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Paper's title: Development frameworks of the Indonesian Partnership for 21st Century Skills Standards For Prospective Science Teachers: A Delphi Studi

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Has been through a proofreading process by the translator at the UPT Bahasa IKIP PGRI Pontianak.

Pontianak, March 21st 2019

Head of UPT Bahasa IKIP PGRI Pontianak



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Development Frameworks ~~of~~for the Indonesian Partnership for 21st--Century Skills Standards: A Delphi Study
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Abstract. In the 21st century, ~~the students~~ student from in many all levels of education ~~face~~face on extremely extreme global ~~competitiveness~~competition, ~~technologically~~technology that is driven by information, and ~~rapidly~~rapid media ~~saturated~~saturation. These dramatic ~~acceleration~~accelerational challenges ~~get~~are at the reason why the educational system must ~~be~~prepare students with the skills ~~that they~~ needed in the era of globalization. Based on ~~the~~a document ~~that~~ published by The Board of National Education Standards in 2010 on the importance of establishing a framework for ~~the~~21st--century education in Indonesia, the necessity ~~for~~of appropriate standards ~~becomes~~has become very important ~~for~~to the current educational system. This paper aims to discuss ~~the~~ conceptual frameworks for prospective science teachers in Indonesia. Using ~~an~~ extensive literature review ~~from~~of three document (P21, enGauge-21CS, ~~dan~~and ATC21S) and group discussion with ~~two~~a two-round Delphi study, we ~~construct~~have constructed the Indonesian Partnership for 21st--Century Skills Standards (IP-21CSS). ~~The~~From ~~result~~the results of this study, we ~~establish~~have established four IP-21CSSs that ~~were~~perceived by panelists as appropriate standards for prospective science teachers in Indonesia ~~range~~ranging from 4.5 to 5 or ~~in the high level~~higher. This standards includes: (1) 4Cs---critical thinking, creative thinking, collaboration, and communication; (2) ICTs (technology, media, and information literacy); (3) ~~Spiritual~~spiritual Valuesvalues (religious beliefs and spiritual awareness); and (4) ~~Character~~character Buildingbuilding (teachers' attitudes and scientific attitudes). Therefore, it concludes that the implementation of 21st--century education learning that emphasizes ~~on~~each IP-21CSS ~~indicators~~,indicator ~~need~~needs to be considered as an essential component in ~~the~~ courses process for prospective science teachers in Indonesia.

Introduction

The explosion of information, the rapid development of technology, and the widespread ~~of~~globalization in ~~the~~ 21st century bring out the concern of many practitioners, educators, and international ~~organization~~organizations in the ~~world~~world about what skills sets ~~that~~students should have ~~prepared~~for students in the future ([1] [2] [3] [4]). This concern arises as the ~~response of the result~~results from many empirical investigations ~~who reported~~showed that in the 21st century, technology would evolve into automation. The computer will ~~substitute~~substitute for each job in performing manual and cognitive tasks because each job requires information rapidly, and computers can ~~be processing~~process information quickly ([5] [1]). Similarly, the report on young people's readiness for work found that over 400 business executives and managers agree that critical thinking and problem-solving, ICT application,

collaboration, creativity, and innovation were at the top of the list ~~to of~~ the job success of the new workforce ([6] [7]). The students, in the 21st century and in many levels of education ~~also,~~ will be faced with the booming boom of digital technology and information, ~~impact on~~ impacting the growth of the millennial generation ([8] [9]). ~~The One of the~~ characteristics of the millennial generation ~~are is~~ their affinity with the digital world. They ~~are growing~~ grow up with smartphones, broadband connection, and social media ~~being as~~ the norm, and they always expect instant access to information, with only a few minutes of "search time" on the computer and a few clicks of a mouse [10]. With the world, currently ~~estimation~~ producing about 2.5 quintillion gigabyte data in the forms of the file, print, and digital (50% of this information fake), they can be faced with a dilemma between the need of accurate information ~~accurately,~~ and the rapid transformation of information ~~becomes into~~ obsolete ~~rapidly data~~ ([10] [11]). It is making a reason ~~why that~~ we need ~~to~~ provide our students ¹ to achieve the learning outcomes to be a good thinker. If students cannot think intelligently and openly about the myriad of information and issues that confront us, they will be in confusion and uncertainty.

