of interaction, 4) set the stage for successful interaction, 5) practice makes perfect, 6) be concise and engaging, 7) take a break and get moving, 8) use peer interaction to the foster community, 9) deploy asynchronous communication tools, and 10) rethink assessment. Its implementation requires special tips for students to achieve optimal results, especially the accuracy of planning time, the tools used, seriousness, smooth communication, use of software, and the psychological condition of students. The learning application that can be used in this research is the Mobile Learning Engine (MLE) because it is comprehensive, namely converting learning models using computers and multimedia-based to a mobile-mobile environment [20] supported by the Zoom, Meet Google, Whatsapp, and Email for Question and Answer applications. and feedback online.

The elements of m-learning were developed from [37] students, lecturers, learning, mobile instructional, and communication infrastructure. The following is a chart of them-learning architecture (Figure 1). The novelty of this study involves supporting and inhibiting student factors form-learning learning and m-leaning variables in preventing the spread and impact of COVID-19. From a technical point of view, the novelty of this research involves the discipline of the
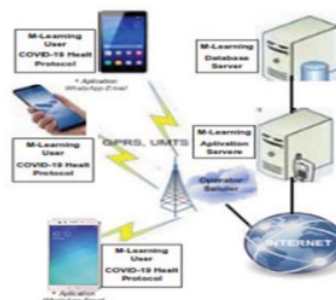

Fig. 1. M-learning architectural charts. Developed [39]

COVID-19 health protocol and using email-whatsaap application communication. Student supporting factors in learning using m-learning during the COVID-19 period must be considered so that optimal learning outcomes must be considered. According to [21] in general, annotated resources for online learning according to the objectives are grouped into: curriculum resources including lessons, videos, interactive modules, others that directly support students in gaining knowledge and abilities; professional development resources, resources that can support lecturers and parents in supporting students, guiding content, skills developing, or adding capacity to support students to learn more independently at home; and tools, tools that help managers to learn (learning management systems or other tools that lecturers communication tools, students can use to create or access educational content, and parents,. Remote learning from home during the COVID-19 outbreak effective according to [22]: 1) plan your time wisely, 2) know what tools you need, 3) take your work seriously. Mistakes that are often made by students [23] are not focusing, 4) communicating, 5) use collaborative software to work together, and 6) relax.

Student competence is a combination of learning outcomes in the cognitive, affective, and psychomotor domains. Cognitive learning outcomes consist of a knowledge dimension and a cognitive process dimension and. The dimension of knowledge consists of four categories, namely: 2) factual, 3) conceptual, 3) procedural, and 4) metacognitive. The cognitive process dimension consists of six levels, namely: 1) remember, 2) understand, 3) apply, 4) analyze, 5) evaluate, and (6) create [24]. Learning outcomes in the affective domain (attitudes) are related to attitudes and values. Attitude competency learning outcomes include behavioral traits such as feelings, interests, attitudes, emotions, and values. "Attitude is a person's reaction in facing an object" [25] To assess a person's attitude towards a certain object can be seen the observed response in facing the object in question ". Assessment of learning outcomes in the realm of attitudes for the formation of students' attitudes and characters is carried out during the learning process through observation, using observation sheets or checklists.

Psychomotor learning outcomes according to [26] "motor skills (perceptual-motor skills) are a series of muscle movements to complete a task successfully". "The aspect of skills is the result of learning, the achievement of which involves muscles and physical strength [25]. Skill competency is related to the skill or ability to act after a person has received a certain learning experience. According to [27], the

classification of learning outcomes in the realm of skills is divided into five ranks, simple to complex ranks, including a) imitation, students can imitate what they have seen, b) manipulation, students can carry out certain activities. based on instructions or orders from the instructor. c) precision, the ability of students to carry out precision activities (elements of accuracy, accuracy, and balance) even though they do not appear to be intact (d) articulation, students can coordinate a series of precise activities by determining the exact sequence between different activities, and (e) naturalization, students have been able to carry out activities in a natural order and activities are carried out with minimum energy.

