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Full Length Research Paper

With parental eye, factors that prevent to attend nature activites

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This study was conducted in order to determine the difficulties and challenges parents and children who have attended /desire to attend nature activities experience in order to access these activities. The study included 50 parents and their children. Interview technique was used in the study. The percentage of the questions asked was calculated to determine the demographic characteristics of the participants. Some of the reasons for not participating in the nature activities, the distance to the natural areas, being away from the natural areas, the high cost concern, the fatigue due to the intensive working hours, the feeling of insecurity and not being able to reach the experts in the field have been shown. In addition, participants stated that the time they spent in nature with their children was not enough, accordingly, they did wrong to them and it pricked their conscience. As can be understood from the participant children's answers, tablet computer / phone usage is often seen as a compulsory choice. Children who have the desire to be in nature unfortunately feel the necessity to make electronic friends because of living conditions, and for this reason, they tend to use tablet computer/phone.

Key words: Outdoor activities, outdoor recreation, family participation.

INTRODUCTION

Unfortunately, many children have to grow up in the shadow of "apartment child" qualification today. Increasingly enlarging concreted "living spaces" have begun to break children's connection with soil and cause them to be desensitized to nature. Moreover, children who can not learn what seasons mean exactly due to global warming, grow up rapidly in apartment buildings, schools and indoor playgrounds.

Over 100 studies of outdoor experiences in the wilderness and natural areas show that natural outdoor environments produce positive physiological and psychological responses in humans, including reduced stress and a general feeling of well-being. It is also a clear-cut finding that people, and especially young children who have not yet adapted to the man-made world, consistently prefer the natural landscape to built environments (Barrows, 1995).

Children have to spend time at the same place for long hours without moving due to many reasons such as intensively working parents, obligations imposed by education system, accessibility to technological tools and many other reasons, which lead to many physical and

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mental problems. In addition to these, the connection that children establish with technological tools also cut off their communication with their families and society, and cause them to live in a “virtual sociability”, and a display-oriented lyfe style substitutes for many games like running, climbing and playing. Now, many children have become more interested in how many followers they have and how many likes they get on social media.

Children may spend less time outdoors because they spend more time indoors using technology. In Canada, children in Grades 6 to 12 spend an average of 7 h and 48 min per day in front of some form of screen. These findings are similar to a U.S. report stating that over the last 5 years, screen time has increased by 1 h and 17 min per day and reading has decreased by 5 min per day. Studies such as these have prompted a movement by more than 300 organizations in the United Kingdom to encourage children to exchange 30 min of screen time for 30 min of outdoor activity each day (Crawford et al., 2017).

Children have little free time. Their lives are structured, organized, and timed nearly to the minute. When they are home and could be playing outdoors, they are often tied to electronic umbilica. In a typical week, only 6% of children, ages nine to thirteen, play outside on their own. Studies by the National Sporting Goods Association, and American Sports Data, a research firm, show a dramatic decline in the past decade in such outdoor activities as swimming and fishing. In San Diego, California, according to a survey by nonprofit Aquatic Adventures, 90% of inner-city kids do not know how to swim; 34% have never been to the beach. In Holland, Michigan, some young people who come to the Outdoor Discovery Center for education based outings in the out-of-doors have collapsed into tears because they are afraid of the woods, and they cannot walk more than a few hundred yards before they are exhausted by the expenditure of physical energy (Charles et al. 2008).

The development of body and mind healthily depends on moving and exercising. Considering that every living learns its around through moving, touching and feeling since the first days of life; it is obvious how important moving is in order to sustain life healthily. Nevertheless, especially education system enforces children to swim in the theoretical knowledge sea. The United Nations Children's Rights Convention states that each child has the right to attend a holistic education that respects natural environment, and that one of the fundamental factors that will contribute to children’s social emotional development in their future lives is also natural environment. Hartle (1994) found in the study investi-gating children's social interactions that preschoolers use better communication and perspective skills during outdoor games.

Unstructured play, indoors or outdoors, allows children to initiate activity rather than waiting for an adult to direct them, while using problem-solving skills, their imagination, negotiating skills with peers, etc. (all of which is very beneficial to children’s learning and development. The outdoors, especially diverse natural environments with varied plants and landscapes, invites children to act on their natural curiosity and, with the endless range of things to explore and question, provides a uniquely engaging environment for unstructured play. Among the added benefits, children’s natural curiosity leads to scientific learning) not only specific details of nature, but scientific method (Charles et al., 2008).

The lives of children today are much more structured and supervised, with few opportunities for free play. Their physical boundaries have shrunk. A number of factors have led to this. Parents are afraid for their children's safety when they leave the house alone; many children are no longer free to roam their neighborhoods or even their own yards unless accompanied by adults. Some working families can't supervise their children after school, giving rise to latchkey children who stay indoors or attend supervised after-school activities. Furthermore, children's lives have become structured and scheduled by adults, who hold the mistaken belief that this sport or that lesson will make their children more successful as adults (White and Stoecklin, 1998).

A Hofstra University survey of 800 mothers with children between the ages of 3 and 12 found that: 85% of the mothers agreed that today’s children play outdoors less often than children did just a few years ago; 70% of the mothers reported playing outdoors every day when they were young, compared with only 31% of their children. Also, 56% of mothers reported that, when they were children, they remained outdoors for three hours at a time or longer, compared with only 22% of their children (Clements, 2004).

Why are children spending less time outside? One study found that 94% of parents surveyed said that safety is their biggest concern when making decisions about whether to allow their children to engage in free play in the out-of-doors. Similarly, of 800 mothers surveyed by a Hofstra University researcher, 82% cited crime and safety concerns as one of the primary reasons they do not allow their children to play outdoors. But 85% of the mothers identified their child’s television viewing and computer game playing as the number one reason, and 77% cited inadequate time to spend outdoors with their children (Clements, 2004).

While technological developments are advancing at high speed, especially recently an increase is observed in tendency of some parents to go towards the nature, with their children. Many parents feel guilty because they do not spare time to care enough with their children, accordingly, they attempt to go to natural areas on all occasions where they can spend time with their family, or they support their children to regularly attend a nature sport. Well, but, what are the restrictive reasons that

parents and children have experienced in attending nature events (whether recreational or sportive).

This study was conducted in order to determine what the restrictive reasons that parents and children that have attended /desire to attend nature activities experience in accessing to these activities and what they are thinking about the benefits of nature activities for their children's personal development. It is also aimed to examine what is the main reason for the preference of children between nature and electronic devices. In line with this purpose, the participants were asked to fill in a personal information form created by the researcher, to determine the demographic characteristics of the participants and to answer the following questions:

(1) Can you access nature events easily and as often as you desire? If your answer is "no", what are the reasons?
(2) Do you think that nature events contribute to the development of your child? If your answer is "yes", then what are these developments?
Participant children were asked the following question;
(3) Do you prefer to be in nature or play with tablet computer / phone?

This research is important in terms of determining the factors that prevent participation in outdoor activities which contributes greatly to child development. It is thought that the results obtained from the research will contribute to the activities that will be done to increase the outdoor activities and participation in these activities.

MATERIALS AND METHODS

Research population consists of 50 parents who attended nature-activities (camping, trekking, seakayaking, sailing and kiteboarding) with their children (70 children aged between 8- 13) during the summer term of 2017- 2018 academic year. Since participant children aged under 18, official consents of their parents were obtained to initiate the research. Interview technique was used in the study, it is a qualitative data collection method and its basic method is verbal communication and dialogues were recorded. In the interview method, the important thing in reporting of data is not the numbers but what the participants says (Creswell, 2007). Therefore it was paid attention to keep the colloquial expressions as they are while doing analysis and reporting. Participant parents were asked to complete their personal information form prior to the activity. And then questions were asked by the researcher and the sound recording of dialogues was made. While the conversation records are reported, the names of the participants were changed. In order to determine the demographic characteristics of the participants, statistical analysis of data IBM SPSS 20.0 (Statistical package for social sciences) was used and the percentage of the questions were calculated.

RESULTS AND DİSCUSSİON

Thirty six percent of the participants were female and 64% of the participants were male. When the distribution of the participants according to age groups is examined, it was seen that 32% and 36- 41 age group constitute the biggest ratio (Table 1). The educational level of participants were 44% of the participants master, 36% university graduates, 12% doctorate and 8% high school graduates. It was seen that 32% of the participants had the largest share with 4501- 6000 TL and 28% with 6001-7500 TL revenue. Sisty eight percent of the parents had one child, 24% had 2 children and 8% had 3 children. Forty four percent of the parents spend 8-11 h a week; 28%, 4 to 7 h; 16%, 1-3 h; 8%, 12-15 h; and 4% spend more than 16 h with their children in nature. When the participants residences' distances to the nearest natural areas were examined, it was seen that a large part (44%) of the participants could access to the natural area after a distance of 17 km and above. After the participants answered the questions aiming to determine their demographic characteristics; some of their answers to the question of "can you access to nature events easily and as often as you desire? If your answer is "no", what are the reasons?" are as follows:

Metin is 42 years old, and father of two children: Unfortunately it is not easy at all. There are many reasons for this. First of all, since we reside in the city center, the distance from our residence to the nearest forest is about 35-40 km. I have to cover this distance with my own car but the gasolin prices are very high. Even if I ignore it, traffic is one of the most serious problems. In addition to these, the fatigue that I experience due to the intensive working often persuades me to stay at home.

Leyla is 32 years old, and mother of one child: There is no natural area nearby, for this reason we have to attend to nature events organized by professionals on weekends. We are very satisfied with these events. but because we have to change cities, we incur serious costs both in transportation and accommodation.

Tugba is 45 years old, and mother of two children: It is very difficult to access to the nature from the city. When we desire to attend an event, we necessarily need to consult an expert. But it is very difficult to find the right people. Everyone consider themselves specialists even if they do not have sufficient knowledge. That's why we have significant problems, so we can not trust people. I never resign my child to someone whom I do not trust.

