

Impact of Interpretation Construction (ICON) Model on problem solving and decision-making abilities

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Abstract

The objective of the present study was to find out the impact of interpretation construction model on developing problem solving and decision making abilities among secondary school students through teaching of political science subject. For this, the *non-equivalent control group quasi-experimental research design* was used over a sample of 72 students; 36 each in experimental and control group. The students of experimental group were taught through interpretation construction model whereas the students of control group were taught through Herbartian method of teaching for eight weeks. The findings revealed that though both the instructional designs have significant impact on developing problem solving and decision-making abilities of secondary school students in political science subject but the impact of interpretation construction model is relatively more than Herbartian method. With respect to relative changes in these abilities, it was found out that increase in problem solving ability was more than decision- making ability by both the designs. The present study will help various stakeholders such as secondary school students, teachers, teacher educators, teacher training institutions, parents, administrators and policy makers for improving quality education of the country in particular and world in general.

Key Words: *Constructivist learning strategy, Experimental research, Higher order cognitive abilities, Learner centric approach, Traditional method of teaching*

Introduction

Development of problem solving and decision making abilities among the students is time relevant educational goal realised by the institutions. In connection to development of these abilities within curricular frameworks, multiple pathways or strategies have been claimed by the researchers (Senan, 2013). Traditionally, teachers were using Behaviorism guided instructional strategy like Herbartian method for developing these abilities. At present, researchers have claimed about effectiveness of constructivist guided instructional designs like interpretation construction (ICON) model (Zulkarnaen, 2018; Sahu, 2013; Tsai, 2001). Though effectiveness of ICON model have been claimed and substantiated by empirical

findings but it has a contextual validity on science and mathematics related subjects (Bharati, 2014; Barik, 2009). Therefore, the present study aimed as to find out the relative impact of ICON model and Herbartian method of instruction on problem solving and decision-making abilities.

Importance of problem solving and decision-making abilities in the present time have been universally realised which leads to a priority for development of these skills within school students especially during secondary level as this is the foundation stage to face real complex world. It is documented in the literature that there are primarily two approaches for developing these abilities (Yen & Halili, 2015). The first approach is externally arranging special training programme and second one is integrating this target curriculum with pedagogical/instructional designs. The first one has the limitation for lack of immediate meaningful cognitive environment for application context but second approach is more effective from economic and application point of view. In this connection, researchers have claimed effectiveness of various instructional designs and curriculum practitioners have used these while transaction of different contents having different type of subjects. Some designs have been claimed as effective irrespective of nature of academic discipline; effectiveness of some designs have been tested upon some specific type of knowledge domains. Therefore, it leads to conflicting situation on the part of teachers to opt and utilise subject specific designs for development of these abilities due to non-availability of results about instructional designs.

Theoretical Background

Problem solving skills are series of actions an individual takes to find out solutions to the problems encountered in day to day life situations found either through prior experiences, introspection and experimentation (Wartono et al., 2019). On the other hand, decision-making is a process by which an individual or group of individuals evaluate solutions and alternatives to select the most appropriate or rational option. The cognitive skills used in problem solving and decision-making abilities are analysis and synthesis skills, critical and creative thinking, reasoning ability, logical deduction, personal and social experiences followed by information available to an individual (Chusinkunawut et al., 2018; Reeve, 2013; Schunk, 2004; Chi & Glaser, 1985). According to Chusinkunawut et al., 2018, each individual encounter multiple problems in day to day activities and try to solve these problems actively by collecting information about objects, events, phenomena and organise them into a structure of knowledge for reaching to an appropriate decision. Thus, it is natural to develop problem solving and decision-making abilities for smooth functioning of life in this multifaceted and complex society. But, a big question arises here is how to develop these abilities?; Can these abilities develop in vacuum?; If no, what are the strategies that can be used?.