~~Te~~ It is, thus, very important to deal with ~~different facets of daunting challenges,~~ the need daunting challenge to cultivate various skills, for students in the 21st century, that will be embedded in their educational systems ~~becomes very important~~ [12]. Ken Kay (President of Partnership for 21st Century Skills) ~~give~~ gives three reasons ~~why that~~ our students should be prepared to learn to think, work to solve problems, communicate, collaborate, and contribute effectively throughout their lives [13]. "First, these skills are rarely incorporated deliberately throughout the curriculum, nor are they routinely assessed. Second, these skills are essential for all students today, not just an elite few. Third, the skills that employers and postsecondary educators say were required for success have converged" [13]. This reality then brings us a view that our curricula, philosophies, assessments, and teaching methods must be designed to meet the current workforce skills ([1] [3]). This skill includes five domains: cognitive, metacognitive, intrapersonal, interpersonal, and ~~others competency other that~~ competencies related with the 21st century (such as literacy and social-civic responsibilities) ~~+~~ ([14] [15]).

In the educational ~~systems~~ system, teachers play a critical role ~~to in~~ develop developing 21st-century skills [15]. Teachers must be adaptable to 21st-century ~~curriculum~~ curricula and then be able to use their imagination to teach ~~it them~~ in creative ways. The ~~questions~~ question then ~~arise,~~ arises as to whether our teachers today have been prepared to face this reality². The answer falls on the option to develop prospective teachers in the future to be able into produce 21st-century skills mastery. As a consequence, teachers and prospective teachers ~~as are~~ the most influential and central ~~factor~~ factors in the firm's educational need to be equipped with new competencies such as the ~~solves~~ solving of new problems ~~ri~~ learn how to learn, unlearn, and re-learn ~~ri~~ communicate with multiple modalities, and efficiently work in collaboration with others [16].

To ~~shared~~ share the vision for a real transformation of the prospective teacher's education system, the summit "Redefining Teacher Education for Digital-Age Learners" ~~bring~~ brings out an effort to ~~introduces~~ introduce a national dialogue on how to develop prospective teachers who can prepare

students for success in 21st century colleges, careers, and civil society [17]. They concluded that the ~~necessary~~necessity to transform education in the schools into 21st century learning staffed by professional leaders and pre-service teachers institution is key to the transformational redesign of teacher education programs in the 21st century [17]. This is in line with the statement delivered by The American Association of Colleges of Teacher Education and the Partnership for 21st Century Skills that believe a prospective teachers have to equipped with 21st century skills and knowledge, and they should have learned how to incorporate these skills into their classroom practice to grasp its goal of successfully meeting the challenges of this century [18].

In ~~related~~relation to the science education programs, the need to ~~cultivated~~cultivate 21st century skills sets for prospective teachers becomes the main agenda that should have focused on reaching consensus on science standards. Schuun found that there is a high intersection between science and 21st century skills standards [19]. For example, the science of inquiry includes references to communication skills and planning and selecting appropriate evidence, which may promote system thinking and non-routine problem--solving [19].

Engaging prospective science teachers in scientific processes (i.e., talk and argument, modeling and representation, and learning from investigations) can build science proficiency, and at the same time, it can develop 21st--century skills ~~which~~that are useful when they become a teacher ([4] [7]). Overall, the need to establish 21st--century skills standards for prospective science teachers will be helpful in driving leaders to make the right ~~policy~~policies that ~~fits~~fit on the demands and challenges that ~~arises~~arise in the 21st century.