Ahmet is 49 years old, and father of three children: I wish we could be in nature every day ... we leave the residence at 6:00 AM in the morning, together with my children. They arrive at home at 05:45 PM and I arrive at 7:30 PM. For this reason, we can not go out on weekdays. What we can do utmost is to have a walk after meal, within the site where we reside. This is also not possible to happen every day, we can be in nature only on weekends for a limited time, and we are trying to be

Table 1. Descriptive analysis table of the study group.

Variable	Group	F	%
Gender	Female	32	64
	Male	18	36
Age	30-35	8	16
	36-41	16	32
	42-47	14	28
	48-53	6	12
	54-59	6	12
Education	High School	4	8
	University	18	36
	Master	22	44
	Doctorate	6	12
Income	1500-3000 ₺	4	8
	3001- 4500 ₺	8	16
	4501- 6000 ₺	16	32
	6001- 7500 ₺	14	28
	7501 ₺- more	8	16
Number of Children	1	34	68
	2	12	24
	3	4	8
Time in Nature (in a week)	1-3 h	8	16
	4-7 h	14	28
	8-11 h	22	44
	12-15 h	4	8
	16 h - more	2	4
Distances to the nearest natural areas	0-5 km	2	4
	6-10 km	6	12
	11-15 km	10	20
	16-20 km	10	20
	21 km- more	22	44
Total		**50**	**100**

contented with that. So, I am very sory for my children. Because I grew up in the street and in nature. But they have been stuck with in concrete buildings, which arouse a feeling of doing wrong for them inside me, and pricks my conscience…

Hatice is 39 years old, and mother of one child: Considering the conditions of the society we live in, is it possible to spend time in nature as we desire? We, as parents, need to work hard to ensure a good future for our children, and take care of them as well. Every day we receive news of kidnapped, murdered, harassed, and raped children. We can not trust anyone ... my child has to wait for my spare time to be in nature. This pricks my conscience. We work weekdays, we are busy with housework on weekends, and so, we can only go to the nearest forest in limited time. In doing so, we are definitely trying to go with a few people and feel safe.

Some of participants' answers to the question of "Do you think that nature events contribute to the development of your child? If your answer is "yes", then what are these developments? are as follows:

Hakan is 45 years old, and father of two children: … My children who are permanently busy with tablet at home, who avoid having a brief chat with us, definitely aren't the same with children running around, climbing trees, leaping and jumping in nature… They physically turn into more dynamic children. They start to talk, and and start asking for everything they see. They become more curious…

Orkun is 51 years old, and father of two children: on all occasions, I try to take every opportunity for my children to attend another nature event. They learn different things in every event, and they start looking around more carefully… I observe that when we are in nature, our family ties get stronger.

Atilla is 47 years old, and father of one child: First of all, being in nature increases human endurence. While people want to cover even a short distance in the city by a car, they untiringly walk everywhere in nature and never complain about that …Since we act as a group, people in the group become more understanding, patient and sharing to others. Moreover, since we take the opportunity to observe the lives of the animals we meet in nature, we behave them more attentively and dotingly.

The participant children's answers to the question of "Do you prefer to be in nature or play with tablet computer / phone?" are as follows:

Anıl is 47 years old: I love being in nature, but I can not waive my phone as well. Because, on the time remained from school and homework, the only thing I can play and enjoy is my phone. ...

Elif is 9 years old: I wish our classes were in the forest. Thus, we would be with plants and animals. … On weekends, we would not try to go anywhere in a traffic jam.

Mert is 11 years old: I love being in nature. When I go to the forest I can run and play after my own heart. Nobody is obliged to say to me that don't run, don't disturb neighbors. So I can have more fun.

Derin is 9 years old: … When my mother went to elementary school, there was a big forestland in the school garden, and when spring came, they always had their classes in the forest, not in class. There are very few trees in the garden of the school that I attend, the places where we play are always concrete. When I look in the window, I see traffic… I think this is injustice, I want to have a class in the forest.

Tuğba is 11 years old: I love to spend time with my tablet computer, because when I come home it is my only friend. However when I am in the nature, I think I neglect it a little (laughs). … I love climbing trees and watching bugs on the ground.

As can be understood from the participant children's answers, tablet computer / phone usage is often seen as a compulsory choice. Children who have the desire to be in nature unfortunately feel the necessity of making electronic friends because of living conditions, and for this reason, they tend to use tablet computer/phone. When the study results are examined, it is seen that 64% of the participants are fathers. This situation is considered due to the fact that mothers have high responsibilities related to home life in addition to that related to their business life. When the age groups of the parents are reviewed, it is seen that the highest participation was in the age range of 36-41 years, and regarding their education levels; 44% got a master's degree, and 36% are university graduate. This situation points out that the level of education of families who direct their children to nature is quite high. It is seen that the distances from participants' residences to the nearest natural areas are 21 km and above. In two recent nationwide surveys in Holland, people who lived within one to three kilometers of green space reported significantly better health than those without such access, after researchers controlled for socioeconomic status, age, and other factors (Vries et al., 2003; Maas et al., 2006).

When the income levels of the participants are examined, it is seen that the largest group with 32% ratio has a income level between 45001- 6000 TL. According to the results of "poverty and hunger limit" related survey conducted by Confederation of Turkish Trade Unions in June 2018, the poverty line for a family of four is 5.584,20 TL. Taking into account this conclusion, it is considered that participants can not adequately direct their children to nature events due to their financial impossibility and they think nature events are expensive.

The majority of the participants answered the question of "Can you access to nature events easily and as often as you desire?" as "no", and for that they gave the reasons such as the longness of the distance from their residence to natural areas, high cost concern, fatigue resulting from intensive working periods, feeling of insecurity, and fail to access to the specialists in their field. As a necessity of today's working life, urbanization has increased and led to traffic problems. The long periods of time spent during traffic cause stress and fatigue for an individual, which leads individuals to do something without using vehicle. But, unfortunately, many city centers today are far out of walking distance to natural areas. High fuel prices, however, also increase transportation costs. Briefly, urban life can be considered as the greatest factor that keep individuals out of natural living environments. As a result of the literature review, not enough study of the factors affecting attendance to nature events has been found. However, it has been shown in some international researches that the reasons why children's dynamism and outdoor games have decreased are increased traffic, loss of playgrounds and reduced social contact with neighbors (Holt et al., 2013; Karsten and Vliet, 2016; Mitchell et al., 2007). The

increase in the number of closed areas, as well as increasingly concretion of green areas during the process of urbanization, are important factors in decreasing of children's dynamism.

The extreme increase in environmental factors-oriented parental concerns lead to restrictions on children's physical activities and restriction of their freedom to wander and play outside house, school or other areas under surveillance (Baker and Palmer, 2006). Harassment and rape cases, especially encountered recently, cause families to take some precautions and try to keep children in their control areas. It was reported in a study conducted at the University of Lancaster in 2004 that children in the age group of ten-eleven year olds were under the strict parental surveillance and were unable to play freely since their games were cut off in a slightest danger sign (Pooley et al., 2005). This, unfortunately, does not allow children to even live their everyday life adventures by means of which they use the world as a means of learning, and which provides their physical, mental and social development.

Previously reported barriers to outdoor play have included safety concerns, a lack of time, and greater pressure on academic study, as well as access to digital entertainment in the home. However, there is little support in the literature for an association between safety perceptions and children's physical activity (McFarland and Gull Laird, 2018). Another answer given by the participants is to "fail to access to the specialists in their field". Due importance is not given to open area recreation leadership in our country yet. Open area recreation leaders are those who should have been specialized in many issues such as geographical features of the region, meteorological information, interpersonal communication, etc. However, both the inadequacy of provided trainings, and under estimating nature's power can cause a group to face with many problems when they go out for nature, which leads to a decrease in confidence to open area recreation leaders. The participants stated that the time they spent in nature with their children was not enough, accordingly, they did wrong to them and it pricked their conscience. Individuals who were in childhood in the 80s and 90s are often referred to as the last generation who spent their childhood in streets, parks and natural areas. It should be considered as an extremely normal situation for parents, who often spent their childhood in natural environments, to feel discomfort in the case that their children can not benefit from these opportunities.

The participants gave positive answer to the question of "Do you think that nature events contribute to the development of your child? If your answer is "yes", then what are these developments?" in general.

They stated that their children became physically stronger and more durable, that a positive development was provided in family relations, that communication and sharing with other individuals increased, that they became more sensitive, attentive and respectful to nature, by means of attendance to nature events.

Mental disorders and mood disorders are more prevalent in urban areas, partly due to decrease in access to nature. Outdoor environments are also useful to improve children's socio-emotional skills, in addition to helping their psychomotor and cognitive development. Rivkin (2000) emphasized that children have opportunity to recognize different people or animals, and they have the chance of having all kinds of experiences with their peers and comparing their behaviors with each other through these experiences while playing outside (Creasey et al., 1998). Moreover, they can improve their communication and empathy skills by interacting with their peers during outdoor activities (Hartle, 1994; Richardson, 2007).

It was reported in the consequence of the survey in which the children attended outdoor activities were observed by their families that there was a decrease in the attention deficit symptoms of children attending activities in a greener environment than normal (Taylor et al., 1998).

Outdoor activities provide meaningful experiences to children, which lead them to be interested in natural environments, wild animals, plant species and outdoor recreation activities (Chawla and Derr, 2012). When the children's answers to the question of "Do you prefer to be in nature or play with tablet computer / phone?" were examined, it was seen that they prefered to be in nature, and compulsorily tended towards electronic devices.

Baker and Palmer (2006) stated that technology has developed rapidly than our biology's, that increasing conflict between technology-driven culture and our biological heritage has damaged to children's abilities of thinking, learning and behaving properly, and that next generation wouldn't be intelligent and balanced as it used to be as long as nothing is done to solve this problem. He also stated that the problems such as increasingly focusing, self restriction and considering other people's needs and interests are confronted in children. Children involved in a complex contemporary culture need more parental wisdom, guidance and support than ever before.