A considerable number of studies have proposed that there are two approaches that can be used for teaching higher order cognitive thinking like problem solving and decision-making abilities (Yen & Halili, 2015; Zohar, 2013; Zohar & Schwartz, 2005; Rajendran, 2001, 2002). The first approach is Infusion approach (Fisher, 1999) where teaching of higher order cognitive thinking occurs in a content-specific setting. In this approach, teachers integrate higher order cognitive thinking explicitly with content specific teaching. The second approach is Separate-subject approach where a teacher does not integrate higher order cognitive thinking explicitly with content rather teachers use general strategies across the subject domains. In this approach, a set of skills or strategies are used by teachers to acquire higher order cognitive abilities. For example, associating sensory information with mental content through non-explicit, intuitive and associative processes (Gupta & Mishra, 2021); effective teaching and learning by engaging students in constructive thinking (Yen & Halili, 2015) are used in teaching these abilities. In this context, instructional designs and nature of subject or discipline have significant importance. Each design may not be appropriate for all type of academic discipline. The term “instructional design is defined as the entire process of instructional planning and implementation. It refers to the principles and procedures by which instructional materials, lessons, and whole educational systems can be developed in a consistent and reliable fashion” (Zierer & Seel, 2012). Do, all the instructional designs are equally effective for increasing these abilities?

The effectiveness of instructional designs for developing these abilities required a clear conception contextual application from evolutionary perspective. In fact the development of various instructional designs is not new rather it trace back to ancient time and have a long history. John Dewey along with some European pedagogues such as Jaen Piaget, Lev Vygotsky are known as father of modern instructional designs. The systematic planning of modern instructional designs started in 1920s. From the third decade to till date, a series of instructional designs have been emerged to meet the changing requirements of educational system across the world. From the 1950s to 1980s, three approaches of instructional movements such as i) “Skinner’s theory of operant conditioning”; ii) “Bloom’s taxonomy of cognitive domain”; iii) “Herbartian method of teaching” and iv) “the cybernetic approach of systems theory” were heavily influential (Seel & Hanke, 2011). The *Operant conditioning* of B.F Skinner was a behaviouristic learning theory rooted in Thorndike’s learning “law of effect”. It assumes the activeness of the organism can be conditioned for behaviour shaping by the use of reinforcement in proper sequence and time. As a result, educational practitioner have interrelated this psychological proposition while designing their pedagogical practices for better learning outcomes and cognitive behavioural modification among students. *Bloom’s taxonomy* of Benjamin Bloom was a behaviouristic learning theory that believes on the process of learning proceeds from lower cognitive abilities to higher cognitive abilities. For example, before understanding any concept, a student has to remember and before applying that

concept, he/she has to understand that concept properly. *Herbartian methods* of teaching is framework based on behaviourism and system approach. Due to its established effectiveness in terms of achievement of behavioural objective, it has been widely applied by educational practitioner throughout the globe. Herbartian method is scientifically designed instructional plan of action. As per this pedagogical method before presenting the learning experience, the instructional objectives would be written in behavioural terms and this behavioural objectives should be based on Bloom's taxonomy of the instructional design. As per the objective, the instructor scientifically proposes the way of transmitting the experience to the students. This method constitute five steps for lesson delivery such as introduction, presentation, association/comparison, generalization and application. Finally, the instructor uses some techniques to access how much behavioural changes has been happened among students and how much he/she is successful in achieving the target. Due to its scientific base and supportive empirical finding for bringing desirable changes among the students, this model is popularised and accepted by educational practitioner as a common method of teaching. Along with these behaviouristic approach of instructional designs, some other instructional designs were also played prominent role in 1960s and 1970s. For example, the prescriptive model of instructional design developed by Gagne and Briggs (1976), model developed by Dick and Carey (1978, 2005), instructional model of Merrill (1983) and others. All these instructional models were based on the assumptions of cognitive operations and processes (Seel & Hanke, 2011).

In response to the paradigm shift in psycho-pedagogical orientation, some educational psychologist such as Piaget, Bruner, Bandura, Ausubel, Cronbach and others realised the requirements of "cognitive revolution" in psychology (Bruner 1990). To a great extent, the Piaget's theory of cognitive development has inspired many cognitive psychologist to replace behaviourist approach and develop new learning theory called as "educational learning theory" (Bereiter, 1990). As a result, the constructivist instructional designs have been emerged in the late 1960s of the 20th century. In constructivist based instructional designs, the free learning environment and opportunities for critical and reflective thinking is encouraged (Farnham-Diggory 1972).