Research problems: 1) supporting and inhibiting factors faced by students in m-learning in increasing competence during the spread of COVID-19 ?, 2) can the implementation of m-learning prevent the spread and impact of COVID-19 ?, and 3) what is the level of effectiveness m-learning is viewed from the competence of students who were taught using m-learning during the spread of COVID-19. The research objectives: 1) analyze supporting and inhibiting factors in m-learning in improving student competence during the spread of COVID-19, analyzing the implementation of m-learning in preventing the spread and impact of COVID-19 ?, 3) analyzing the level of effectiveness of m-learning in terms of student competencies learned using m-learning during the spread of COVID-19. It is hoped that the results of this research will contribute to finding new theories and providing input from stakeholders in improving student competence during the COVID-19 period.

II. RESEARCH METHOD

To answer the research problem, it was taken through a quasi-experiment with a quantitative approach because it was very difficult to control the variables outside the one understudy that was thought to affect the results of the study [28]. Data analysis used descriptive analysis techniques and a t-test preceded by the requirements test and the gain test.

The research population was students of the Faculty of Engineering (FT) State University of Surabaya (UNESA) Indonesia who took m-learning learning in five subjects (electric machines II, AC electric machines, maintenance, and repair of electric machines, electromagnetic control practices, and electric machine control. The sample of 116 students from the Department of Electrical Engineering, FT UNESA, was determined using the stratified random sampling technique. The study was conducted from March to July 2020 in the Electrical Engineering Department, FT UNESA, lecturers' homes, and at the homes of each student.

Data collection techniques through online survey techniques for factor data that support and hinder students in learning m-learning using online survey instruments/questionnaires. The test technique (pretest-posttest) to collect data on learning outcomes in the cognitive, affective, and psychomotor domains (student competencies) uses cognitive test sheets and performance tests to obtain learning outcomes data in the affective and psychomotor domains. The instrument developed was tested for validity before use.

Indicators of factors that support and hinder students in learning m-learning from home so that their competence increases and in an effort to prevent the spread and impact of COVID-19: 1) compatibility of m-learning with curriculum, material content, video, audio, interactive modules, evaluation, duration of time; 2) the ability to plan and use time wisely; 3) ownership of adequate m-learning support tools; 4) compatibility of the learning platform with m-learning content on mobile phones; 5) Adequacy of Mobile screen size; 6) seriousness in learning; 7) ability to access online learning resources; 8) communication capabilities via email and whatsapp for inquiries, discounts and feedback; 9) availability and ability to use collaborative software to work together (google meet app, zoom cloude); 10) relax; 11) parental support (motivation and internet data package or Wifi); 12) smooth internet; 13) discipline to apply the COVI-19 protocol; 14) health condition; 15) conducive environment for independent learning at home; 16) ability to understand English content; and 17) timeliness of completing assignments and evaluation results.

Indicators of student discipline to carry out health protocols to prevent the spread of COVID-19 refer to [1] students: 1) regularly and clean all hands by rubbing with washing with soap water or alcohol, 2) maintaining a minimum distance of 1 meter between people, 3) avoiding going to crowded places, 4) avoiding touching the mouth, eyes, and nose, 5) ensuring that people around follow good respiratory hygiene, 6) isolating themselves and staying at home, if you have to leave the house wearing a mask, 7) if fever, cough and difficulty breathing, seek medical help, 8) always update information from reliable sources, such as Word Health Organization (WHO), or national - local health authorities.

Indicators of symptoms affected by COVID-19 [1]: 1) the presence of common symptoms of COVID-19: fever, fatigue, and dry cough, 2) experiencing pain and aches, runny nose, sore throat or diarrhea, nasal congestion, mild symptoms and appeared gradually.

Indicators of cognitive learning outcomes instruments in the dimensions of cognitive processes: (apply, analyze, evaluate, create). Dimensions of knowledge: metacognitive, procedural, conceptual, factual. Indicators of learning outcomes in the affective domains are feelings, interests, attitudes, emotions, and values. Psychomotor learning outcomes instrument, ability: 1) to carry out activities based on standard operational procedures (SOP), 2) to carry out activities precisely, 3) to coordinate a series of precise activities in precise order among different activities, and 4) to carry out sequential activities naturally with minimum energy.