Conclusion

Growing interest of outdoor activities also suggests the need to conceptually expand areas of study for future research. For example, national impact of the nature deficit are needed, combining such measures as potential health savings, better school performance, financial impact of expanded nature recreation for children and young people. An urban region tackling such a task might then set an example for other regions by producing an annual report card on the total benefits and deficits of the

human-nature connection within the community.

While it is critical to understand children's views and experiences regarding outdoor play spaces, parents' perceptions are also important, as they have been shown to be a major determinant of children's outdoor behaviors. Parent perceptions regarding how safe an outdoor area is, for example, have been linked to the amount of time children spend outside and parental perceptions are a primary constraint to children's use of the outdoors. In a range of contexts, parents' attitudes have a strong influence on children's activities and attitude development. Parents who prefer natural settings for their children's outdoor play have young children who also prefer natural settings. Additionally, parent preferences based on setting type were related to their children's affinity toward nature. Parents who preferred forests had children with significantly stronger levels of affinity toward nature than parents who preferred the other setting types of water, fields, and parks (Ernst, 2017 Exploring Young Children's and Parents' Preferences for Outdoor Play Settings and Affinity toward Nature, 2017, International Journal of Early Childhood Environmental Education, 5(2): p. 30).

Parents feel nervous about children's outdoor play so they try to balance it by providing children these opportunities to avoid hovering or helicopter parenting. This struggle between wanting their children to be independent and wanting to protect their children supports findings that parents feel a "socially assigned responsibility" to protect their children (McFarland and Gull Laird, 2018).

Research finds that parents' safety concerns for their children act as barriers which prevent their children's participation in particular sports and physical activities (Boufous et al., 2004). Other studies have found that parental beliefs about neighbourhood safety impact children's opportunities to engage in independent physical activities (Soori and Bhopal, 2002; Weir et al., 2006). Another study based in Australia found that, although parents had positive memories of unsupervised and unstructured play outdoors in their own childhoods, they were not likely to provide such experiences for their own children (Gull-Laird et al., 2014).

Tandon et al. (2016) states that parental attitudes about playing outside, family socioeconomic status, potencial injuries, not providing appropriate clothing for playing outdoors and parental perceptions of neighbourhood safety have been found to be associated with children's opportunities for physical activity. Despite ever-increasing working hours and declining natural living environments, there is obviously a need for natural living environment. It has become a nonignorable necessity as a society to undertake initiatives to protect and increase green spaces. It is necessary to add more "nature" theme to everyday life by making arrangements such as roof gardens, urban parks, urban farming areas, gardens inside and around buildings, including municipalities and schools. The purpose herein is more than introducing nature in urban areas. People should be able to interact with these elements by using their senses more, in order to experience the physical and psychological benefits of nature and to shift the collective baseline toward a better understanding and appreciation of the natural world. The cities, designed as meshed with nature will have a reparative effect both psychologically and sociologically, and making access to nature easier will also allow younger generation to grow up as more sensitive towards nature and having environmental consciousness. When the results of the research are evaluated, it is possible to make the following recommendations:

(1) The training of outdoor recreation experts in the relevant departments of universities is an important requirement.
(2) The link between schools and natural areas should be established and children should be offered an opportunity to grow in nature from an early age.
(3) Schools and municipalities should plan outdoor activities for families and their children.
(4) Natural areas should be planned by the municipalities at points close to the living areas.
(5) Outdoor activities in schools should be part of the lesson plan
(6) Natural habitats and outdoor recreation areas should become more secure for families.
(7) While altering perceptions of parents about be in nature regarding difficulty may be a wise investment in efforts to increase time young children spend in nature.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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A study of factors and causal relationships on the results of national test: Mixed method research

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The general objective of this research was to study factors and causal relationships on the results of national test. Also, the research was conducted under three specific objectives: 1) to study causal relationships on the results of national test, 2) to create and investigate causal relationships on the results of national test, and 3) to develop excellence model in promoting the results of national test. Quantitative data were collected from 580 fourth-grade students in schools under the Office of the Basic Education Commission, Chaiyaphum Province. They were drawn using multistage sampling. Qualitative data were collected from 3 school administrators, 6 fourth-grade to sixth-grade teachers, and 6 fourth-grade students in schools under the Chaiyaphum Primary Education Service Area Office 2, using Stratified random sampling. The criterion of schools holding the results of national test higher than national level on the average in all learning strands for 6 consecutive years was employed in this research. Research instruments consisted of 30-item test, 14-item questionnaire, and 3 interview forms. Mplus Version 7.2 was applied to structural equation model and confirmatory factor analyses. The analyses revealed 3 main findings. 1) Positive relationships between observed variables were found, and all pairs of the variables showed statistical significance level of .01. This finding indicated that the relationships between the observed variables were adequate for the analyses. 2) Creation and investigation of the causal relationships demonstrated the model fits empirical data. Factors of direct and indirect effects consisted of creativity, reading literacy, and analytical thinking, showing their effects of 0.306, 0.194, and 0.095 respectively. Factors possessing only direct effects consisted of mathematical literacy and scientific literacy, showing their effects of 0.297 and 0.108, respectively. In addition, the coefficient of determination was 0.946. 3) Development of excellence model showed that the sample prescribed the principles for improving learning achievement as well as educational quality. Those principles included 3% increase in prescribed criteria of test results, performance guidelines according to the plan of learning achievement improvement, analyzing learners individually, providing several activities based on problems and needs of authentic development in accordance with the focal point of school and community environment.

Key words: Causal relationships, national test, mixed method research, structural equation model, excellence model.

INTRODUCTION

The Basic Education Core Curriculum B.E. 2551 (A.D. 2008) has divided educational measurement and

evaluation into 4 levels: classroom, school, education service area, and national levels. The national level comprises 2 types of measurement and evaluation. First, Ordinary National Educational Test (O-NET), which is the national standard-based quality assessment for students, provided for the sixth-, ninth-, and twelfth-grade students. Second, National Test (NT) provided for the third-grade students to examine the tendency of educational development and is used as a national indicator of educational quality (National Institute of Educational Testing Service, 2016). The students are tested covering 3 skills, that is literacy, numeracy, and reasoning abilities.

Office of the Education Council (2016) has set the National Education Plan Framework Bill B.E. 2560-2574 (A.D. 2017-2031) for the purpose of being a tool for developing human resources in terms of citizenship, discipline, and life quality including happiness of life at social, national, and global levels. In addition, curriculum and instructional management have been prescribed to be flexible, diverse, and able to respond to students' needs. This is in order to promote desirable behaviors, the 21st century learning skills, and life skills including developing knowledge, ability, and competency. To promote and develop human capital potential, Thai people of all ages should be good and talented, disciplined, and gain high quality of life by focusing on developing human potential as the foundation for increasing national competitiveness by improving educational quality for the 21st century learning (Office of the National Economic and Social Development Board, 2016).

The Institute for the Promotion of Teaching Science and Technology (IPST) collaborating with the Organization for Economic Co-operation and Development (OECD) has run the Programme for International Student Assessment (PISA) to assess the quality of educational system of member states and to assess students' knowledge and skills in terms of reading, mathematics, and science. The assessment results has shown that Thai students' scores in 2015 are lower than 2012 (Institute for the Promotion of Teaching Science and Technology, 2015). In case of the Ordinary National Educational Test or O-NET, the results have demonstrated that the sixth-grade students' scores in 2016 academic year are lower than 2015 academic year (Chaiyaphum Primary Education Service Area Office 2, 2017). In consequence, the results are not in line with the policy of the Office of the Basic Education Commission; in other words, instructional method should be improved to get positive learning achievement (Chaiyaphum Primary Education Service Area Office 2, 2015). As mentioned earlier, these problems should be solved by educational organizations under the goal of the 20-Year National Education Plan B.E. 2560-2579 (A.D. 2017-2036). The goal of this plan is that all Thai people receive high-quality education and life-long learning and live happily based on the Sufficiency Economy Philosophy and the changes in the 21st century (Office of the Education Council, 2017). According to the national assessment of educational quality of the third-grade students in 2013 academic year and the sixth-grade students in 2016 academic year in schools under the Chaiyaphum Primary Education Service Area Office 2, the results of relationship analysis reveal the relationships between students' scores showing statistical significance level of .01. In 2016, the sixth-grade students' average O-NET scores are mostly below national level standard. From a review of literature and related studies, there are some scholars studying and seeking proper ways in improving the results of national test. For example, Suwathanpornkul (2015) conducted the research on analysis and synthesis of strategies to develop students' quality, using Ordinary National Educational Testing (O-Net) results: a multi-case study of O-Net high score schools. This research consisted of 10 schools with a good level of O-NET performance. The qualitative data were collected using the document analysis form, interview form, and observation form. In addition, Wongchai (2015) studied the multi-level factors affecting the result of Ordinary National Educational Test (O-NET) in mathematics of sixth-grade students in educational opportunity expansion schools under Chiangrai Primary Education Service Area Office 3. However, there has not been any research investigating factors affecting the results of national test by applying the scores that show their relationships from 2 tests to instructional development purpose. Apart from that, schools have to provide learning activities to promote students' important skills for the purpose of preparing them for the complex life and the 21st century working environment (Office of the Education Council, 2017).

National test is used in educational quality assessment in terms of instruction focusing on testing, literacy, numeracy, and reasoning abilities. The assessment results are implemented during planning to improve as well as develop the national education. Factors and models affecting the results of national test are highlighted in this research; thus, learning theories as well as mentioned factors and models were synthesized using mixed method. In the first step, quantitative research method was used to gain data to assure the factors and models. In the second step, qualitative in

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Table 1. The number of sample in quantitative research.

Affiliation	Sex				Total	
	Male		Female			
	Number	%	Number	%	Number	%
Chaiyaphum Primary Education Service Area Office 1	148	25.52	142	24.48	290	50
Chaiyaphum Primary Education Service Area Office 2	144	24.83	146	25.17	290	50
Total	292	50.34	288	49.66	580	100

research method was employed to study two groups of schools. First, schools that were successful educational management were investigated to obtain the finding of best practice for being used as a model and guideline by general schools, with similar factors and contexts for better practice. Second, schools with different factors and contexts were studied to gain a guideline that can be applied to practice such academic administration and improvement of instructional management to promote student quality and learning achievement to meet the national standard.

