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An Analysis of the Characteristics of 3rd Grade Addition and Subtraction Problems in Online Web Resources

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Abstract

This study is a part of a larger study investigating structures of elementary school 3rd grade addition and subtraction word problems used in all resources including text books, supplementary books, teacher produced resources and online web resources. The current study is originated from questions about extensive usage and overexposure of certain problem structures which may cause difficulties for students in understanding of different problem situations they faced in later grades. The purpose of this study is to identify structures of 3rd grade addition and subtraction problems appeared on the online resources which are most frequently used by students and parents as learning aid. Upon determination of 17 most frequently used web sites, 1542 addition and subtraction problems were extracted from these resources. These 1542 problems were than analyzed by researchers and categorized under certain problem structures in the light of theoretical frame of this study. In the second phase of the study descriptive statistics were used in order to understand and define the trends in these problem structures. Findings of this study suggested that certain types of problems are extensively used in all of the web resources. This overexposure to a certain type of math problems may cause difficulties in understanding the non-routine problems in mathematics and real life. When students develop limited understanding for addition and subtraction, they often have difficulties later on when addition or subtraction is called for but the structure is different from the ones they used to do.

Key Words: Addition and subtraction, Mathematics problems, Web resources.

1. Introduction

Learning through problem solving has first underlined in the publication of NCTM's original Standards document (NCTM, 1989). Since then the results of many research studies have been showing that problem solving is a powerful and effective tool for learning. As stated in the Principles and Standards (NCTM, 2000):

> Solving problems is not only a goal of learning mathematics but also a major means of doing so. Problem solving is an integral part of all mathematics learning, and so it should not be an isolated part of the mathematics pro-gram. Problem solving in mathematics should involve all the five content areas described in these Standards. Good problems will integrate multiple topics and will involve significant mathematics. (p. 52)

Although there are many other definitions have been made for a problem throughout the history of learning, a problem is mostly defined as any task or activity for which the students have no prescribed or memorized rules or methods, [1]nor is there a perception by students that there is a specific "correct" solution method (Hiebert et al., 1997). A problem may not necessarily contain words or phrases. According to Desoete, Roeyers and Buysse, (2001), there are different types of problems and story problems are not always "non-routine" problems which is a common misbelief among classroom teachers. On the contrary these researchers stated that a story or word problem can be "routine" which requires only arithmetic calculations such that students can tell right away whether it is a multiplication, division, addition, or subtraction problem.

In his famous book called "How to Solve It" George Polya (1945), outlined four steps for problem solving. This four-step approach to problem solving was extensively accepted by many mathematicians and mathematics educators for problem solving and appeared and continue to appear in many research studies, resource books and textbooks. Research studies in the field of mathematics education have clearly revealed that teaching these Polya's four steps to students can improve their ability to think analytically and their abilities in problem solving. These four steps are:

i. **Understanding the problem.** First you must be engaged in figuring out what the problem is about and identifying what question or problem is being posed.
ii. **Devising a plan.** In this phase you are thinking about how to solve the problem. Will you want to write an equation? Will you want to model the problem with a manipulative? (See the next section, "Problem-Solving Strategies.")
iii. **Carrying out the plan.** This is the implementation of your strategy/approach.
iv. **Looking back.** This phase, arguably the most important as well as most skipped, is the moment you determine whether your answer from step 3 answers the problem as originally understood in step 1. Does your answer make sense? If not, loop back to step 2 and select a different strategy to solve the problem or loop back to step 3 if you just need to fix something within your strategy.

1.1. Teaching for or Through Problem Solving Approaches

Teaching for problem solving: Researchers Lester and Mau (1993) have identified two types of approaches to problem solving in their classic publication on the types of teaching related to problem solving. They claimed that these two approaches are:

i. teaching for problem solving
ii. teaching through problem solving.