Based upon constructivist based principles, some instructional designs and models have been developed. Among all the instructional models based upon constructivist approach of teaching, the Interpretation construction design model (ICON design model) is one. This model was designed by Black and McClintock in 1995 and centred on the principles of "observation, contextualization, cognitive apprenticeship, collaboration, interpretation construction, multiple interpretations and multiple manifestations". Along with Black & McClintock (1995), a significant number of researches have subjected that there exists significant effect of ICON design model on higher order cognitive abilities (Zulkarnaen, 2018;

Mahapatra, 2013; Sahu, 2013; Barik, 2009 and Tsai, 2001). Among the higher order cognitive abilities, problem solving and decision-making are two of them (Tsai et al. 2015).

But, which instructional strategy is more effective for developing problem solving and decision-making abilities have been conceptualised from their individual focused behavioural objectives. Herbartian method of teaching primarily based upon system theory and its focus is on development of objectives as per Blooms instructional objectives, i.e. knowledge or memory, comprehension or understanding, application, analysis, synthesis and evaluation. As a result, the objectives like problem solving or decision-making are less focused. On the other hand ICON model based on constructivist pedagogy gives importance on active involvement of students as creator of learning experience and their supportive explanation. Some researchers are of the opinion that ICON model is primarily problem solving oriented and students use their logical stance in support of their created outcomes (Tsai et al. 2015).

Although majority of research findings support positive impact of ICON design model on higher order cognitive abilities but results have been validated on mathematics and science related subject (Enoch et al. 2019; Obrero & Obrero, 2019; Lkama, 2019; Osondu, 2018; Adak, 2017). Also some researchers have tested its effectiveness in some social science subjects like geography and economics. But a dearth number of studies are available where the effectiveness of ICON design model in political science subject were carried out (Kauts & Sikand, 2019; Parasurama, 2017; Alt, 2015; Kwan & Wong, 2015; Mahesha, 2014). Political science is an important subject taught in the general education under school education in India. Do, ICON design model has significant effect on problem solving and decision-making abilities of secondary school students in political science is an important question to be answered in the present study. Although there exists significant effect of ICON design model in science and mathematics subjects, the effect of this model in political science subject may or may not be similar. Because the essence of science and mathematics subjects are based on objective principle whereas the political science subject is subjective in nature. The political phenomena are contextual, complex, multifaceted and rapidly changing whereas science and mathematical phenomena are systematic, scientific, logical and rational. The political thoughts, ideologies, theories takes multiple shapes in multiple interpretations. Thus, the relative impact of ICON model and Herbartian methods of instruction on problem solving and decision-making abilities in political science of secondary school students was investigated in the present study.

Objectives

1) To find out the impact of ICON model on problem solving and decision-making abilities of secondary school students in political science and 2) To find out the relative changes between problem solving and decision making abilities of students of experimental group taught through ICON model and students of control group taught through Herbartian method.

Hypothesis

With reference to theoretical perspectives and its effectiveness in social science subjects, we hypothesise that ICON design model will be more effective than Herbartian method of teaching in developing both problem solving and decision-making abilities in political science.

Materials and Methods

Study Design and Participants: To meet these objectives, the non-equivalent control group quasi-experimental design was used. One secondary co-education school in western Odisha named as Balika Vidyalaya, Sambalpur, Odisha, India was selected purposively for conducting the experimentation over a sample 72 students, 36 each in experimental group and control group. The sample size of the present study was calculated through Apriori power analysis based on ANCOVA using G*Power software suggested a range of N=41-83 to detect the medium effect size ($d=0.4$) having numerator $df=1$, number of groups=2, Number of covariates=2 with 70%-95% power (i error probability 0.05). The researchers followed all the ethical procedures of sample selection and treatment recommended by Institutional Ethics Committee for Human Research (IECHR) of the University where research work was carried out. The consent of the school authority was taken before sample selection. After testing equivalency through pre-test and general mental ability test of students studying in section-A and section-B of class IX of that school, the section-A and section-B were assigned as experimental and control group respectively through lottery method.