Data analysis steps: 1) data description, 2) analysis requirements test, 3) hypothesis testing. Supporting and hindering data for students in m-learning and data on the prevention of the spread and impact of COVID-19 that have been obtained are tabulated and described. Student competency data is described by tabulating the data using the help of SPSS 20. Data analysis of supporting and inhibiting factors and data on the prevention of the spread and impact of COVID-19 uses descriptive statistics. The t-test and gain test to determine the effectiveness of m-learning is preceded by meted parametric assumption tests, including a) samples from normally distributed populations, b) variance values inhomogeneous sample groups, c) interval and ratio scale data, and d) the study sample was taken randomly [28]. The normality test was carried out by the Kolmogorov Smirnov Test, and the homogeneity test in the study was not carried out because of 1 sample group. the decision states the normal distribution and variance homogeneity, the result of the t-test is at an error level of 5%.

TABLE I. LEVEL ACCURACY OF THE COMBINATION OF LOGISTIC REGRESSION AND DISCRETIZATION METHOD WITH 3-INTERVAL

Supporting and Inhibitor Factors for Students in the Implementation of m-Learning	Number of Students Stated	
	Supported (%)	Unsupported (%)
The fun of m-learning, semester course plans (RPS), material, video, audio, interactive modules, evaluation, and time duration	86.21	13.79
Ability to plan and use time wisely	60.34	39.66
Ownership of adequate m-learning support tools	96.55	3.45
Platform compatibility with e-learning content on mobile	77.59	22.41
Adequate HandPhone screen size	64.66	35.34
The seriousness of learning through m-learning	60.34	39.66
Ability to access information - online learning resources	85.34	14.66
Communication capabilities via social media applications (email- WhatsApp)	82.76	17.24
Ability to use collaborative software to work together (google meet, zoom cloud)	86.21	13.79
Relax	68.97	31.03
Parental support (motivation and internet data plan or Wifi)	84.48	15.52
Smooth internet	77.59	22.41
Discipline in implementing the COVI-19 protocol	86.21	13.79
Health condition	100.00	0.00
Conducivity of the learning environment at home	60.34	39.66
Ability to understand English language content	48.28	51.72
Timeliness in completing assignments and evaluation results	82.76	17.24
Average	76.98	23.02

III. Research RESULT

A. Supporting and inhibiting factors faced by students

There are many supporting and inhibiting factors faced by students in m-learning in increasing competence and preventing the spread of COVID-19. The summary of student supporting and inhibiting factors in m-learning can be seen in Table 1.

Supporting and inhibiting factors for students in m-learning with an average of 84% -100% (very supportive) 7 factors; mean 68% -83% (support) 6 factors; mean 52% - 67% (quite supportive) 4 factors, and mean 36% -51% (less supportive) 1 factor. The overall mean results showed that the 17 factors supported 76.98% (89) students, and did not support 23.92% (27) students in m-learning.To prevent the spread of COVID-19, it can be done by disciplining health protocols. Table II shows disciplinary data for students to carry out the COVID-19 health protocol.

Based on Table II, it shows the level of health protocol discipline in the category always (very disciplined) 107 (91.92%) students and 9 (8.08) students are in the frequent category (discipline).

Table III shows the symptoms experienced by students who are suspected of being impacted or infected with COVID-19. It appears that students who experience general symptoms of fever, fatigue, and dry cough are together 0 (0.00%); fever 3 (2.57%); feeling tired 4 (3.45%); dry cough 8 (6.90%). The