Objectives

1. To study causal relationships on the results of national test
2. To create and investigate causal relationships on the results of national test
3. To develop excellence model in promoting the results of national test

Scope of the study

The population was 10,883 fourth-grade students of 2017 academic year in schools under the Office of the Basic Education Commission, Chaiyaphum Province. The sample was divided for 2 methods of research: (1) Quantitative research comprised 580 fourth-grade students of 2017 academic year in schools under the Office of the Basic Education Commission, Chaiyaphum Province drawn using stratified random sampling to gain data for validity check of structural equation model; (2) Qualitative research comprised 15 people divided into 3 groups (3 school administrators, 6 fourth-grade to sixth-grade teachers, and 6 fourth-grade students in schools under the Chaiyaphum Primary Education Service Area Office 2 using purposive sampling to gain data about effective instructional model).

Variables comprised 5 causal factors on the results of national test, that is analytical thinking, creativity, reading literacy, mathematical literacy, and scientific literacy.

RESEARCH METHODOLOGY

This research was to study factors and causal relationships on the results of national test, using mixed method research with 2 phases of data collection: quantitative research for the first phase and qualitative research for the second phase. The research was performed according to the following steps:

1. Review of literature, theories, and studies related to factors and causal relationships on the results of national test covering 5 aspect: analytical thinking, creativity, reading literacy, mathematical literacy, and scientific literacy was conducted to obtain important data for developing conceptual framework.
2. The conceptual framework was developed based on the reviewed literature, theories, and studies.
3. The conceptual framework was checked and edited by advisors and experts.
4. Research instruments, 30-item test, 14-item questionnaire, and 3 interview forms for interviewing school administrators, teachers, and students, were developed and validated before collecting data.
5. Data collection plan was created.
6. Quantitative data were collected from a sample of 580 people.
7. The obtained quantitative data were analyzed using descriptive statistics and inferential statistics as well as using Mplus program for structural equation analysis. Then the findings obtained from quantitative research were summarized.
8. Qualitative data were collected from a sample of 15 people; school administrators, teachers, and fourth-grade students in school under the Chaiyaphum Primary Education Service Area Office 2.
9. The obtained qualitative data from interviewing school administrators, teachers, and students were analyzed using content analysis followed by conducting analytic induction.
10. The findings were summarized and policy recommendations were proposed. Finally,the research report was written.

RESULTS

Results of studying relationships on the results of national test

Analysis results of basic information of the sample in quantitative research for investigating general characteristics of the sample are shown in Table 1.

Table 1 indicates that the number of the sample for quantitative research is equal in both affiliations. Classified based on sex, there are 292 males (50.34%) and 288 females (49.66%), the proportion between male and female is almost equal. Based on service area, there are more males than females in the service area office 1 but more females than males in the service area office 2.

Analysis results of elementary statistics on factors

Table 2. Elementary statistics of factors affecting national test.

Variable	n	Min	Max	$\overline{X}$	S	C.V.	Sk	Kur
1. Analytical thinking								
1.1 Factor Analysis	580	2	5	3.047	0.801	26.288	0.057	-1.115
1.2 Relationship Analysis	580	1	5	3.117	0.808	25.922	0.197	-0.549
1.3 Principle Analysis	580	2	5	3.040	0.814	26.776	0.408	-0.394
2. Creativity								
2.1 Originality	580	1	5	2.967	0.858	28.918	0.474	-0.535
2.2 Fluency	580	1	5	3.038	0.849	27.946	0.302	-0.709
2.3 Flexibility	580	1	5	2.953	0.967	32.746	0.461	-0.710
3. Results of national test								
3.1 Literacy	580	8	35	17.960	4.934	27.472	0.418	-0.196
3.2 Numeracy	580	6	27	16.926	4.182	24.708	0.171	-0.825
3.3 Reasoning Abilities	580	9	34	19.719	5.544	28.115	0.307	-0.602
4. Reading literacy								
4.1 Reading Comprehension	580	1	4	3.284	0.721	21.955	-0.591	-0.845
4.2 Reading for Main Idea	580	1.5	4	3.158	0.615	19.474	-0.451	-0.271
4.3 Interpretation	580	1.5	4	3.257	0.698	21.431	-0.528	-0.919
5. Mathematical literacy								
5.1 Chart and Three Dimensional Shape	580	1	4	3.357	0.694	20.673	-0.826	-0.300
5.2 Thinking and Reasoning	580	1	4	3.348	0.575	17.174	-0.862	0.544
5.3 Problem Posing and Solving	580	1.5	4	3.277	0.683	20.842	-0.574	-0.729
6. Scientific Literacy								
6.1 Scientific Phenomena	580	1	4	3.358	0.698	20.786	-0.906	0.036
6.2 Inquiry Process	580	1	4	3.319	0.597	17.987	-0.823	0.674
6.3 Interpretation of Data	580	1	4	3.244	0.839	25.863	-0.849	-0.452

affecting national test are presented as Table 2.

According to Table 2, observed variable is used for measuring the factor of analytical thinking showing mean ($\overline{X}$) of 3.040 – 3.117. Considering its sub-variables, relationship analysis displays highest mean ($\overline{X}$ = 3.117) including showing its standard deviation (S) = 0.808, right-skewed distribution (Sk) = 0.197, kurtosis (Kur) = -0.549. Factor analysis displays second highest mean ($\overline{X}$ = 3.047) including showing its standard deviation (S) = 0.801, right-skewed distribution (Sk) = 0.057, and kurtosis (Kur) = -1.115. Principle analysis displays the lowest mean in this variable ($\overline{X}$ = 3.040) including showing its standard deviation (S) = 0.814, right-skewed distribution (Sk) = 0.408, and kurtosis (Kur) = -0.394.

Analysis results of coefficient between observed variables reveal that the relationships between 18 observed variables demonstrate positive relationships of 153 pairs of the variables, and all pairs of them show statistical significance level of 0.01. This means that the relationships are adequate for analyses with Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.911, Bartlett's Test of Sphericity Approx. Chi-Square = 3.874, df = 153, and p = 0.000.

Results of creating and investigating causal relationships on the results of national test

After investigating the causal relationships on the results of national test by linear structural relationship analysis using Mplus program, the results are shown in Figure 1 and Tables 3 and 4.

Figure 1 exhibits the investigation results of causal relationships on national test considering from statistics using for testing goodness of fit between developed

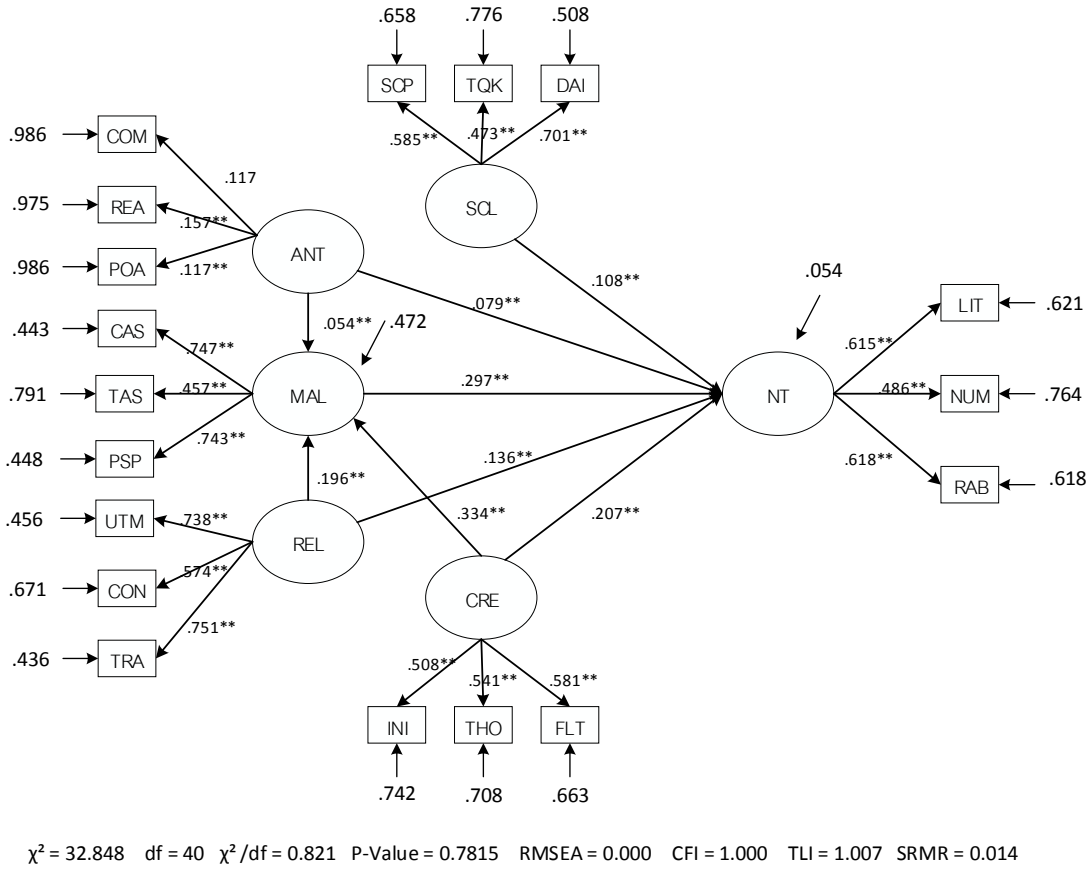

Figure 1. Causal relationships on the results of national test.

model and empirical data. After adjusting the model, the results are as follows: Chi-square = 3.874 at Degree of Freedom of 40 showing no statistical significance (P = .7815), Comparative Fit Index (CFI) = 1.000, Tucker-Lewis Index (TLI) = 1.007, Root Mean Square Error of Approximation (RMSEA) = 0.000, and Standardized Root Mean Square Residual (SRMSR) = 0.014. From the results, it can be indicated that the developed model theoretically fit empirical data.