Teaching for problem solving approach can be shortly described as improving students' problem-solving skills. In other words, teaching various skills so that a student can improve her/his problem-solving ability by using those skills. According to Lester (1994), teaching for problem solving usually starts with learning the theoretical concept and then learning some skills to solve problems related to those abstract concepts then applying those learned skills by solving problems. However, many researchers such as Sasser (1991) expressed that this approach to teaching and learning mathematics has not been effective for many students in meaningful understanding or remembering mathematics concepts. In other words, with this approach students mostly memorize the rules and procedures required [2]to solve problems rather conceptually understand and learn the mathematical ideas. Here are some of the reasons why *teaching for problem solving* approach does not effectively work on meaningful learning or conceptual understanding:

i. *Teaching for problem solving* approach requires that all students have the necessary prior knowledge to understand the teacher's explanations, which is rarely, if ever, the case.
ii. The approach generally involves the teacher presenting only one way or limited ways of solving problems to do the problem/procedure, which may not make sense to many learners, because of individual differences (disadvantaged or special students who could solve the problem differently).
iii. The approach usually focuses on teaching procedures not the real meanings behind the ideas.
iv. The approach may create a critical misunderstanding and misbelief that there is only one way to solve a specific problem and may disempower students who naturally may want to try to do it their own way.
v. The approach has negative potential to separate learning skills and concepts from problem solving, which does not improve student learning (Cai, 2010).
vi. The approach decreases the possibility of students' attempts to a new problem without receiving plain clear instructions on how to solve it.

Teaching through problem solving: Teaching through problem solving approach commonly described as an effective approach in which students learn mathematical concepts and ideas through real contexts, problems, situations, and models. With this approach students can build meaning for the mathematical concepts and ideas with extensive use of relevant contexts and models so that they can grasp abstract concepts. In *teaching through problem solving*, problems (tasks or activities) are not the purpose rather they are vehicles by which the desired content is learned. Therefore, it can be obviously revealed that these features of *teaching through problem solving* described above is central to setting up meaningful learning environments where students engage in and make sense of mathematical ideas and concepts.

Like many other researchers, Whimbley and Lochhead (1986) have clearly stated in their research study that Mathematics concepts and procedures are best taught through problem solving. This statement perfectly reflects the NCTM's Principles and Standards and represents current thinking of almost all researchers in the field of mathematics education (Cai, 2003, 2010; NCTM, 2000; Stein, Remillard, & Smith, 2007). Cai (2010) expressed in his summary of the review of research that there are two roles in the effective implementation of teaching through problem solving:

i. Selecting tasks and,
ii. Orchestrating classroom discourse.

One of the powerful tools of engaging students in critical thinking activities is posing non-routine tasks and problems. Teachers should pose these kinds of tasks and problems in order to engage students in productive struggle to develop meaningful and conceptual understanding of mathematical concepts and ideas. Selecting effective non-routine problems and tasks that will do this is important to effective teaching.

1.2. Computer-Based and Online Instruction

In this era of technology, computers, educational software, and web resources can contribute in a variety of ways to effective learning environments, when they are used appropriately (Herrington & Oliver, 1999; Martindale, Cates, & Qian, 2005; Snider, 1992). When we look at the use of instructional software in classrooms, we can see that they have used in a variety of purposes ranging from drill-and-practice for remediation to entire curricula and instructional processes. Recent developments in multimedia and web-based instruction may provide an opportunity to communicate with wide and diverse audiences, including students, teachers, administrators, and parents.

According to Trouche, Gueudet, and Pepin (2018), well-designed instructional web resources and software can provide opportunities for students both at school and at home in learning mathematics. Some research studies (Sasser, 1991; Misra, 2018; Pepin, Gueudet, and Trouche, 2017). claim that students who use appropriate web resources, especially when completing homework assignments, have higher achievement than those who use traditional methods. McDonald and Hannafin (2003) found that use of Web-based computer games designed for high-stakes test preparation promoted higher-order learning outcomes. These outcomes included increased meaningful dialogue among students and the identification of student misconceptions.

Although these outcomes contributed to deeper understanding, no significant differences were found on test scores between those students who used the computer games and those who did not.

Still, considerable research supports the hypothesis that online learning environments have a positive effect on learning outcomes (Goldenberg & Cuoco, 1996; Russell, 1997; Sanders, 2001; Ryan, Scott, Freeman, & Patel, 2013; Trouche, Gueudet, and Pepin, 2018). These reseach studies claim that well designed web resources can accommodate a variety of learning styles. Some research studies also show that online resources can support higher-order learning, (Paolucci, 1998; Schank, 1993), especially in mathematics (Nicaise, 1997); and can teach problem-solving skills to those who struggle with learning difficulties (Babbitt & Miller, 1996).