TABLE II. DISCIPLINE DATA FOR STUDENTS PROTOCOLING THE HEALTH OF COVID-19

Discipline in Carrying Out Health Protocols	Number of Students			
	Always	Often	Rarely	Never
Regularly- thoroughly clean hands with rubbing alcohol/ washing with soap & water	116	0	0.00	0.00
Maintain a minimum distance of 1 m between people	112	4	0.00	0.00
Avoid going to crowded places	112	4	0.00	0.00
Avoid touching nose, eyes, mouth	110	6	0.00	0.00
Ensure that people around you follow proper respiratory hygiene	100	16	0.00	0.00
Stay at home and isolate yourself, if you have to leave the house wearing a mask.	111	5	0.00	0.00
If fever, cough, and difficulty breathing, seek medical help	111	5	0.00	0.00
Updated information from reliable sources (WHO) or local-national health authorities)	81	35	0.00	0.00
Amount Average	107	9	0	0
Percentage	91.92	8.08	0.00	0.00

TABEL III. SYMPTOMS EXPERIENCED BY STUDENT SUSPECTED AS IMPACT OR INFECTED BY COVID-19

Symptoms of Affected COVID-19	Number of Students			
	Always	Often	Rarely	Never
General symptoms				
Fever	0	0	3	113
Fatigue	0	0	4	112
Dry cough	0	0	8	108
Fever, feeling tired and dry cough	0	0	0	116
Symptoms are mild and appear gradually				
Aches and pains	0	0	6	110
Nasal congestion	0	0	8	108
Sore throat	0	0	0	116
Diarrhea	0	0	7	109
Experiencing aches and pains, congestion, runny nose, nasal sore throat, diarrhea	0	0	0	116
Average			4	112

number of students who experienced mild symptoms and appeared gradually. Experienced pain and aches, nasal congestion, sore throat, runny nose, diarrhea 0 (0.00%); aches and pains 6 (5.17%); nasal congestion 8 (6.90%); sore throat 0 (0%); and diarrhea 7 (6,03).Symptoms Experienced By Student Suspected As Impact Or Infected By Covid-19.

B. Level of Effectiveness of M-Learning in terms of Competence of Students Learning During the Spread of COVID-19

A descriptive statistical summary of student competence is shown in Table IV.

The initial competence of 116 students before learning used m-learning with a mean of 38.41 in the low category and after learning 76.38 in the high category [30] with the lowest score of 44.00 and a maximum value of 92.00.The increase in student competence is measured using the n-gain score:

TABLE IV. SUMMARY OF DESCRIPTIVE STATISTICS OF STUDENT COMPETENCY

	N	Mean	Std. Deviation	Min.	Max.
Pretest	116	38.41	13.12	20.00	56.00
Posttest	116	76.38	11.98	44.00	92.00

TABLE V. ONE SAMPLE KOLMOGOROV SMIRNOV TEST

		Pretest	Posttest
N		116	116
Normal Parameters	Mean	38.41	76.3793
	Std. Deviation	13.12	19.823
Kolmogorov Smirnov Z		1.692	1.743
Asymp. Sig. (2-tailed)		.007	.005

$$\langle g \rangle = \frac{(S_i - S_f)}{S_i} \frac{(76.38 - 38,41)}{76.38} = 0,49$$ in the high enough category [30].

$\langle g \rangle$ competency improvement
S_f initial average competency
S_i student's final competency average

Based on the normality test data, the pretest and posttest data showed normal (Table V) because of the sig. greater than 0.05, namely 0.07 and 0.05, so that the paired sample t-test can be continued. The summary of paired samples of student competency test is shown in Table VI. Based on the normality test data, the pretest and posttest data showed normal (Table V) because of the sig. greater than 0.05, namely.

IV. RESEARCH FINDING AND DISCUSSION

A. Supporting and inhibiting factors for students in m-learning in increasing competence and preventing the spread of COVID-19

Factors that strongly support students in m-learning learning have an average of 84% -100% according to [29] categorization based on percentages, namely: m-learning according to RPS, material, video, audio, interactive learning modules, evaluation, and time duration learn; adequate ownership of m-learning supporters; the ability to access information - online materials, use collaborative software to work together; disciplinary discipline to apply the COVID -19 protocol; motivation - parent internet data package support; and health.