Total effect (TE), indirect effect (IE), and direct effect (DE) are shown in Tables 3 and 4. From Tables 3 and 4, the results of national test obtained the most positive total effect, both directly and indirectly, from creativity factor with the effect of 0.306 followed by reading literacy factor with the effect of 0.194 and analytical thinking factor with the effect of 0.095.

The mathematical literacy factor had the most direct effect on the results of national test, with the effect of 0.297; followed by creativity factor, with the effect of 0.207; reading literacy factor, with the effect of 0.136; scientific literacy factor, with the effect of 0.108; and analytical thinking factor, with the effect of 0.079.

The mathematical literacy factor is positively affected directly by reading literacy factor, with the effect of 0.334 followed by creativity factor with the effect of 0.196, and analytical thinking factor with the effect of 0.054.

Considering the coefficient of factors determination, its value is 0.946, which indicates that the factors in the form of causal relationships on the results of national test can be generally used for describing variance of factors affecting the results of national test (94.60%).

Results of developing excellence model in promoting the results of national test

Analysis results of the basic information of a sample of 15 people from 3 different schools in quantitative research reveal that each school consists of a sample of 5 people; 1 school administrator, 2 teachers, and 2 students.

In quantitative research, the sample was interviewed about causal factors on the results of national test. The results are divided into following 5 points.

(1) In analytical thinking factor, school administrators set up policies and provide guidelines for managing learning

Table 3. Direct effect (DE), indirect effect (IE), total effect (TE) of latent variables, and standard error of causal relationships on the results of national test.

Criterion variable	Factor variable	Direct effect (DE)	Indirect effect (IE)	Total effect (TE)
Results of National Test (NT)	Analytical Thinking (ANT)	0.079** (0.018)	0.016 (0.007)	0.095** (0.016)
	Creativity (CRE)	0.207** (0.078)	0.099** (0.030)	0.306** (0.069)
	Reading Literacy (REL)	0.136** (0.048)	0.58 (0.028)	0.194** (0.056)
	Mathematical Literacy (MAL)	0.297** (0.094)	-	0.297** (0.094)
	Scientific Literacy (SCL)	0.108** (0.037)	-	0.108** (0.037)
Mathematical Literacy (MAL)	Analytical Thinking (ANT)	0.054** (0.015)	-	0.054** (0.015)
	Creativity (CRE)	0.196** (0.056)	-	0.196** (0.056)
	Reading Literacy (REL)	0.334** (0.069)	-	0.334** (0.069)

**Showing statistical significance level of 0.01. Values in parentheses represent standard error.

Table 4. Correlation matrix between latent variables.

Latent variable	ANT	CRE	NT	REL	MAL	SCL
ANT	1.000					
CRE	0.525**	1.000				
NT	0.592**	0.437**	1.000			
REL	0.558**	0.456**	0.554**	1.000		
MAL	0.564**	0.483**	0.549**	0.727**	1.000	
SCL	0.595**	0.458**	0.502**	0.692**	0.696**	1.000

**Showing statistical significance level of 0.01.

activities by giving teachers freedom to provide practice-based learning including preparing instructional media under the extent specified in curriculum. Teachers provide and insert activities promoting analytical thinking into other subject areas, while students can practice their analytical thinking during learning such as mathematics, arts, and Thai.

(2) In creativity factor, school administrators provide practices as well as evaluation for teachers by giving them freedom in terms of instructional management including promoting the use of media, especially multimedia, and promoting student to learn by doing, such as making a tiny book. In case of teachers, they can have the guidelines for carrying on activities and doing evaluation by allowing students to get involved in designing learning activities as well as implementing group process and project-based learning. For students, their favorite activities are science experiment, invention, and making tiny books.

(3) In reading literacy factor, school administrators have the guidelines for instructional management in terms of using innovation to solve illiteracy problem among students including putting projects in an operational plan, promoting creation of media, and giving priority to buying books for a library. In terms of teachers, model on promoting students' reading literacy is integrated in all subject areas. For students, they are promoted their reading literacy by reading as well as making a reading summary, and project-based learning activities.

(4) In mathematical literacy factor, school administrators set a policy in organizing instructional activities and mathematics competitions for students without expectation of prize except experiences students will get, and examining the outcomes of teaching. Moreover, using games in the classroom is promoted. At the same time, teachers have techniques and methods in teaching mathematics that do not make students get bored by using games, using attractive teaching style, and trying to get them remember complex theories. In case of students, geometry is their favorite topic in mathematics, because they can create many things in different shapes. In addition, they enjoy number crunching, learning fractions, and telling time.

(5) In scientific literacy factor, school administrators provide operational guidelines and promote participation in academic competitions arranged by other organizations, including emphasizing scientific process such as experiment or learning by doing. As for teachers, they provide interesting instructional style and evaluation of science for students such as learning by doing,

learning outside the classroom, learning through multimedia, and getting involved in the Little Scientists' House Project. Students, therefore, can have opportunities to learn in science classroom, and they prefer scientific experiment and using or touching real objects.

The results of developing excellence model in promoting the results of national test according to authentic investigation and data about sample schools reveal that schools have analyzed students individually and created the guidelines for developing students individually. The results of O-NET have been used as the standard for improving lesson plan allowing students to experience virtual test based on the concept of the National Institute of Educational Testing Service. In addition, strategic plan has been created to raise students' learning achievement, and there have been various activities for improving the quality of students based on the focal point of school. All activities have been planned, designed and carried on with cooperation from many sectors. Trace and care system has also been created to develop and solve problems encountered by the students individually. Classroom research as well as development of the schools to become a learning society of the community has been conducted. Similarly, teachers have advanced in terms of instructional activity management for the 21st century. Apart from this, community or locality involvement has been highlighted regarding Local Wisdom Project, support of local resources, and project monitoring and evaluation. Regarding students, a project concerning educational opportunity promotion for students has been developed using an educational administration system called "SMILE Model" together with focusing on students' quality development, life planning skills, and appropriate behaviors. Finally, the project "Parents as Teacher, Promotion of Wisdom" has been performed.

DISCUSSION

The results of studying causal relationships on the results of national test showed that according to the relationships between 18 observed variables, there were 153 pairs of variables demonstrating positive relationships and statistical significance level of .01. This means that the relationships are adequate for the analyses. According to investigation of data distribution in each variable, normal distribution was found when Maximum-likelihood Estimation of Confirmatory Factor Analysis used the Skewness between -3 and +3 and positive Kurtosis (or greater 0) (Vanichbuncha, 2013). These results, Skewness (-0.906 – 0.474, |Mean|= -0.201) and Kurtosis (-0.919 – 0.544, |Mean|=-0.439), met the criteria. In testing the suitability of data, Kaiser-Mayor-Olkin (KMO) was used to examine the relationships between variables (Poonpong, 2014), and the analysis found that KMO = 0.911. The results of hypothesis testing of the relationships between variables employing Bartlett's Test of Sphericity with Chi-square approximation distribution at significance level of < 0.05 revealed that χ^2 = 3.874 and P-value < 0.001, so the data can be used in continued factors analysis.

The results of creating and investigating causal relationships on the results of national test confirmed that the model fits the empirical data. The results generally showed that the factors having direct and indirect effect on the results of national test were creativity, reading literacy, and analytical thinking (Effect = 0.306, 0.194, and 0.095, respectively). The factors having direct effect on the results of national test were mathematical literacy and scientific literacy (Effect = 0.297 and 0.108, respectively).

Creativity factor having an effect on the results of national test was composed of 3 observed variables that is originality, fluency, and flexibility. According to the results, creativity factor had both direct and indirect effect on the results of national test (Effect = 0.306). It can be said that creativity is the mental ability to think complicatedly and diversely, "Divergent Thinking", comprising originality, fluency, and flexibility. Naturally, all human beings have creativity and positive thinking that can lead to new things that will benefit to individuals and public; however, usability depends on obtained development and promotion (Tweesak, 2016). Boonnita (2015) studied on the development of creative thinking using the creative skills practice on computer project subject. The results revealed that efficiency index was 0.5106 or 51.06%. Students' scores increased after skill training. Their average score after skill training was 47.52 or 79.20%, which increased from the score before skill training, which was 34.50 or 57.50%; and their average development score was 50.69%.

Reading literacy factor had both direct and indirect effect on the results of national test (Effect = 0.194). Reading literacy is the ability of readers to read correctly within prescribed time and to understand what they read (Bureau of Academic Affairs and Educational Standards, 2014). Moreover, reading literacy is defined as knowledge and skill of reading comprehension including interpreting what the readers perceives from reading, and evaluating as well as analyzing based on purposes in writing (Institute for the Promotion of Teaching Science and Technology, 2015). Furthermore, reading is regarded as a tool for knowledge acquisition, especially school age people, as well as a tool for a successful career; in other words, knowledge gained from reading is beneficial to personal and career development (Ratchaneekool, 2015).

Analytical thinking factor had both direct and indirect effect on the results of national test (Effect = 0.095). From the result, it can be explained that analytical thinking is

intellectual ability composed of analytical thinking of content and analytical thinking of relationship. Analytical thinking of content is the decomposition of factor while analytical thinking of relationship is analysis of relationship between factors to examine the relationship of data reasonably and to check and find out more data for decision-making (Worakamin et al., 2016). Analytical thinking influences the results of national test, which is consistent with the study of Potisutha (2014) on the development of learning achievement and thinking analysis skills of concerning environmental problems in North and South America through the cooperative learning model with the six thinking hats technique of grade 3 students. The result revealed that the students' learning outcome after participating in learning was better than one before participating in learning showing statistical significant level of .05.

Mathematical literacy factor had direct effect on the results of national test (Effect = 0.297). This is because the Institute for the Promotion of Teaching Science and Technology or IPST (2015) has determined the elements based on the evaluation framework of OECD/PISA, focusing on students' mathematical understanding and skills to face the real world as much as possible. In other words, mathematical literacy is regarded as situation or context mostly close to the students, so it can influence the results of national test. Supported by the study of Pejchang (2015) on the development of mathematics achievement on probability for grade 11 Students by the Polya process, the students' mathematics learning achievement after learning was higher than before, with .05 level of statistical significance. In addition, the study of Leeyana (2015) on the mathematical learning achievement on probability for IPST students in grade 9 using the 7E learning cycle and STAD methods showed that the students' average achievement score was 20.17 which was higher than the 50% of deducted scores from pre-test exam (16.13).