Interactivity and opportunity for feedback may be one of the most important features of nowadays technology. There are many research studies supporting (), interactivity, feedback, pacing, and individualization (Abrami, Bernard, Bures, Borokhovski, & Tamim, 2011; Hannafin & Scott, 1998), which may significantly improve achievement (Naime-Diefenbach & Sullivan, 2001). Feedback is particularly important for enhancing achievement, especially in terms of immediacy, amount of information provided, and the type of task involved (Donnelly, 2010; Khine, 1996; Kulhavy & Wager, 1993). Feedback and interactivity also influence learner motivation in online environments (Bolliger & Martindale, 2004; Hawkes & Dennis, 2003).

1.3. Research Questions

In this age of technology, students in every level extensively use online resources to better understand the subject matter and to do extra exercise. These online resources have important effects on students' understanding of the subject matter. Therefore, the main goal of this investigation was to explore the structures of addition and subtraction problems found in most frequently used online learning resources by elementary grade-3 students. More specifically, the research questions in this study are:

1) What are the structures of addition and subtraction problems found in most frequently used online learning resources for grade 3?
2) Are there any statistically significant differences among number of addition and subtraction problems with different structures used in online learning resources for grade 3?

2. METHODS

2.1. Identification of Data Sources

There are considerable number of resources in the world wide web providing online interactive tools such as animated learning videos, games, quizzes, and activities to encourage kids on their unique learning path. One of the primary goals of this study is to investigate most frequently used online math resources by 3rd grade students. Therefore, we have contacted 18 3rd grade teachers to identify online resources that are used by students more frequently. After obtaining the initial list of online resources we identified 17 online resources that students use for practice on solving addition and subtraction problems. Upon identification of resources, we extracted 1542 3rd grade addition and subtraction practice problems used in those online resources.

2.2. Calibration of Decisions

Prior to this study a pilot study was conducted in order to ensure that all researchers were choosing the correct categories for problems. Another goal of this calibration study is to identify errors and misunderstandings ahead of time in the categorization process. The calibration study was repeated 5 times by using 20 addition and subtraction word problems in each time to make sure exact agreements on categorization of the problems were maximized.

Overall calibration results are presented in Table 2.1. All 5 researchers were able to complete the entire calibration set. The number and the percent of exact agreement with the correct category for the 20 responses in the first set was 14 or 70% exact agreement. The number and the percent of exact agreement with the correct category for the 20 responses in the second set was 16 or 80% exact agreement. The number and the percent of exact agreement with the correct category for the 20 responses in the third set was 20 or 100% exact agreement. The number and the percent of exact agreement with the correct category for the 20 responses in the fourth set was 19 or 95% exact agreement. The number and the percent of exact agreement with the correct category for the 20 responses in the fifth set was 19 or 95% exact agreement.

Table 2.1.
Calibration Results

Calibration Sets	Number of Problems	Number of Exact Agreements	Percent of Exact Agreements
Set-1	20	17	85%
Set-2	20	18	90%
Set-3	20	20	100%
Set-4	20	19	95%
Set-5	20	20	100%

2.3. The Framework for Categorization of Problems

When students are exposed to new problems, the familiar characteristics will assist them in generalizing from similar problems on which they have practiced. Furthermore, teachers who are not aware of the variety of situations and corresponding structures may randomly offer problems to students without the proper sequencing to support students' full grasp of the meaning of the operations. By knowing the logical structure of these problems, you will be able to help students interpret a variety of real-world contexts. More importantly, you will need to present a variety of problem types (within each structure) as well as recognize which structures cause the greatest challenges for students.