Establishing Validity of the Experimental Design: Since it was a non-equivalent control group quasi-experimental research, some threats like history, maturation, instrumentation and selection were controlled automatically (Gay et al. 2015) whereas other threats were controlled in the following ways. The Analysis of Co-variance was used to control the statistical regression; data of participants who were having 95% and more attendance during the experimentation were only used for analysis and controlled mortality threat; as the experiment was conducted over same time, place and situation, the threat of history was controlled; the Hawthorne effect was controlled as the participants were not informed that this teaching is a part of experimentation; as there was no chance of losing marks, grades or credits, the John Henry effect was controlled. In addition to control these threats, though the influence of differential teachers' personality traits and knowledge level in students' behavioural changes cannot be undermined but in this context, total experiment in the form of teaching has been done by the same teacher.

Instruments: In the present experiment, 100 instructional materials in the form of 50 lesson plans based on ICON model and 50 lesson plans based on Herbartian method of teaching were developed by the investigator for use in experimental group and control group

respectively. Since experimental school was an English medium school, all lesson plans were developed in English. All lesson plans were developed by the investigator and validated by the suggestions of experts comprising of five subject teachers, five educationists proficient in constructivist learning strategy and interpretation and construction model and two language experts. For measuring problem solving and decision-making abilities, a self-developed multiple choice type test (consisted 12 items) in the subject of political science was used. The construction of test items based on problem solving and decision-making abilities followed such principles as i) each item was meaningful by itself and presented a definite problem in political science; ii) the items were free from irrelevant material; iii) the negatively stated items were mostly avoided; iv) all of the alternatives were grammatically consistent; v) each item consisted only one clear and correct answer; vi) All the distracters in each item were plausible; vii) the relative length of the alternatives was not providing any clue to the answer, and viii) the alternatives such as “all of the above” and “none of the above” were used sparingly. For the items under problem solving ability, the action verbs like identify steps to solve problems and choose best possible solutions for a problem were used whereas for the items under decision-making ability, the action verb decide an action in a specific situation. The items of the test were evaluated through the procedure of criterion reference test recommended by Gronlund in 1981. The item answered correctly was awarded with one mark numerically whereas the item answered wrongly was awarded with zero mark. The content validity of the test was ascertained by the experts’ judgement. The reliability coefficient calculated by Pearson’s product-moment method was 0.89 which showed the test having high test-retest reliability. Specifically, the reliability coefficients calculated for sub – tests such as problem solving and decision making were 0.81 and 0.83 respectively. Besides the problem solving and decision-making test, Raven’s Standard Progressive Matrices was used to measure general mental ability of students as intelligence has been taken as a covariate.

Experimental set up: Students of section-A (36 students of both boys and girls) were taught for eight weeks by ICON model of instruction and students of section-B (36 students of both boys and girls) were taught same units of political science by Herbartian method for same period in separate class rooms every day for one hour. While transacting content to both students of experimental group and control group, information and communication technology (ICT) and audio-visual aids were used by the investigator. Before the intervention both groups were pre-tested in their general mental ability and problem solving and decision making abilities. After intervention, students of both the groups were post-tested and the data collected from pre-test and post-test were used for data analysis.

Results

Variability between Experimental and Control group before and after intervention

It is evident from Table 1 that the means of problem solving ability of the experimental and control groups in pre-test were 1.08 and 1.33 respectively and the standard deviation of two groups were 1.18 and 1.17 respectively. It is found out that the calculated 't' value for problem solving ($t=0.90$; $df=70$; $p>0.05$) is less than the tabulated value at 0.05 level of significance. Hence, there was no significance of difference between these two groups relating to their problem solving ability in political science before the treatment. In other words, both the groups were almost same as far as their previous problem solving ability is concerned. However, the means of problem solving ability in political science of the experimental and control groups in post-test were 3.81 and 2.28 respectively and the standard deviation for two groups were 1.28 and 1.52 respectively. The calculated 't' value for problem solving ($t=4.60$; $df=70$; $p>0.01$) is greater than the probability value at 0.01 level of significance. Hence, there exists significant difference between these two groups relating to their problem solving ability in political science after the treatment. In other words, both the groups are different after the treatment.