In Indonesia, the attention to ~~the~~ 21st--century education has been conceptually voiced since 2010, whereas The Board of National Education Standards (Badan Standar Nasional Pendidikan, BSNP) released a document about Indonesia's 21st--century education paradigm. The BSNP stated that Indonesian 21st--century ~~National~~national ~~Education~~education aims to realize the ideals of the nation--a prosperous Indonesian society with a respectable and equal position with other nations in the global world through the establishment of a community that ~~consisting~~consists of qualified human resources, namely self-reliant, willing, and capable of fulfilling the ideals of the nation [20].

This goal indicates that Indonesian 21st century national education is not only directed to make--a--learner knowledgeable, but also to adopt a scientific attitude (i.e., critical-logical thinking, inventive-innovative thinking, consistent, and adaptable) and cultivation of noble values and commendable attitudes in social life ~~with~~ oriented towards mathematics, science, and humanities. Every level of ~~educations~~education must be a closely-linked system that fully supports the next level towards the frontier of science by considering aspects of ethnic, cultural, religious and social diversity in society [20]. It is in line with the vision of the Indonesian Long-Term National Education Development Plan (RPPNJP) 2005-2025 to produce smart and competitive Indonesia citizenship by the year 2025. This concept then encourages leaders in strengthening the achievement of the national education paradigm in the 21st century, among others through mastery of science knowledge and science process skills [20].

The regulation of the Indonesian National Education Minister (Permendikbud) No. 20, 21, 22, and 24 years 2016 which contains the competency standards of graduates (attitudes, knowledge, and skills), content standards, process standards, and core and basic competencies standards, principally referring to 21st century education standards ([21] [22] [23] [24]). For ~~example~~example, on the competency standards of graduates in the dimension of skills where it had stated that the graduates must have the skills of thinking and act creatively, productively, critically, independently, collaboratively, and communicatively through a scientific approach to the development of the learned unity of education and other resources independently.

~~Related with science content standards, the~~The regulation of the Indonesian National Education Minister, ~~number~~numbers 21 and 22 of 2016, established that, in the teaching and learning process, science teachers should be able to encourage students to understand the scope of science and its application in the conceptual era of the 21st century and ~~applying to~~apply science process skills to understand science problems and relate them to the environment, technology, and society. Students also have the ability to ~~presenting~~present data on research and observation and, then, ~~communicates~~communicate both written and oral data, using various media, ~~which in the, as a whole,~~ can be obtained ~~through~~by multiple forms of activity, such as observing, asking, trying, reasoning, tasting, and creating.

~~To~~Prospective science teachers, be to be able ~~to~~ teach the science standards, ~~prospective science teachers firstly~~ must, firstly, master the skills, as well. Thus, the course process for prospective science teachers should always rely on 21st-century education standards. The ~~problem~~question is ~~what kinds: of~~What 21st-century education standards are appropriate for prospective science teachers in Indonesia?. ~~Based on this facts the need to realize the standards that appropriate for Indonesian prospective science teachers becomes importantly.~~ This study aims to create a conceptual framework of the ~~Indonesian~~ 21st-century ~~skills~~skill standards for prospective science teachers in Indonesia. This standard ~~was~~is called ~~as the~~ Indonesian Partnership of 21st Century Skills Standards (IP-21CSS).

Research Methods

This study involved exploratory research with qualitative analysis in developing conceptual frameworks of Indonesian 21st century skills standards to be integrating into prospective science teachers curriculum. The data in this study were collected using the Delphi method. This method brings out discussion on specific areas to obtain a strong consensus from perception or judgments held by expert knowledge ([25] [26] [27]).

A two-round Delphi process was used to initiate a consensus among 15 panelists to make decisions about 21st century standards for prospective science teachers in Indonesia. All panelists involved in this research ~~were~~ grouped according to three categories ~~include~~including qualification (QL), teaching experience (TE), and scientific expertise (SE). The data of panelists' ~~demographi~~demographics can be seen in Table 1.