Researchers have separated addition and subtraction problems into structures based on the kinds of relationships involved (Verschaffel, Greer, & DeCorte, 2007). These include *join* problems, *separate problems*, *part-part-whole* problems, and *compare* problems (Carpenter, Fennema, Franke, Levi, & Empson, 1999). The basic structure for each of these three categories of problems is illustrated in Figure 2.1. The problems are described in terms of their structure and interpretation and not as addition or subtraction problems. A joining action does not always mean addition, nor does separate or remove always mean subtraction. Examples for all of these categories is shown in Table 2.2 below.

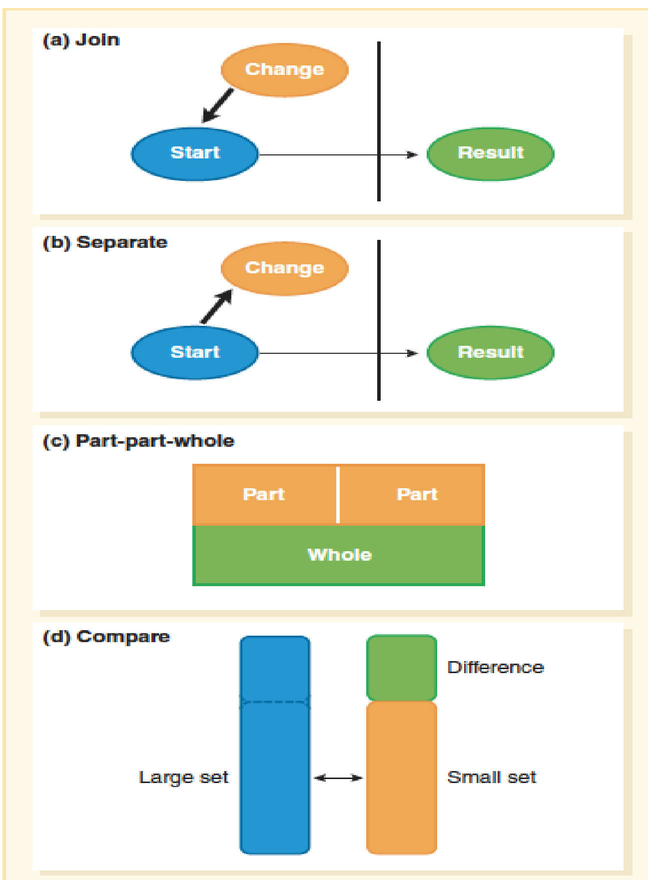

Figure-2.1. Basic structures for addition and subtraction word problem types.

Table 2.2.
Examples of problems in each problem type.

Problem Type	Unknown Part	Sample Problem
JOIN	Start-Unknown	Sandra had some pennies. George gave her 4 more. Now Sandra has 12 pennies. How many pennies did Sandra have at the beginning?
	Change-Unknown	Sandra had 8 pennies. George gave her some more. Now Sandra has 12 pennies. How many did George give her?
	Result-Unknown	Sandra had 8 pennies. George gave her 4 more. How many pennies does Sandra have altogether?
SEPARATE	Start-Unknown	Sandra had some pennies. She gave 4 to George. Now Sandra has 8 pennies left. How many pennies did Sandra have to begin with?
	Change-Unknown	Sandra had 12 pennies. She gave some to George. Now she has 8 pennies. How many did she give to George?
	Result-Unknown	Sandra had 12 pennies. She gave 4 pennies to George. How many pennies does Sandra have now?
PART-PART-WHOLE	Part-Unknown	George has 12 coins. Eight of his coins are pennies, and the rest are nickels. How many nickels does George have?
	Whole-Unknown	George has 4 pennies, and Sandra has 8 pennies. They put their pennies into a piggy bank. How many pennies did they put into the bank?
COMPARE	Small-Unknown	George has 4 more pennies than Sandra. George has 12 pennies. How many pennies does Sandra have?
	Large-Unknown	Sandra has 4 fewer pennies than George. Sandra has 8 pennies. How many pennies does George have?
	Difference-Unknown	George has 12 pennies, and Sandra has 8 pennies. How many more pennies does George have than Sandra?