Table 1 Summary of 't' values for variability analysis between experimental and control group before and after intervention relating to their problem solving and decision-making abilities

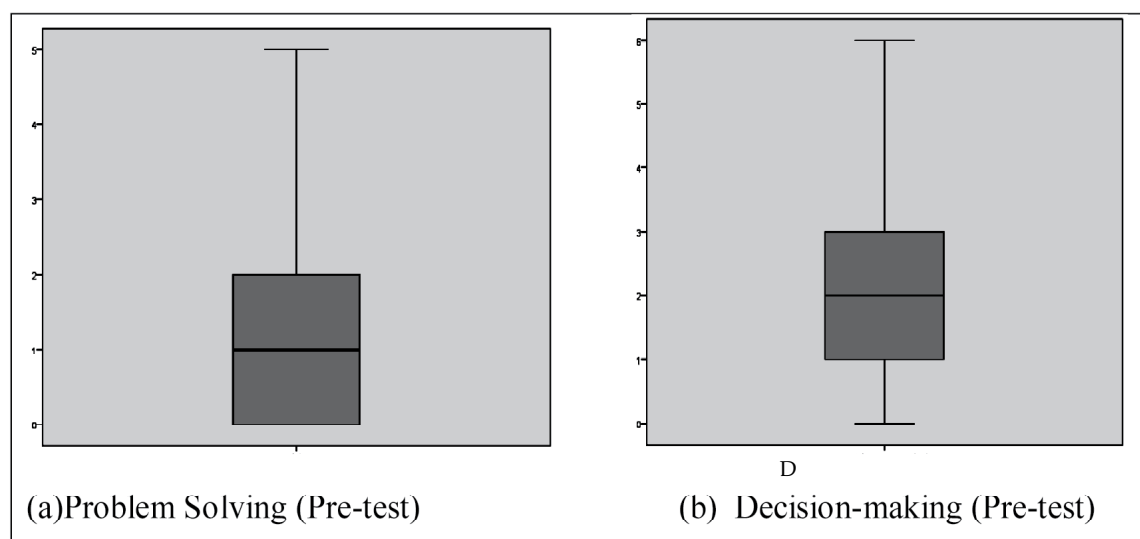
Ability	Test	Experimental Group (36)		Control Group (36)		df	't' Value	Remarks
		Mean	SD	Mean	SD			
Problem	Pre-test	1.08	1.18	1.33	1.17	70	0.90	NS
Solving	Post-test	3.81	1.28	2.28	1.52	70	4.60**	S
Decision	Pre-test	2.44	1.52	1.86	1.62	70	1.57	NS
Making	Post-test	4.33	1.07	2.83	1.38	70	5.15**	S

NS-Not Significant; **Significant at 0.01 level (S)

Further, with respect to decision-making ability, the mean scores of the experimental and control groups were 2.44 and 1.86 respectively and the standard deviation of two groups were 1.52 and 1.62 respectively. It is found that the calculated 't' value ($t=1.57$; $df=70$; $p>0.05$) is less than the tabulated value at 0.05 level of significance. Hence, there was no significance of difference between these two groups relating to their decision-making ability in political science before the treatment. In other words, both the groups were almost same as far as

their previous decision making ability is concerned. However, the means of decision-making ability in political science of the experimental and control groups were 4.33 and 2.83 respectively and the standard deviation of two groups were 1.07 and 1.38 respectively. It was found that the calculated 't' value ($t=5.15$; $df=70$; $p>0.01$) is greater than the probability value at 0.01 level of significance. Hence, there exists significant difference between these two groups relating to their decision-making ability in political science after the treatment. In other words, both the groups are different as far as their post decision-making ability is concerned. It is evident from Figure 1 (a & b) that there exists no outlier or extremes scores in problem solving and decision-making abilities at pre-test level.