Table 1. The Data of Panelists Demographic

Data Panelist

N

Total Sample

Qualification

Magister
Doctor
Teaching experience
Expert Assistant
Lector
Senior Lector
Professor
Scientific expertise
Biology education
Physics education
Chemistry education
15

9
6

6
4
4
1

8
3
4

The Delphi Process

Primarily, to build on the IP-21CSS, we employed a two-step process. The first step aims to ~~identified~~identify and ~~compared~~compare ~~standards~~standard 21st century skills from numerous documents based on literature reviews. The second step aims ~~to~~for the preparation of questionnaires based on the result of literature reviews and conducting focused group discussion to establish the conceptual frameworks of IP-21CSS ~~that~~ perceived by panelists using a two-round Delphi study.

Literature reviews

The conceptual framework of IP-21CSS is arranged based on the results of depth literature reviews that related to numerous documents of 21st century education. The documents includes: (a) frameworks for 21st century skills (P21) [28], (b) enGauge of 21st century skills (enGauge-21CS) [8], and (c) Assesment and Teaching 21st Century Skills (ATC21S) [29].

Preparation of Questionnaires and Conducting Focus Group Discussion

The entire skills from all documents that have reviewed became the basis for the preparation of questionnaires. Moreover, we are also doing focus group discussion with panelists on determining the standard which becomes the benchmark of 21st century education for prospective science teachers in Indonesia. After discussion, we conclude ~~that~~ two standards that need to be considered as standards competence for prospective science teachers in Indonesia, namely+ character building (teacher attitudes and scientific attitudes) and spiritual values (religious belief and spiritual awareness). In detail, the stage to build the IP-21CSS conceptual framework can be described as follows:

Preparation questionnaires

Round 1 Delphi

Literature reviews

Round 2 Delphi
FGD

Data Results

Establish IP-21CSS

Figure 1. Two-Round Delphi Process in Developing IP-21CSS Research Instrument

Instruments in this study ~~consisting~~consist of two-~~forms~~form questionnaires for a two-round Delphi study. In the first round, the instrument used a checklist questionnaire form. Some 26 skills ~~on~~in six domains were used in this questionnaire. This domain includes cognitive skills (4~~four~~ core skills), ICT skills (4~~four~~ core skills), metacognitive skills (4~~four~~ core skills), ~~Interpersonal~~interpersonal skills (6~~six~~ core skills), ~~Intrapersonal~~intrapersonal skills (3~~three~~ core skills), and other skills related to literacy (5~~five~~ core skills).

Panelists in this round were directed to rank the core skills in each domain that they felt were the most essential and eligible ~~to~~for ~~teach~~teaching in the course for prospective science teachers in Indonesia. In the second round, the instruments used a rating-~~scales~~ ~~questionnaire~~questionnaires form with Likert's five-scales ranging from strongly agree (5) to strongly disagree. A total of 13 skills-~~that~~ used in this study were developed based on eight skills that were assessed as most important from round one and four skills from two standards based on a recommendation from a focus group discussion.

Research Analysis

Data in this study employed descriptive statistical analysis. In ~~the~~-round one, the data was analyzed based on a percentage (%) that were chosen by the panelist. In this round one of ~~the~~ Delphi study, each core skill ~~will~~ ~~be~~was considered-~~as~~ a consensus if it ~~was~~-selected by over 70% of the ~~panelist~~panelists. In round two, the data was analyzed using descriptive statistical analysis by computing the median values. In doing so, the relevancy of the 21st-~~century~~ skills was categorized into two distinct levels: high (the median value equal or above 4) and low (the median value equal or below 3.5).