3. RESULTS

Results of the study indicated that all web resources use “Result Unknown” problems more often than the other two types (Start Unknown and Change Unknown) in “Join” problems. As seen in the Figure-3.1, the number of addition and subtraction problems in which “result” is asked (unknown) is way over the number of other two types mentioned above. This result clearly indicates that students are mostly exposed to one type of “Join” problems when they use the web resources. This over exposure to a single type of math problems may cause difficulties in understanding the non-routine problems in mathematics and real life.

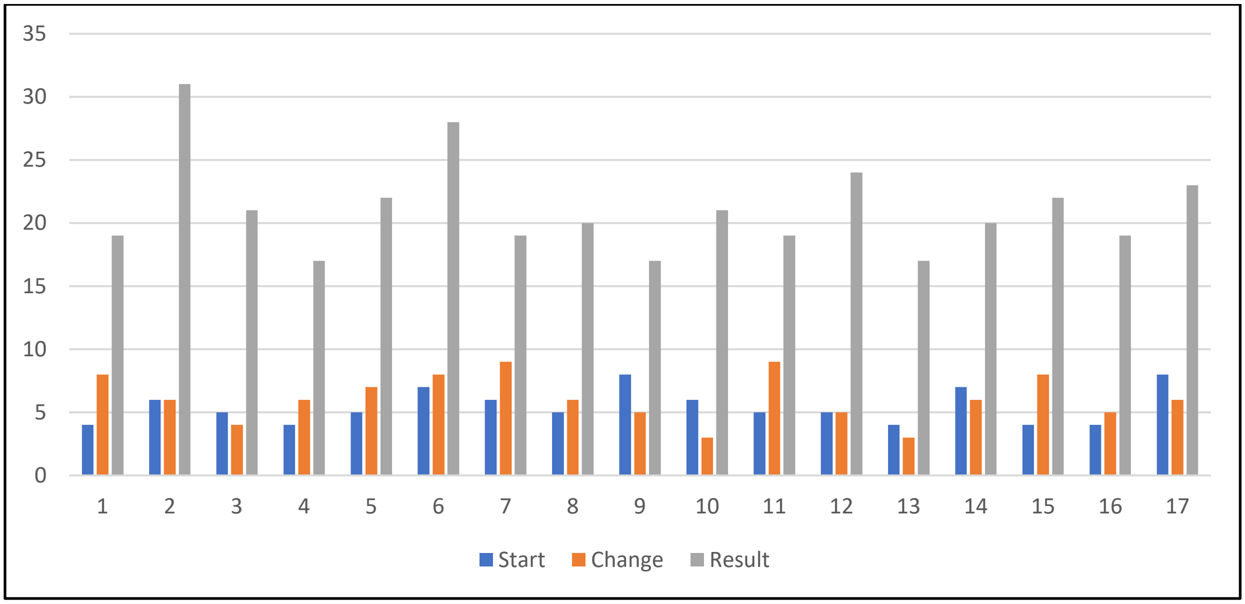

Figure-3.1. Distribution of "Join" problems among different unknown parts.

"Separate" problems may also appear in three main structures (Start Unknown, Change Unknown, and Result Unknown). Findings of the study also indicated a resemblance with the previous finding about use of "Join" problems. It was clearly observed that all web resources use "Result Unknown" problems more often than the other two types (Start Unknown and Change Unknown) in "Separate" problems too. As seen in the Figure-3.2, the number of addition and subtraction problems in which "result" is asked (unknown) is much larger than the number of other two types. This result clearly indicates that students are mostly exposed to one type of "Separate" problems when they use the web resources. Again, we can confidently state that this overexposure to a specific type may cause indelible limitations in students' reasoning and critical thinking abilities when they face non-routine problems in different contexts.