Scientific literacy factor had direct effect on the results of national test (Effect = 0.108). This is because scientific literacy originates from 4 associated factors: 1) intellectual development, 2) understanding of environment, 3) use of reasoning and thinking for inquiry process, and 4) mind habits. Comparing these factors in the form of a four-sided pyramid, scientific is at the top of the pyramid, so instructional management has to emphasize students' scientific literacy. The Department of Academic and Educational Standards (2014) defined scientific literacy as the ability for a person to connect real life situations with relevant scientific issues by creating a discourse with the reason related to science and technology. Capacity and scientific knowledge in the context of disease and health, natural resources, environmental quality, harm, and advanced science and technology in accordance with the PISA framework is required.

This conforms to the study of Khanthasiri (2014) on an organization of learning activities on the topic "Life and the Environment" using the Inquiry and the socio-scientific issue-based approaches to promote learning achievement in science literacy and decision making for sixth-grade students. The results found that students' average scores of learning achievement, scientific literacy, and decision-making were 58.33, 56.67, and 67.58% respectively; besides learning achievement in science literacy is also higher.

The results of developing excellence model in promoting the results of national test obtained from in-depth interview with school administrators, teachers, and students as well as analyzing data about sample schools. The findings consisted of analyzing students individually, implementation of O-NET analysis results in improving lesson plan, organizing virtual test, creation of strategic plan to raise learning achievement, planning as well as design and running the activities with the cooperation, developing school into learning center, test construction based on learning standards, support of resources from community, community involvement, project regarding educational opportunity promotion for students using an educational administration system "SMILE Model", administration of students' quality development, emphasis on life planning skills as well as appropriate behaviors, and conducting project like "Parents as Teacher, Promotion of Wisdom".

Conclusion

The results of studying causal relationships on the results of national test show that according to the relationships between 18 observed variables, there are 153 pairs of the variables demonstrating positive relationships and statistical significance level of .01. This indicates that the relationships are adequate for analyses.

The results of creating and investigating causal relationships on the results of national test reveal that the model fits the empirical data (χ^2 = 32.848, df = 40, χ^2/df = 0.821, p-value = 0.7815, CFI = 1.000, TLI = 1.007, RMSEA = 0.000, and SRMR = 0.014).

The results of national test receive the most positive total effect, both directly and indirectly, from creativity factor (Effect = 0.306) followed by reading literacy and analytical thinking (Effect = 0.306 and 0.095 respectively). The factor having the most direct effect on the result of national test is mathematical literacy factor (Effect = 0.095) followed by creativity, reading literacy, scientific literacy, and analytical thinking factors (Effect = 0.207, 0.136, 0.108, and 0.079 respectively). The obtained coefficient of determination is 0.946, indicating that the factors in the form of causal relationships on the results of national test can be used for expressing variance of factors affecting the results of national test

(94.60%).

The results of developing excellence model in promoting the results of national test are concluded as following.

(1) The sample schools specify the principles to improve learning achievement and educational quality by increasing the criteria of test results by 3% in all subjects as well as setting the guidelines according to the plan of learning achievement improvement that is creation of guidelines for developing students individually and implementation of O-NET analysis results in improving lesson plan.
(2) Schools provide various activities for improving the quality of students based on authentic problems and needs corresponding to the focal point of the school and local or community characteristics. In terms of administrative process, school administrators plan, design, and run the activities with the cooperation. Historical results of evaluation and operation are applied to the development, in accordance with the development goal. For teachers, they organize student-centered instruction.
(3) Factors leading to meeting the criteria for being a best-practice small-sized school comprise participative management, creation of plans and projects on cooperation with related parties, networking for seeking cooperation, involvement of community in supporting local wisdom, and monitoring, evaluation, as well as reporting for future development.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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The development of inspirational test in learning science for junior high school students in schools under the Regional Education Office No. 14

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This study aimed at auditing the quality of inspirational test in learning situational science for junior high school students using Exploratory Factor Analysis and Second Order Confirmatory Factor Analysis. Mixed methodology was used in this study. The sample was divided into 2 groups: (1) qualitative sample of 9 experts who were lecturers in the Department of Educational Psychology, educators or scientific experts who possess published academic work, and experts in religion, and sample of 6 students in Princess Chulabhorn's College Buriram and (2) quantitative sample of 2 student groups, that is, 450 students for Exploratory Factor Analysis and 709 students for Second Order Confirmatory Factor Analysis. The results can be presented based on 3 steps. In step 1, employing quantitative methodology to synthesize literature and related research, 6 factors and 30 indicators were found. Then the outline obtained from the synthesis was applied to in-depth interview with the experts and the students, and the result showed that there were 6 factors and 30 indicators. In step 2, the result obtained from the Exploratory Factor Analysis revealed that there were 6 factors found in the inspirational test, that is, (1) intrinsic motivation, (2) positive effect, (3) confidence, (4) creativity, (5) commitment, and (6) faith. In step 3, the result gained from the Second Order Confirmatory Factor Analysis demonstrated that the model showed its construct validity according to consideration of statistical validity test (e.g. = 368.876, df = 339, p-value = 0.1270, CFI = 0.991, TLI = 0.988, RMSEA = 0.011, SRMR = 0.026, and χ^2/df = 1.088). The standardized factor loading of measurement model of all indicators showed statistical significance of 0.05.

Key words: Inspiration in learning science, mixed method research.

INTRODUCTION

In developing scientific and technological knowledge, scientists believe that research with strong scientific method as well as scientists' ethics can lead to new discoveries which are sustainably beneficial to

improvement of life and social quality. Therefore, motivation and inspiration to implement scientific and technological knowledge in creating innovation which has a positive effecton Thai society are promoted to increase young scientists possessing high potential including new concept and knowledge which can be applied to national development in the future (Phetchaburi Rajabhat University, 2014).

Learning management in science is currently focused more on subject matter than affective domain because measurement and evaluation emphasize learning achievement which has a strong influence on learners' further study in a reputable educational institution. As a result, learners do definitely not have scientific understanding due to lack of motivation and inspiration. In fact, they should be inspired to learn and enjoy acquiring knowledge with appropriate instruction of science. According to science learning management in the 21st century, powerful learning has to be obtained from learners' inspiration by seeing, touching, understanding, and enjoying through activities designed by teacher. Also, knowledge acquisition of learners is inspired by teacher even though they can access knowledge or information online anytime and anywhere (Nuangchalerm, 2014). As a result, inspiration can be beneficial to learners in terms of knowledge construction (Jamjan, 2015), appreciation for success and ambition, self-confidence (Tonghom, 2013), knowledge application, and stimulation of learning science and technology with creativity (Kachintorn, 2015).

According to reviewed literature and related research on inspiration conducted in Thailand, there has not been any developed inspirational test in learning science used in measuring inspiration (Yoelao et al., 2013). In case of inspirational test development in foreign countries, structuralism of inspirational factors was studied, and 7-point scale test was developed. After that the studies on inspiration were conducted by implementing inspirational test developed by Thrash and Elliot (2003), and there were many variables used as the indicators of inspirational characteristics such as intrinsic motivation, openness to experience, absorption, work mastery, creativity, positive effect, perceptual competence, self-esteem, optimism, and self-determination. However, there were 5 out of 10 variables used as indicators of inspiration gained from daily life experiences, that is, intrinsic motivation, openness to experience, work mastery, creativity, and positive effect (Thrash and Elliot, 2003). These are also employed to develop a tool for auditing and measuring the inspiration (Oleynick et al., 2014).

For Thailand, inspirational test developed by Thrash and Elliot (2003) was applied to evaluation research on watching movies to build inspiration among under-graduates in Srinakharinwirot University for the purpose of measuring the inspiration of learners at higher education level only (Yoelao et al., 2013). However, there was not any inspirational test applied to learners at primary and secondary levels.

As mentioned earlier, the studies on inspiration are mostly found in foreign research, that is to say, the studies on this field in Thailand are somewhat fewer, and the inspirational test is adapted from foreign research. Nevertheless, the adapted test does not match with the context of Thai society, and it can be applied to general people only. Also, inspirational test in learning science has not been found. Therefore, the researcher saw the inspiration as important and developed inspirational test based on the concepts of Thrash and Elliot (2003) and Yoelao et al. (2013) to measure individual internal characteristics. This test was designed appropriately for junior high school students to be used for checking the validity of developed test to gain the characteristics that match with the context of Thai society. Inspirational test in learning situational science with 4 choices was used, and score of each choice was based on feeling levels of Krathwohl et al. (1964). This study not only attains to inspirational test with high quality, standard, and reliability, but also helps improve the inspiration among junior high school students. It is also the guidelines for developing the quality of inspirational test in learning science for students in the future.

Objective

To audit the quality of inspirational test in learning situational science for junior high school students using Exploratory Factor Analysis and Second Order Confirmatory Factor Analysis.

Scope of the study

Population and sample

(1) The population of this study was 246,047 junior high school students during the second semester of 2017 academic year in schools under the Regional Education Office No. 14.
(2) The sample was divided into the following 2 groups: (a) Qualitative sample of 9 experts who was lecturers in the

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Department of Educational Psychology and educators or scientific experts who possess published academic work including experts in religion, and sample of 6 students in Princess Chulabhorn's College Buriram; (b) Quantitative sample was composed of 2 student groups: (i) A group of 450 students from 5 schools in Chaiyaphum Province for Exploratory Factor Analysis drawn by Purposive Sampling and (ii) A group of 709 students from 12 schools in the school in Chaiyaphum Province for Second Order Confirmatory Factor Analysis drawn by using Multistage Sampling.

Content

The content on factors and indicators of inspirational characteristics in learning science for junior high school students was highlighted in this study.