Result and Discussion

Literature Reviews Findings

In this study, we have identified 43 skills from three documents that analyzed includes P21 (12 skills), enGauge-21CS (20 skills), and ATC21S (11 skills). The result of this study found that most of the core skills in each document are interchangeable to each other. The result becomes evidence that essentially the demands of the skills contained in the three documents have similar content, and there is considerable congruence among

the various competency frameworks, indicating a degree of consensus among researchers in the field [30]. It is making significant contributions in aiding this reconceptualization of education for the 21st century [31]. For more details, it can be seen in Table 2.

Round 1 Delphi Findings

The list of skills collected from the three documents is categorized into six domains, such as cognitive, ICT, metacognitive, interpersonal, intrapersonal, and other domains related to 21st century education. In this grouping, the screening of relevant core skills or sub-skills

~~doing~~is done in this study. For example, decision-making on ATC21S are grouped into critical thinking and problem-solving in P21, with the consideration that decision-making is a sub-skill of critical thinking. The same is true for high-order thinking, and sound reasoning in enGauge-21CS that assessed include in more specific skills such as critical thinking, creative, and problem-solving.

In the first round of the Delphi study, panelists were then presented to assess with the list of skills that are considered very important and possible to taught for the current prospective science teachers in Indonesia. The panelist then directed to assessing the list of proposed skills by considering various aspects, such as curriculum demands, learner characteristics, availability of facilities and infrastructure, teacher readiness, and institutional support in realizing 21st century education standards for prospective science teachers.

Table 2. Interrelations between frameworks of 21st century skills from P21, enGauge-21CS, and ATC21S

P21

enGauge-21CS

ATC21S

Learning and Innovation

Inventive Thinking

Ways of Thinking

Creativity and Innovation

Critical thinking and Problem Solving

Creativity

High-Order Thinking and Sound Reasoning

Curiosity

Risk-Taking

Creativity and Innovation

Critical thinking

Decision--Making

Leaning to Learn

Metacognition

Effective Communication

Ways of Working

Communication

Collaboration

Interactive Communication

Teaming and Collaboration

Interpersonal Skills

Personal, Social, and Civic Responsibility

Inventive Thinking
Adaptability and Managing Complexity
Self-Direction
High Productivity
Prioritizing, Planning, and Managing Results
Effective Use of Real-World Tools
Ability to Produce Relevant, High-Quality Products
Communication
Collaboration
Life and Career

Living in The World
Social and Cross-Cultural Skills
Leadership and Responsibility

Flexibility and Adaptability
Initiative and Self-Direction

Productivity and Accountability

Life and Career
Personal and Social Responsibility
Information, Media, and Technology
Digital-Age Literacy
Tools for Working
Information Literacy
Media Literacy
Technology Literacy
Information Literacy
Technological Literacy
Visual Literacy
Basic Literacy
Scientific Literacy
Economic Literacy
Multicultural Literacy
Global Awareness
Information Literacy
ICT Literacy (information, media, and technology)

The results of this study show that from 26 skills recorded, there are 11 core skills considered by panelist ~~becomes~~as urgent to have in prospective science teachers, ~~includes~~including three core skills on cognitive domain and ICT, two core skills in the interpersonal domain, and one core skill on metacognitive, intrapersonal domain, and other domains (Table 3). Furthermore, ~~table~~Table 3 shows that less than 50% of skills recorded from the three documents selected by the panelist— show that not all skills contained in the three documents fit the character of the prospective teacher in Indonesia. ~~++This~~This can be seen from the low acceptance of the metacognitive, intrapersonal, and other forms of literacy domains. This condition becomes ~~some barriers~~a barrier to implementing 21st century education. It is ~~the~~a managerial ~~concerns~~concern, non-emergency of

anticipated activity theory, non-technological efficacy, academic culture, and an overwhelming sense of keeping up [32].

Moreover, all panelists agree that these eleven skills are the core skills that must ~~have~~be taught for prospective science teachers in the course process. This agreement showed the high percentage of the eleven core skills that overall are above 70% or in other words this response category can be used to determine consensus. It is indicating that experts have a firm intention to establish a professional curriculum for prospective science teachers.