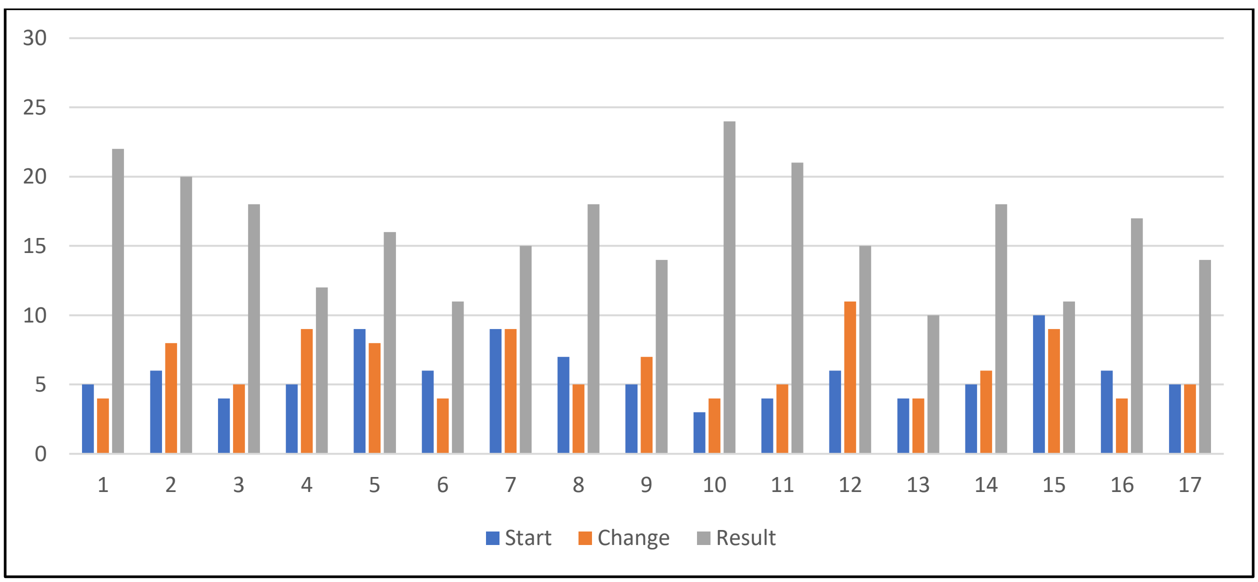

Figure-3.2. Distribution of "Separate" problems among different unknown parts.

It was revealed from the analysis of data that all of the 17 web resources have more "whole unknown" problems than "part unknown" problems. This result also resembles with the results in "Join" and "Separate" problems in which "result unknown" problems are extensively used in all of the investigated web resources. Figure-3.3 shows the number of problems in each of the two categories (part unknown and whole unknown) that these resources used. Again, it can be obviously seen an overexposure of one specific category of problems that may have negative impact on students understanding of variety of addition and subtraction contexts.

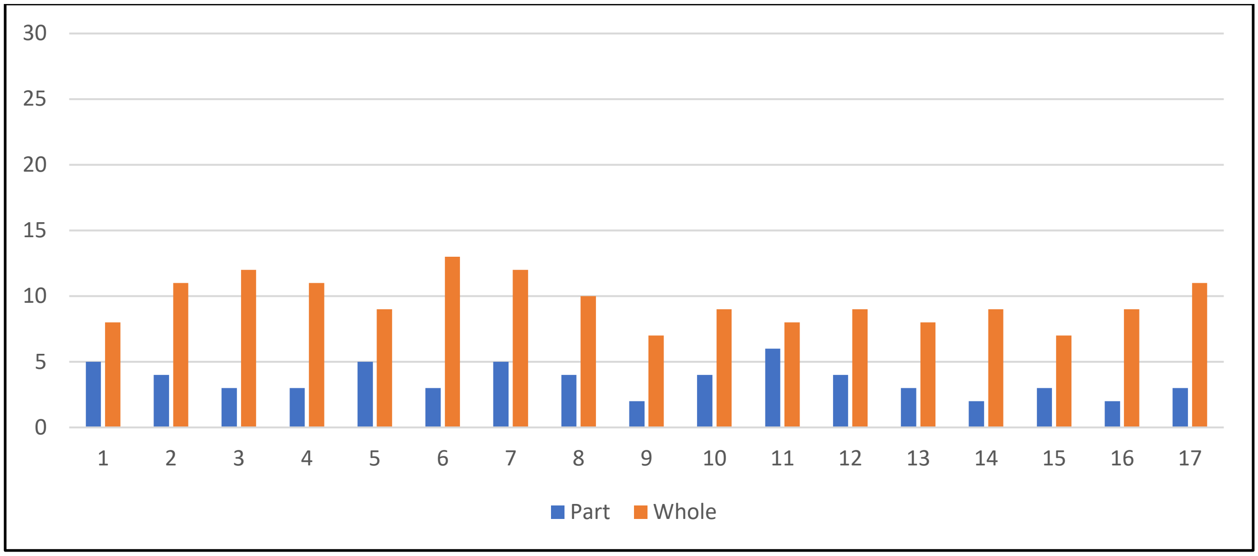

Figure-3.3. Distribution of “Part-Part-Whole” problems among different unknown parts.