Figure 1 Outlier effect of descriptive data in problem solving and decision-making in pre-test



Impact of ICON model on Problem Solving Ability of secondary school students in political science

As can be seen from Table 2 that after controlling the effect of pre-test score in problem solving ability and general mental ability scores, it is found that means of experimental and control group became 3.91 and 2.17 respectively in problem solving ability. It is evident from Table 3 that both the experimental and control groups are significantly differ as the calculated 'F' Value is greater than the probability value at 0.01 level of significance ($29.668 > p=0.01$) in favour of experimental group because the adjusted mean of experimental group is greater than the adjusted mean of control group (adjusted $M=3.91 > \text{adjusted } M=2.17$). Thus, from the above interpretation, it is concluded that teaching learning through ICON design model has

substantially improved the students' problem solving ability in political science as compared to teaching learning through Herbartian method. Thus, the null hypothesis is rejected in favour of alternative hypothesis. Therefore, the directional hypothesis stating "there exists significant impact of ICON design model on problem solving ability in political science" was retained.

Table 2 Mean and adjusted mean values of experimental group and control group in problem solving ability after controlling general mental ability and pre-test score in problem solving ability

Ability	Groups	Mean	AdjustedMean
Problem SolvingAbility	Experimental Group	3.81	3.91
	Control Group	2.28	2.17

Table 3 Summary of 'F' values for impact of ICON model on problem solving ability of secondary school students in political science when general mental ability and pre-test score in problem solving were controlled

Source	Sum of squares	df	Mean square	'F' Values
Corrected Model	61.472	3	20.491	11.669
Intercept	1.888	1	1.888	1.075
Covariate(Pre-test score in problem solving ability)	13.648	1	13.648	7.772
Covariate(General Mental Ability score)	8.031	1	8.031	4.574
Treatment	52.094	1	52.094	29.668**
Error	119.403	68	1.756	
Total	847.000	72		
Corrected Total	180.875	71		

****Significant at 0.01 level**

Impact of ICON model on Decision-Making Ability of secondary school students in political science.

As can be seen from Table 4 that after controlling the effect of pre-test score and general mental ability score, it is found that means of experimental and control group became 4.31 and 2.86 respectively in decision-making ability. It is evident from Table 5 that both the groups are significantly differ as the calculated 'F' Value is greater than probability value at

0.01 level of significance ($27.090 > p=0.01$) in favour of experimental group because the adjusted mean of experimental group is greater than the adjusted mean of control group (adjusted $M=4.31 > \text{adjusted } M=2.86$). Thus, from the above interpretation it is concluded that teaching learning through ICON design model has substantially improved the students' decision-making ability in political science as compared to teaching learning through traditional teaching. Thus, the null hypothesis is rejected in favour of alternative hypothesis. Therefore, the directional hypothesis stating "there exists significant impact of ICON design model on decision-making ability in political science" was retained.

Table 4 Mean and adjusted mean values of experimental group and control group in decision-making after controlling general mental ability and pre-test score in decision-making ability

Ability	Groups	Mean	AdjustedMean
DecisionMakingAbility	Experimental Group	4.33	4.31
	Control Group	2.83	2.86

Table 5 Summary of 'F' values for impact of ICON model on decision-making ability of secondary school students in political science when general mental ability and pre-test score in decision-making were controlled

Source	Sum of squares	df	Mean square	'F' Values
Corrected Model	58.713	3	19.571	14.989
Intercept	5.862	1	5.862	4.489
Covariate (Pre-test score in decision making ability)	12.401	1	12.401	9.497
Covariate(General Mental Ability score)	6.084	1	6.084	4.659
Treatment	35.372	1	35.372	27.090**
Error	88.787	68	1.306	
Total	1072.000	72		
Corrected Total	147.500	71		

**Significant at 0.01 level

Relative impact of Interpretation construction model and Herbartian methods of instructional designs on Problem Solving and Decision-Making Abilities.