Table 3. Percentage Panelist Votes of Core Skills from Six Domains on Round 1 Delphi Study

No

Domains

Core Skills

Total

Percentage

1

Cognitive

Creativity and Innovation

15

100%

Critical thinking and Problem Solving

15

100%

Scientific Literacy

15

100%

Ability to Produce Relevant, High-Quality Products

7

46,7%

2

ICT

Information Literacy

15

100%

Media and Visual Literacy

12

80%

Technology Literacy

15

100%

Effective Use of Real-World Tools

8
53,3%
3
Metacognitive
Initiative and Self-Direction
10
66,7%

Adaptability and Managing Complexity
9
60%

Curiosity
13
86,7%

Metacognition (Learning to Learn)
10
66,7%
4
Intrapersonal
Productivity and Accountability
7
46,7%

Flexibility and Adaptability
5
33,3%

Life and Career
4
26,7%

Leadership and Risk-taking
11
73,3%

Personal Responsibility
10
66,7%

Prioritizing, Planning, and Managing Results
10
66,7%
5
Interpersonal

Communication

15

100%

Collaboration

15

100%

Social and Civic Responsibility

9

60%

Social and Cross-Cultural Skills

8

53,3%

6

Others

Basic Literacy

15

100%

Economic Literacy

4

26,7%

Multicultural Literacy

7

46,7%

Global Awareness

10

66,7%

Focus Group Discussion Results

To obtain a benchmark of 21st century education for prospective science teachers in Indonesia, we employed one round of focus group discussions. The discussion activities start from highlighting paradigm of Indonesian 21st century education with two questions.

What are the "~~domain~~domains" specific to prospective teachers in Indonesia in the 21st century?

What ~~are~~ "unique~~-skills~~ skill sets" ~~that can~~ represent characteristics of 21st~~--~~ century education for prospective teachers in Indonesia?

To be able to answer both questions, all panelists in this discussion were given the opportunity to express their opinions, mainly related to the current Indonesian national education system requirements. ~~The results~~

~~of Those in the~~ discussion ultimately concluded that the Indonesian national education system is not only ~~is~~ directed to mastering cognitive and ICT domains, but more than that, ~~there are~~ it requires another domain

to be its ~~benchmarks~~benchmark. In this case, there are two main focuses that panelists insist on being constructed for prospective science ~~teachers~~teacher education programs.

First, the need for characters building related to the characteristics of the Indonesian nation. The degradation of the nation's morality due to excessive euphoria to foreign cultures without going through the filtering process that affects the weakening of national values and the eroding of local wisdom is a strong reason why future teachers need to be equipped with substantial characters building. Second, ~~thethere is a~~ need to encourage spiritual values that can be implemented in the classroom learning. The need is based on the mandate by law of Indonesian national education system No 20/2003, ~~article~~Article 3, which states that the goal of Indonesian national education is "...the development of the potential of learners to become a man of faith and cautious to God Almighty, be noble, healthy, knowledgeable, capable, creative, independent, and become a democratic and responsible citizen" [33].

Overall, the discussion creates two ~~domains~~domain-specific ~~are suggested areas~~ by the panelist to be added as ~~a benchmark~~benchmarks of 21st--century education for prospective teachers in Indonesia, namely, ~~character--~~building and spiritual values. To highlight the implementation of ~~the~~ both the domain-specific suggestions, a set of indicators called "core skills" was developed. In this study, the core skills in ~~character--~~building domains include the teacher's attitude and scientific attitude, while the core skills in the spiritual awareness domain include religious belief and spiritual awareness.

Round 2 Delphi Findings

The data obtained from round 1 of the Delphi study and focus group discussion ~~become~~became the material in preparing a conceptual framework of IP-21CSS. In this study, we classified data in round 1 of the Delphi study into two domains, i.e., 4Cs (creativity and innovation, critical thinking and problem solving, collaboration, and communication) and ICTs (information literacy, media and visual literacy, and technological literacy) referring to document P21. Meanwhile, the panelist consensus based on the focus group discussion results has ~~been~~ established two domain-specific areas, ~~that is~~which are ~~character--~~building and spiritual values.