Moreover, analysis of data clearly suggested that all web resources use “Difference Unknown” problems more often than the other two types (Large Unknown and Small Unknown) in “Compare” problems. As seen in the Figure-3.4, the number of addition and subtraction problems in which “difference” is asked (unknown) is way over the number of other two types mentioned above.

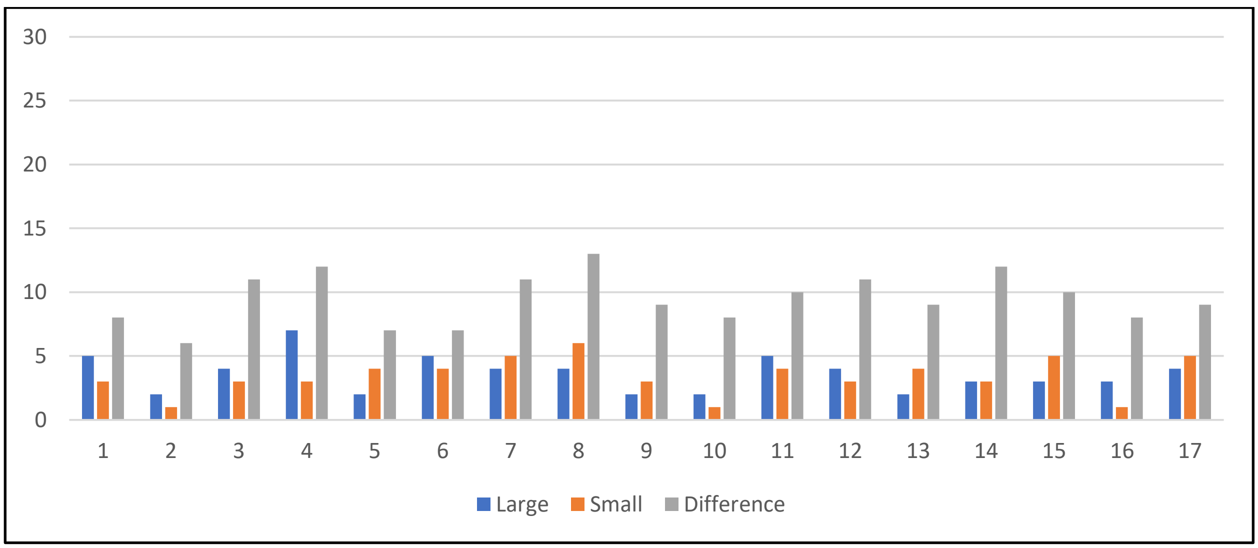

Figure-3.4. Distribution of “Compare” problems among different unknown parts.

Results of the current research revealed that although web resources use all kinds of word problems related to addition and subtraction, it can be clearly seen in the Figure-3.5 that they extensively use types called “Join” and “Separate” comparing to “Part-Part-Whole” and “Compare” problem types. Out of 1542 problems extracted from web resources, 556 have been identified as “Join” whereas 482 as “Separate” , 224 as “Part-Part-Whole”, and 280 as “Compare”.