Tools

(1) 6-factor interview form on inspiration in learning science for collecting data from the experts.
(2) 60-item inspirational test in learning situational science.
(3) 30-item inspirational test in learning situational science.

METHODOLOGY

This study focused on developing factors and indicators of inspirational characteristics in learning science for junior high school students using mixed methodology of sequential design; in other words, qualitative method is dominant while quantitative one is less dominant. The development was divided into 3 steps: synthesizing factors and indicators of inspirational characteristics in learning science, auditing the quality of inspirational test in learning situational science for junior high school students using Exploratory Factor Analysis, and auditing the quality of inspirational test in learning situational science for junior high school students using Second Order Confirmatory Factor Analysis.

Step 1:

Factors and indicators of inspiration in learning science were synthesized using qualitative method through reviewing related theories, textbooks, documents, and research. Then the obtained content was analyzed to determine an outline of variables for developing factors and indicators of inspiration in learning science. After that, the outline was applied to the in-depth interview with 15 experts who had a good command of scientific learning management. Most of the experts eventually went along with factors and indicators of inspiration.

Step 2

The quality of inspirational test in learning situational science for 450 junior high school students from 5 schools in Chaiyaphum Province was audited using Mplus Version 7.2 for Exploratory Factor Analysis.

Step 3

The quality of inspirational test in learning situational science for 709 junior high school students from 12 schools in Chaiyaphum Province was audited using Mplus Version 7.2 for Second Order Confirmatory Factor Analysis.

RESULTS

Step 1

Synthesis of factors and indicators in learning science from reviewing theories, textbooks, documents, and research related to inspirational characteristics, factors, and indicators conducted by Bass and Avolio (1994), Thrash and Elliot (2003), Oleynick et al. (2014), Adler (2008) cited in Juhl and Fuglsig (2009), Fulmer (2007), Tansakul (2000), Wipawin (2008), Samutachak (2009), Panmanee (2013), Maksuriwong (2010), Yoelao et al. (2013), Tonghom (2013), Phureesitr (2015), Gothica (2015), and Oonla-or (2010) can receive 6 factors and 30 indicators of inspiration as presented in Table 1.

Step 2

The result of quality audit of inspirational test in learning situational science for 450 junior high school students from 5 schools in Chaiyaphum Province using Mplus Version 7.2 for Exploratory Factor Analysis can be presented as the following.

Analysis result of correlation coefficient between the items of inspirational test in learning situational science

Relationships between the items of inspirational test were studied to consider the appropriateness of correlation matrix used for analyzing whether the correlation coefficient of factors was different from 0. If any item or variable did not show the relationships; in other words, it did not have a common factor, it would not be used for factor analysis. The result from analyzing the relationships between variables of inspirational test in learning situational science showed 435 pairs of relationships between all items. Apart from that, the correlation coefficient was between -0.013 and 0.664, and Bartlett's Test of Sphericity was 4.863E3 ($p< 0.000$). This can be implied that the correlation matrix was significantly different from identity matrix. In the meantime, Kaiser-Meyer-Olkin was 0.938 signifying that the variables showed the relationships among them and were suitable for factor analysis.

Table 1. Factors of Inspiration.

Characteristic-Based Indicators / Factor of Inspiration	
Characteristics / Factors	**Indicators**
Factor 1: Intrinsic motivation	1.1 Attention and enjoyment 1.2 Need of having talent 1.3 Need of challenge 1.4 Need of self-determination 1.5 Self-esteem 1.6 Perseverance
Factor 2: Commitment	2.1 Attempt to finish an assignment 2.2 Paying attention 2.3 Endurance 2.4 Trying to overcome obstacles 2.5 Desire of real fact accessibility
Factor 3: Positive effect	3.1 Eagerness 3.2 Happiness 3.3 Satisfaction
Factor 4: Confidence	4.1 Assertiveness 4.2 Self-adjustment to any situation 4.3 Being able to face any situation 4.4 Being able to solve a problem with self-confidence 4.5 Being confident of doing something 4.6 Accepting the consequences with satisfaction and pride
Factor 5: Faith	5.1 Believing and trusting in a faithful person' s action 5.2 Having belief and faith 5.3 Cause-effect awareness 5.4 Having co-expectation to achieve a goal 5.5 Being confident of success
Factor 6: Creativity	6.1 Creating new things 6.2 Having spirituality of knowledge creation 6.3 Complex thinking 6.4 Having spirituality of knowledge creation developed from prior knowledge 6.5 Taking an interest in innovation

Exploratory factor analysis result

Common factors of variables in inspirational test in learning situational science were investigated using Principal Component Analysis and there were 22 factors found from the investigation. Oblique rotation after factor extraction employed Promax with Kaiser Normalization to gain the items which were obviously related to the principal component. Factor loading of over 0.30 was used as the criteria for considering and matching between item and factor properly. Any factor loading of below 0.30 with statistical significance, conversely, was matched with that factor. However, if factor loading of any item had more than one factor, the highest loading of the factor was selected. From the analysis, the factor loading in each item was found in the same factors, that is, 6 factors and 30 indicators. It was also found that indicator of one factor could belong to the indicator of others. For instance, factor 1: intrinsic motivation included 4 indicators (4 items), factor 2: positive effect included 4 indicators (4 items), factor 3: confidence included 10 indicators (10 items), factor 4: creativity included 6 indicators (6 items), factor 5: commitment included 3 indicators (3 items), and factor 6: faith included 3 indicators (3 items) as shown in

Table 2. Loading of indicators in each factors.

Indicator	Factors						Combination value
	1	2	3	4	5	6	
S1	0.637*						0.690
S3	0.769*						0.490
S5	0.339*						0.572
S7	0.326*						0.539
S10		0.328*					0.709
S12		0.732*					0.551
S14					0.282*		0.627
S15		0.317*					0.469
S18			0.261*				0.667
S19			0.413*				0.554
S22				0.408*			0.617
S24		0.293*					0.645
S25			0.547*				0.518
S28			0.308*				0.456
S29			0.246*				0.643
S32			0.428*				0.966
S33			0.528*				0.541
S35					0.439*		0.755
S37			0.230*				0.677
S39						0.330*	0.668
S42					0.396*		0.579
S44			0.301*				0.564
S45				0.290*			0.543
S48						0.469*	0.576
S49						0.297*	0.616
S52				0.249*			0.628
S54				0.182*			0.652
S55				0.323*			0.661
S57			0.278*				0.584
S59				0.213*			0.591

*P<0.05.

Table 2.

Step 3

The result of quality audit of inspirational test in learning situational science for 709 junior high school students from 12 schools in Chaiyaphum Province using Mplus Version 7.2 for Second Order Confirmatory Factor Analysis can be presented as the following.

Analysis result of correlation coefficient between noticeable variables of inspirational test in learning situational science

According to the analysis of relationships between noticeable variables of inspirational test in learning science applying Pearson's correlation to a sample of 709 people under 6 factors and 30 variables: 4 variables of intrinsic motivation (MO), 4 variables of positive effect (POS), 10 variables of confidence (CON), 6 variables of creativity (CRE), 3 variables of commitment (COM), and 3 variables of faith (FAI), the result found 435 pairs of correlation coefficient among variables. However, there were 355 pairs which were statistically significantly different from 0 ($p< 0.05$). Also, there were 398 pairs having positive relationships while only 37 pairs had negative relationships. In addition, correlation coefficient was between -0.003 and 0.558, and Bartlett's Test of Sphericity was 3.678E3 ($p<0.000$). This indicated that the correlation matrix was significantly different from identity matrix. Kaiser-Meyer-Olkin was 0.910 which was close to 1

indicating that the variables were related to each other and suitable for Second Order Confirmatory Factor Analysis.

Result of second order confirmatory factor analysis inspirational test in learning science

The result of Second Order Confirmatory Factor Analysis of inspirational test in learning situational science using Mplus Version 7.2 revealed that χ^2 = 368.876, df = 339, and *p* = 0.1270. This showed that Chi-Square was significantly from 0; in other words, it rejected the null hypothesis stating that theoretical model was consistent with empirical data considering from χ^2 which was not statistically significant. Moreover, other values were considered, for instance, Comparative Fit Index (CFI) and Tucker-Lewis (TLI) which were equal to 0.991 and 0.988, respectively; the values were close to 1. Also, considered by the researcher, Root Mean Square of Error Approximation (RMSEA) was equal to 0.011, Standard Root Mean Square Residual (SRMR) was equal to 0.026, and Relative Chi-Square (χ^2/df) was equal to 1.088. In other words, RMSEA was lower than 0.06, SRMR was lower than 0.08, and χ^2/df was lower than 2 (Hu and Bentler, 1999 cited in Khampirat, 2005) (Table 3). From this result, it can be concluded that the model was fit for empirical data, or it showed the construct validity representing linear structural relationship obtained from the analysis as illustrated in Figure 1.

According to the analysis, the coefficient of factor score can be used for creating the equations of inspirational factors in learning science as follows:

INSPI = 0.217(S1) + 0.237(S2) + 0.107(S3) + 0.070(S4) + 0.016(S5) + 0.029(S6) + 0.014(S7) + 0.036(S8) + 0.015 (S9) + 0.011 (S10) + 0.021(S11) + 0.027(S12) + 0.044(S13) + 0.013(S14) + 0.016(S15) +0.036(S16) +0.027(S17) +0.029(S18) + 0.028(S19) + 0.026(S20) +0.028(S21) + 0.029(S22) + 0.030(S23) + 0.039(S24) + 0.040(S25) + 0.031(S26) + 0.033(S27) + 0.021(S28) + 0.009(S29) - 0.019(S30)

In brief, 30 indicators were regarded as major factors for measuring the inspiration in learning science. Indicators from S1 to S29 showed positive loading which indicated that they were related to each other; however, S30 showed negative loading at low level (r was between -0.232 and 0.742). Also, the factor showing the highest loading was confidence (0.991).

DISCUSSION

In accordance with the study, inspiration in learning science consists of 6 factors: intrinsic motivation, positive effect, confidence, creativity, commitment, and faith. These factors are inclusive of human emotions and feelings.