Moreover, with the consideration of the experts, the researchers then classify the scientific literacy into scientific attitudes, visual literacy grouped into media literacy, and leadership and risk-taking grouped into teachers' attitudes. The results of this study in round 2 of the Delphi study show that all panelists receive frameworks on all IP-21CSS domains with the high category (Table 4).

Table 4. Median Values Core Skills of IP-21CSS Domain on Round 2 Delphi Study

No

IP-21CSS Domain

Core Skills

Median

Interpretation

1

4Cs

Creativity and Innovation

5
High

Critical thinking (includes Sound Reasoning, Decision Making, and Risk Taking) and Problem Solving

5
High

| Communication (includes Basic ~~literacy~~Literacy)

5
High

Collaboration

5
High

2

ICTs

Information Literacy

5
High

Media and Visual Literacy

4.5
High

Technology Literacy

4.5
High

3

Character Building

Teachers attitudes (includes Leadership)

4
High

Scientific Attitudes (includes Scientific literacy and Curiosity)

4.5
High

4

Spiritual Values

Religion beliefs

4
High

Spiritual awareness

4.5
High

To facilitate the process of implementation IP-21CSS domain, this study also prepared indicators on each domain. This indicator covers the skills that prospective science teachers are required to learn in the 21st century and the skills ~~that~~ needed for prospective science teachers to become teachers in the 21st century (Table 5).

Table 5. Indicators on Each IP-21CSS Domain.

No

IP-21CSS Domain

Indicators

1

4Cs

The ability to create new ideas or generate new ideas from something's existence (redesign) ~~with~~ independently or in groups. ~~This--this~~ capability covers many forms, including imitation, modification, and invention.

The ability to identify, analyze, interpret, and evaluate evidence, arguments, claims, and data ~~uses~~using rational reasoning to decide whether to believe it or not and to ~~use it to~~ solve problems and find the most appropriate ~~solutions~~solutions.

The ability to articulate thoughts, opinions, and ideas ~~effectively~~clearly and ~~clearly~~effectively using oral, ~~and~~ written skills and ~~media~~various in a forms variety of contextsmedia.

The ability to ~~working~~work with others, ~~to shared~~share knowledge and information, solve problems, and create a novel ~~product~~products ~~to that~~ enrich personal experience and knowledge.

The ability to ~~using~~use a variety of models, methods, and learning strategies that can encourage students to think critically and creatively ~~and~~ develop students' ~~skills in~~ communication and collaboration skills in order to solve problems.

2

ICS Skills

The ability to access and assess information from multiple sources accurately and critically ~~and~~, generate ~~messages~~media ~~media~~message delivery using various tools ~~and~~, and use ~~various~~different technological tools, especially digital technology.

The ability to apply various models, methods, and learning strategies that utilize technology and digital information.

3

Character Building

The ability to demonstrate ~~scientific~~ attitudes (curiosity, honesty, thoroughness, openness, and prudence) ~~and~~, ~~adapt~~able display adaptability to the values prevailing in society ~~and~~, exhibit a spirit ~~have of~~ leadership ~~spirit~~, and uphold the ~~attitude~~attitudes and behavior ~~as of~~ a teacher

~~Able~~The ability to teach moral values and scientific attitudes in the teaching and learning ~~process~~processes ~~to that~~ building guide the students' ~~character~~characters to fit conform into the identity of the Indonesian nation.

4

Spiritual values

The ability to accept and appreciate the Creator through science and internalize the spiritual values in everyday life.

Able to teach the concept of the Creator to the student through science.