Table 6 Summary of 't' values and percentage of changes happened in experimental and control groups from pre-test level to post-test level in problem solving ability and decision making

Ability	Group	Pre-test		Post-test		Changes in	't' Values (df=70)
		Mean	SD	Mean	SD	Mean	
Problem Solving	Experimental (N=36)	1.08	1.18	3.81	1.28	2.73 (253 %)	9.41**
	Control (N=36)	1.33	1.17	2.28	1.52	0.95 (71 %)	2.97**
Decision Making	Experimental (N=36)	2.44	1.52	4.33	1.07	1.89 (77%)	6.10**
	Control (N=36)	1.86	1.62	2.83	1.38	0.67 (36%)	2.73**

**Significant at 0.01 level

It is evident from Table 6 that the means of the experimental group in pre-test and post-test in problem solving ability were 1.08 and 3.81 respectively. So, 253% changes happened in problem solving ability of the students within experimental group who were taught through interpretation construction model and this difference is significant as the calculated 't' value is greater than the probability value at 0.01 level of significance ($t=9.41 > p.01$). But in case of control group, the means of pre-test and post-test were 1.33 and 2.28 respectively. So, 71% changes happened in problem solving ability of the students within control group who were taught through Herbartian method and this difference is also significant as the calculated 't' value is greater than the probability value at 0.01 level of significance ($t=2.97 > p.01$). Thus, it was found out that both the instructional strategies i.e interpretation construction model and Herbartian method of teaching were found significant in enhancing problem solving ability of secondary school students but the magnitude of effect of interpretation construction model is higher than the Herbartian method of teaching.

Further, the means of the experimental group in pre-test and post-test in decision-making ability were 2.44 and 4.33 respectively. So, 77 % changes happened in decision making ability within experimental group who were taught through ICON method and this difference is significant as the calculated 't' value is greater than the probability value at 0.01 level of significance ($t=6.10 > p.01$). But in case of control group, the means of pre-test and post-test scores were 1.86 and 2.83 respectively. So, 36 % changes happened in decision-making ability of students within control group who were taught through Herbartian method of teaching and this difference is significant as the calculated 't' value is greater than the probability

value at 0.01 level of significance ($t = 2.73 > p.01$). Thus, it was found out that both the instructional strategies i.e interpretation construction model and Herbartian method of teaching were found significant in enhancing decision-making ability of secondary school students but the magnitude of effect of interpretation construction model is higher than the Herbartian method of teaching.

Impact of Interpretation construction model on Problem Solving Ability as compare to Decision-Making Ability

It is evident from Table 6 that the students of experimental group taught through ICON model have increased their problem solving ability to 253% from pre-test level to post-test level whereas their decision-making ability has been increased up to 77% only. Thus, the ICON design model has brought greater impact on problem solving ability than decision-making ability.

Impact of Herbartian method on Problem Solving Ability as compare to Decision-Making Ability

It is evident from Table 6 that the students of control group taught through Herbartian method of teaching have increased their problem solving ability from pre-test to post test is 71% whereas their decision-making ability has been increased up to 36 % only. Thus, the Herbartian method of teaching has brought relatively more impact on problem solving ability than decision-making ability.

Thus, the present result study emerged with following findings such as 1) there was no significance of difference between the students of experimental group and control group relating to their problem solving and decision-making abilities prior to the experimentation; 2) there exists significance of difference between the students of experimental group and control group relating to their problem solving and decision-making abilities after the experimentation when the covariates were not controlled; 3) the students of experimental group taught through Interpretation construction model was found significantly better than the students of control group taught through Herbartian method of teaching in problem solving ability when the covariates were controlled; 4) the students of experimental group taught through Interpretation construction model was found significantly better than the students of control group taught through Herbartian method of teaching in decision-making ability when the covariates were controlled; 5) both Interpretation construction model and Herbartian method of teaching have significantly positive impact on problem solving ability of the students in political science but magnitude of effect in case of Interpretation construction model was higher than the Herbartian method of teaching; 6) both Interpretation construction model and Herbartian method of teaching have significantly positive impact on decision-making

ability of the students in political science but magnitude of effect in case of interpretation construction model was higher than the Herbartian method of teaching; 7) the Interpretation construction model used to teach the students of experimental group has brought greater impact on problem solving ability than decision-making ability and 8) the Herbartian method of teaching used to teach the students of control group has brought greater impact on problem solving ability than decision-making ability.