From studying all 6 factors, it corresponds with the concept of Krathwohl et al. (1964). This is also consistent with constructionism which is a learning theory focusing on internal processes of learners in creating knowledge by connecting new experiences or information to prior knowledge to make their own understanding (Jamjan, 2015). Lewin's Field Theory can also be used to describe inspiration in learning science to clarify its meaning as well as factors influencing human behaviors as well as physical and mental development for better understanding of inspirational characteristics in learning science. From the analysis of inspirational factors, the loading of confidence, commitment, creativity, positive effect, faith, and intrinsic motivation factors were 0.991, 0.940, 0.933, 0.922, 0.854, and 0.833, respectively. It can be seen that confidence factor shows the highest loading (0.991). Discovered by Yoelao et al. (2013), idealistic personality is the most important cause of inspirational latent variable followed by socialization in terms of goal setting. The most important outcome of inspirational latent variable is motivation in self-regulation showing the loading of a major indicator which is self-regulation from intrinsic motivation. This is the ability in expression and decision on achieving something with confidence as described in Tirasupapkul (2016) that daring to be curious and encounter with experiences of satisfaction or happiness and others can occur when a person gains self-confidence; it probably reflects human spirit.

The creativity factor is consistent with Oleynick et al. (2014) finding out that inspiration is regarded as motivation for stimulating a person to achieve success, and it plays different roles in creativity process. Corresponding to Panmanee (2013), inspiration is beneficial to creativity such as (1) creating commitment to get successful, (2) being insensitive to environmental changes, (3) increase of patience and discipline to do something continuously, (4) being hopeful, joyful, and feeling extremely proud of doing and sharing something.

The positive effect factor is influenced by doing something desirable bringing about to eagerness and pride. The effect can be related to both current and future periods. According to Thepsaeng et al. (2017), the positive effect can lead to work happiness. Additionally, Jebarajakirthy and Lobo (2014), they define positive effect that it influences the senses of eagerness, excitement, inspiration, and interest.

The intrinsic motivation factor is an important mechanism in encouraging learners to be curious about surroundings; however, learners' intrinsic motivation should be cultivated during childhood stage. The intrinsic motivation also encourage learners' internal drive to set their goal and start to achieve it which results in learning motivation created by the learners (Nuangchalerm, 2014).

Table 3. Result of Second Order Confirmatory Factor Analysis of Inspirational Test in Learning Science.

Variable	Coefficient of Standardized Factor Loading (β)	SE	Z	Coefficient of Factor Score (FS)	R^2
First Order Factor Analysis					
Intrinsic Motivation (MO)					
S1	0.739	0.024	31.423	0.217	0.546
S2	0.742	0.023	31.987	0.237	0.550
S3	0.535	0.031	17.082	0.107	0.286
S4	0.374	0.037	10.214	0.070	0.140
Positive Effect (POS)					
S5	0.328	0.037	8.858	0.016	0.108
S6	0.521	0.033	15.607	0.029	0.271
S7	0.346	0.038	9.160	0.014	0.120
S8	0.622	0.029	21.079	0.036	0.387
Confidence (CON)					
S9	0.315	0.037	8.544	0.015	0.099
S10	0.279	0.038	7.394	0.011	0.078
S11	0.417	0.034	12.175	0.021	0.174
S12	0.462	0.033	13.838	0.027	0.213
S13	0.652	0.026	25.437	0.044	0.425
S14	0.369	0.036	10.276	0.013	0.136
S15	0.273	0.038	7.166	0.016	0.074
S16	0.614	0.027	22.668	0.036	0.377
S17	0.473	0.033	14.416	0.027	0.224
S18	0.520	0.031	16.747	0.029	0.270
Creativity (CRE)					
S19	0.364	0.037	9.761	0.028	0.133
S20	0.411	0.036	11.327	0.026	0.169
S21	0.408	0.036	11.328	0.028	0.167
S22	0.424	0.036	11.870	0.029	0.180
S23	0.293	0.039	7.561	0.030	0.086
S24	0.542	0.034	15.830	0.039	0.294
Commitment (COM)					
S25	0.458	0.047	9.763	0.040	0.210
S26	0.260	0.046	5.676	0.031	0.067
S27	0.351	0.042	8.332	0.033	0.123
Faith (FAI)					
S28	0.183	0.034	5.335	0.021	0.034
S29	0.104	0.048	2.165	0.009	0.011
S30	-0.232	0.056	-4.177	-0.019	0.054
Second Order Factor Analysis					
MO	0.833	0.034	24.639	0.033	0.693
POS	0.922	0.043	21.199	0.016	0.850
CON	0.991	0.035	28.559	0.027	0.982
CRE	0.933	0.051	18.152	0.022	0.870

Table 3. Contd.

COM	0.940	0.080	11.784	0.038	0.884
FAI	0.854	0.060	14.130	0.021	0.730
χ^2=368.876	df=339	p=0.1270	χ^2/df=1.088	-	-
CFI=0.991	TLI=0.988	RMSEA=0.011	SRMR=0.026	-	-

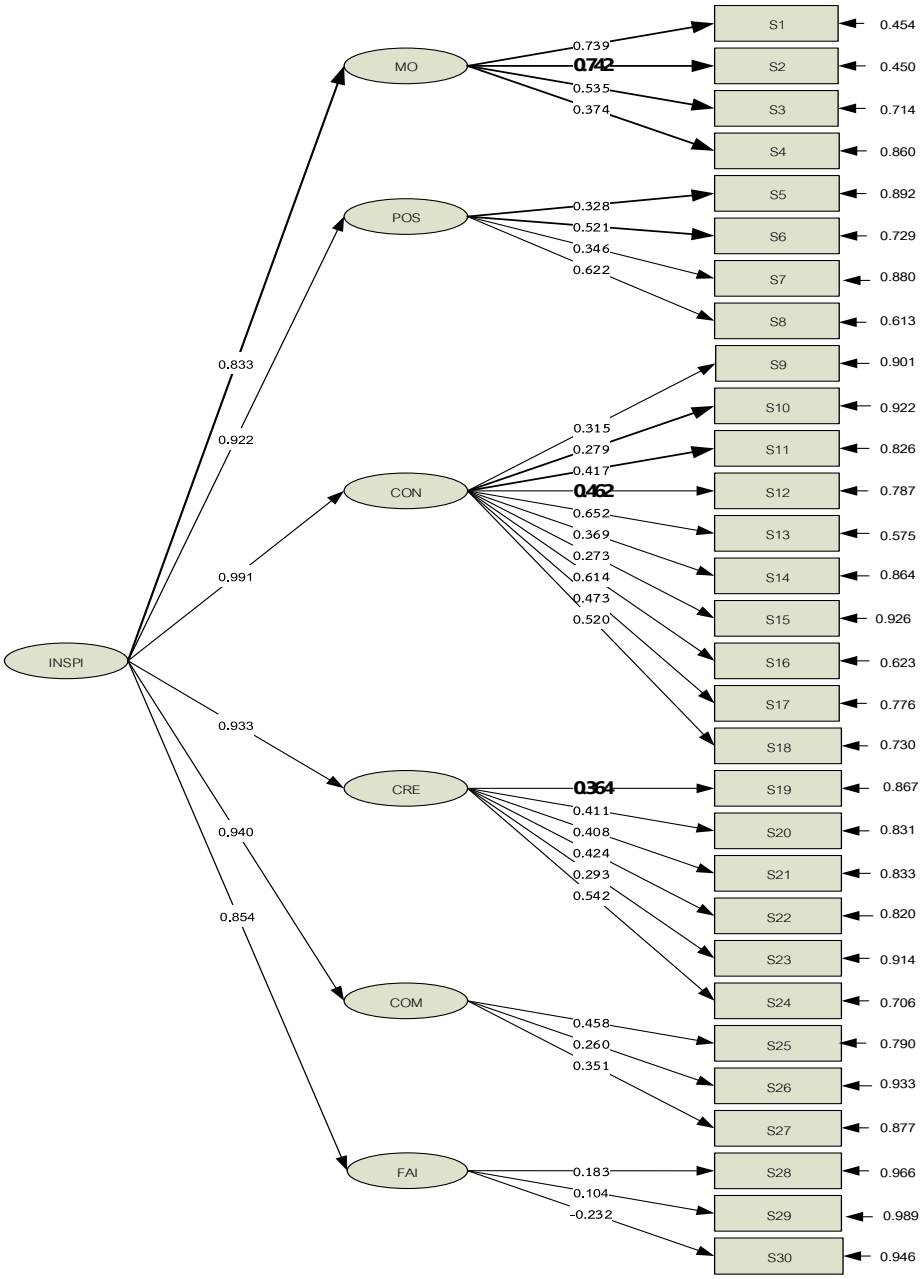

Figure 1. Model for Second Order Confirmatory Factor Analysis of Inspirational Indicators in Learning Science. χ^2 = 368.876, df = 339, p-value = 0.1270, CFI = 0.991, TLI = 0.988, RMSEA = 0.011, SRMR = 0.026, χ^2/df = 1.088.

This agrees with Yoelao et al. (2013) describing that idealistic personality is the most important cause of inspirational latent variable followed by socialization in terms of goal setting, and the most important outcome of inspirational latent variable is motivation in self-regulation.

Commitment factor is a behavior showing determination to do something seriously and continuously with accountability, endeavor, and patience to reach a goal. Said by Suwansawat (2018), inspiration together with commitment of reaching a goal is important for gaining self-development and achievement.

Faith factor is defined as the senses of confidence, believability, trust, and liking towards a stimulator without enforcement or reason that causes a belief or changes a behavior into success. This is consistent with Thepsaeng et al. (2017) stating that inspiation creation can produce faith and trust. In addition, found by Yoelao et al. (2013), self-confidence, commitment to do something, and faith in expected achievement are related to inspiration creation.

It can be concluded that inspiration consists of 6 factors and 30 indicators, that is, intrinsic motivation, positive effect, confidence, creativity, commitment, and faith; all can be applied to learners.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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