Conclusion

In response to the call for all students to learn 21st century skills, some organizations have developed frameworks for the new content and processes that should ~~deliver~~be delivered as part of their institutional brand [31] that ~~indicating~~indicates horizontal consistency in curriculum intentions [34]. IP-21CSS is a conceptual framework that was developed as a response to the educational intentions of the 21st century education in Indonesia. This framework was developed as part of the embodiment of the discourse of changing the 21st century education paradigm in Indonesia according to a document released by BSNP [20]. The embodiment of this framework begins with a study of the literature of three 21st century educational documents most widely used as a reference in the development of 21st century education around the world.

Based on the results of the literature review, we find that there is a high interrelation between the skills of ~~each~~ 21st century educational document that describes the benchmarks of the ~~Institutional~~institutional brand, such as P21, enGauge-21CS, and ATC21S. These interrelations include some of the broader aspects, such as high order thinking and ICT Literacy, while others are sub-skills, such as sound reasoning, decision-making, risk taking, learning to learn, and metacognition, which are sub-skills of critical thinking. Many organizations have frameworks that are mostly consistent regarding what should be added to the curriculum, and each group has different areas of emphasis within the overarching skillset ([31] [34]).

The study result found 12 core skills ~~into~~in four domains (4Cs, ICTs, ~~Character Building~~character-building, ~~dan~~and ~~Spiritual~~spiritual Valuesvalues), which are considered ~~relevance with~~relevant to the characteristics of prospective science teachers in Indonesia.

~~Domains~~The domains of 4Cs and ICTs in this study refer to terms proposed by a P21 framework that released a document from the research series in 2015 on how to ~~conceptualizing~~conceptualize, ~~developing~~develop, and ~~assessing of~~assess communication, collaboration, critical thinking, and creativity skills [28] using various media, technology, and information in the digital age. With ICTs, prospective science teachers are expected to have the ability to access, share, analyze, and present information gained from a variety of sources and in many different ways and ~~provides~~provide them with opportunities to work collaboratively and independently ([35] [36] [37]). Two ~~of~~ other domains, namely, ~~character--building~~ and ~~spiritual values~~, are ~~aspecifically specific-domain develop~~developed with the help of an expert as benchmarks of 21st-century education in Indonesia for prospective science teachers. As a benchmark within the IP-21CSS framework, these two domains are principally aimed at overcoming the nation's competition due to ~~youth~~youths' moral and spiritual degradation ~~such as through~~ loitering, drugs, sex, school and ~~riders~~rider gangs, bullying, and various other cases.

In science education, character and spiritual education cannot be taught as a separate curriculum, because science education is ~~at the~~the ~~foundation~~basis ~~on of~~ education ~~for in~~ the information era ~~whom~~that allows all people ~~can to~~ participate in the freedoms and democratic society that ~~requires~~require good character and spiritual values [38]. ~~As For~~For ~~example~~example, when teachers and students address scientific and technological knowledge in the context of character education, they can participate in informed reflection about ethics in science and technology [38]. ~~It~~This is ~~a reason~~ why building character and spiritual values across the curriculum is used to shape society and ~~become~~achieve the

status of a skilled developed country in this challenging century. Furthermore, ~~this~~these skills must to taught ~~with~~using a ~~myriad~~wide range of teaching techniques such as simulation, debates, discussions, and other models that ~~which leads~~lead to the formation of a scientific attitude, with the final goals ~~is~~being to build a moral and religious ~~citizenship~~citizenry ([39] [40]) (Revell & Arthur, 2007; Choudhury, 2016). Nevertheless, ~~the findings of~~this study's findings are ~~only~~ limited to a conceptual framework. ~~Implementation~~The implementation of this framework is essential infor determining the strengths and weaknesses of the established IP-21CSS framework. With the development of pedagogical models, methods, and strategies aimed at encouraging the acquisition of 21st--century skills based on the results of emerging research, the opportunity exists to infuse this framework ~~in~~into the course increasingly to ~~obtain~~develop a more reliable framework for prospective science teachers.

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