This is in line with online learning steps [22] and online learning tips. Factors that support the mean of 68% -83%, namely; This is in line with how remote learning from home during the COVID-19 outbreak remains effective according to [22]. Factors that are quite supportive (52% - 67%) of students are the ability to plan and use time wisely, adequate screen size for mobile phones, serious learning, conducive learning environment at home. The dominant facilitator who does not support or hinder students' ability to understand English content.

Other students experienced obstacles in some of the facilitators described so that their learning outcomes or competence were still low. This is in line with several research results that show that students do not use mobile devices to learn small screens with small resolutions, insufficient memory, internet speed, and lack of standards and comparability [31]; [32]; [33];. Mobile limitations [33] [34]

TABLE VI. PAIRED-SAMPLES TEST STUDENT COMPETENCY

		t	df	Sig. (2-tailed)
Pair 1	pret - posttest	21.495	115	.000

in user psychology, users prefer to use mobile for hedonic things such as texting, social media rather than for learning purposes, listening to music.

B. Prevention of the Spread and Impact of COVID - 19

Students involved in m-leaning learning are always (very disciplined) 107 (91.92%) in carrying out health protocols in preventing the spread of COVID-19 according to provisions [1] in terms of regularly and cleaning all hands by rubbing with alcohol or washing with water and soap, 2) maintain a minimum distance of $\geq$ 1 meter between people, 3) avoid touching the mouth, nose, eyes, 4) ensure that people around follow good respiratory hygiene, 5) avoid going to crowded places, 6) stay at home and self-isolation if leaving the house wearing a mask, 7) if fever, cough and difficulty breathing, seek medical assistance, 8) always update information from reliable sources (WHO or national-local health authorities). The remaining 9 (8.08%) students only frequent category or discipline in carrying out the health protocol due to accidental factors due to forgetfulness.

Of the 116 students who took m-learning, there were 15 (12.93%) who experienced general symptoms but separately or partially experienced symptoms of COVID-19, for example, some students only experienced fever, fatigue, and dry cough and respectively. This shows that as long as students take m-learning, no one experiences symptoms of being affected by COVID-19. This is also because the learning environment is conducive, healthy, and students learn to relax and be happy.

C. Level of Effectiveness M-Learning during of COVID-19

M - Learning is effective in terms of student competence after learning in terms of the results of the gain test 0.49 (high enough), the categorization is appropriate [30], and there is a significant difference in the competence of students before learning with a mean of 38.41 (low) and after learning through m-learning an average increase of 76.38 (high). This is because IT can meet various student learning styles and produce a real impact of m-learning on the effectiveness of students [35]. M-learning also offers greater opportunities for audiences to take advantage of social interactions to achieve the highest standards of learning and academic performance [36].

V. CONCLUSION

Student supporting factors in m-learning in improving competence and preventing the spread of COVID-19 consist of 3 categories: 1) very supportive factors: m-learning according to RPS, material, video, audio, interactive learning modules, evaluation, and time duration; ownership and adequate m-learning support tools; the ability to access information and online materials, use collaborative software to work together; discipline to apply the COVID -19 protocol; motivation and support for internet data packages from parents; and healthy condition; 2) supporting factors: learning platform: e-learning content compatible with mobile; ability to communicate via email and WhatsApp; the ability to learn in a relaxed manner; smooth internet; and the ability to

complete assignments and evaluations on time; 3) sufficiently supportive factors: the ability to plan and use time wisely; Adequate HandPhone screen size; the seriousness of learning, and the conducive learning environment at home. The factors that do not support or hinder students' ability to understand English-language content. .M-Learning is effective in terms of the competence of students learning through m-Learning during the COVID-19 period in terms of the high gain test results of 0.49, a significant difference in the average competence of students before and after learning. Initial competence before learning averaged 38.41 (low) and increased after learning a mean of 76.38 (high). This includes the implementation of m-learning from home which remains effective because it uses tips [22]: 1) plan your time wisely, 2) know what tools you need, 3) take your work seriously. [23] not focus, 4) communicate, 5) use collaborative software to work together, and 6) relax

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