Discussion

Development of students' higher order cognitive abilities like problem solving and decision-making have been acknowledged to assess the quality of education at every level throughout the world. Problem solving and decision-making abilities are two important skills in sustaining socio-cultural, economic and political lives of every human being in the 21st century (Kivunja, 2014). The learner centric instructional designs are instrumental for developing higher order cognitive abilities of the students (National Curriculum Framework, 2005). Among all learner centric approaches of learning, the interpretation construction model is positively correlated with development of higher order cognitive abilities (Kwan & Wong, 2015; Lunenburg, 2011; Tsai, 2001).

From the finding, it is revealed that there exists significant impact of Interpretation construction model of teaching and learning in enhancing two higher order cognitive abilities like problem solving and decision-making abilities of secondary school students in political science subject. The result concurs to the findings of Dokmecioglu et al. 2020; Becirovic et al. 2019; Zulkarnaen, 2018; Topolovcan & Matijevic, 2017; Sheela, 2016; Kwan & Wong, 2015; Sahoo, 2013; Peter et al. 2010; Allen, 2008; Qarareh, 2016; Bardsley & Bardsley, 2007 and Tyanjakla, 1999. Further, significant positive impact of interpretation construction model on problem solving and decision-making is not linear rather mediated through multiple variables like cognitive and motivational strategies of learning (Kwan & Wong, 2015); open ended learning (Aqda et al. 2011); co-operative work, concept mapping and cognitive apprenticeship (Peter, 2010); blending of ICT with ICON model (Tsai, 2001); diversity in approach of teaching (Tyanjakla, 1999) and higher meta-cognitive regulating strategies (Dokmecioglu, et al. 2020).

Another finding of the present study revealed that the magnitude of changes occurred in both the dependent variables such as problem solving and decision-making abilities in both experimental and control groups are positive and significantly greater from pre-test level to post-test level. Therefore, both the instructional strategies i.e Interpretation construction model and Herbartian method of teaching have significantly positive impact in enhancing students' problem solving and decision-making abilities but the magnitude of Interpretation construction model as compare to Herbartian method in enhancing students' problem solving and decision-making abilities is higher. Further, the findings revealed that both the instructional strategies i.e Interpretation construction model and Herbartian method were

more effective in enhancing problem solving ability than the decision-making ability used to teach experimental and control group respectively. Thus, the result has made clear that along with Interpretation construction model, the Herbartian method as an instructional strategy should be equally promoted in teaching school subjects in all levels of education throughout the globe. According to Becirovic et al. 2019 when there was higher the level of development there was higher the effect of instructional designs on higher order cognitive abilities.

Conclusion

The result of the present study supports for comparatively better effectiveness of instruction based on ICON model than Herbartian method for increasing problem solving and decision making abilities in political science subject like other science and social science subjects. The teachers who are primarily considered as curriculum designer and implementer may design the syllabus of political science subject on the line of principles of ICON model and apply it during instructional transaction process. Along with this, direct implication of other two aspects are proposed for accelerating the outcomes. First one is having cognitively enriched class room environment in the form of maps, charts, newspaper cuttings which may act as supporting resource during ICON model based teaching. Second one is the personality of teacher. The ability to have patience for unconventional response or sometimes irrelevant answers by student and encourage for more participation have positive implications in this context. The result of this study is not free from limitations as it was found from an experimental design where both the groups were taken from the same school. There may be a chance of diffusion and transfer of treatment effect to the control group. Secondly, there may be some other variables apart from general mental ability closely associated with problem solving and decision-making and influences the result.

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