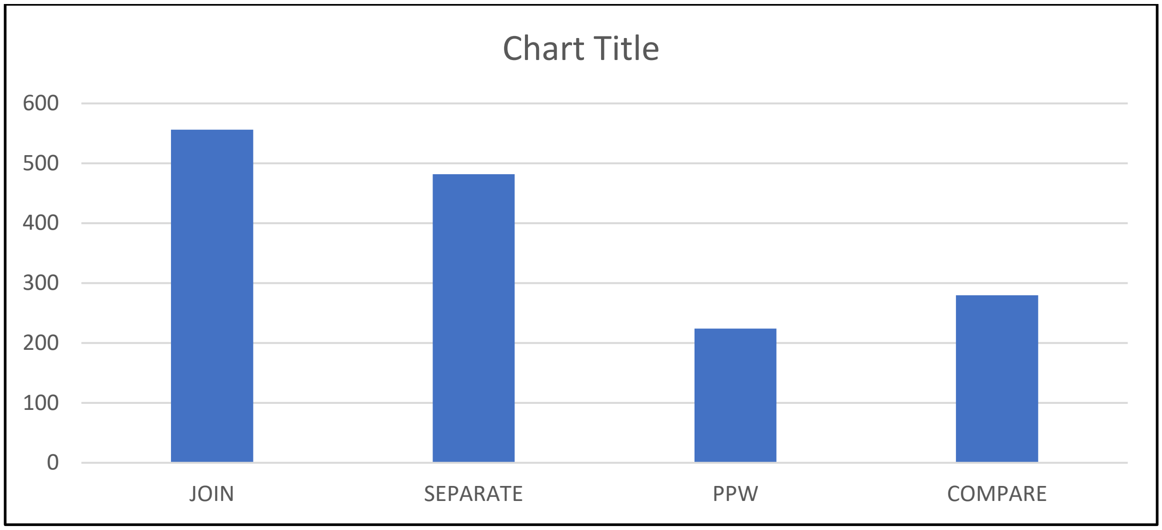

Figure-3.5. Distribution of problems among different problem types.

Table-3.1. Paired variables T-test results.

Pair #	Paired Variables	Mean	Std. Dev.	Std. Err. Mean	t	df	Sig. (2-tailed)
Pair 1	Join_SU Join_CU	-0.647	2.317	0.562	-1.152	16	0.266
Pair 2	Join_SU Join_RU	-15.647	3.639	0.883	-17.728	16	0.000
Pair 3	Join_SU Sep_SU	-0.353	2.548	0.618	-0.571	16	0.576
Pair 4	Join_SU Sep_CU	-0.824	2.744	0.666	-1.237	16	0.234
Pair 5	Join_SU Sep_RU	-10.765	4.309	1.045	-10.301	16	0.000
Pair 6	Join_SU PPW_PU	1.882	2.027	0.492	3.828	16	0.001
Pair 7	Join_SU PPW_WU	-4.118	1.965	0.477	-8.641	16	0.000
Pair 8	Join_SU Comp_LU	1.882	2.176	0.528	3.567	16	0.003
Pair 9	Join_SU Comp_SU	2.059	1.952	0.473	4.350	16	0.000
Pair 10	Join_SU Comp_DU	-4.000	2.574	0.624	-6.408	16	0.000
Pair 11	Join_CU Join_RU	-15.000	3.984	0.966	-15.522	16	0.000
Pair 12	Join_CU Sep_SU	0.294	1.795	0.435	0.676	16	0.509
Pair 13	Join_CU Sep_CU	-0.176	2.604	0.631	-0.279	16	0.783
Pair 14	Join_CU Sep_RU	-10.118	4.540	1.101	-9.189	16	0.000
Pair 15	Join_CU PPW_PU	2.529	1.625	0.394	6.419	16	0.000
Pair 16	Join_CU PPW_WU	-3.471	2.452	0.595	-5.835	16	0.000
Pair 17	Join_CU Comp_LU	2.529	1.772	0.430	5.886	16	0.000
Pair 18	Join_CU Comp_SU	2.706	1.759	0.427	6.341	16	0.000
Pair 19	Join_CU Comp_DU	-3.353	2.737	0.664	-5.050	16	0.000
Pair 20	Join_RU Sep_SU	15.294	3.933	0.954	16.032	16	0.000
Pair 21	Join_RU Sep_CU	14.824	4.127	1.001	14.811	16	0.000
Pair 22	Join_RU Sep_RU	4.882	5.395	1.309	3.731	16	0.002
Pair 23	Join_RU PPW_PU	17.529	3.875	0.940	18.652	16	0.000
Pair 24	Join_RU PPW_WU	11.529	3.375	0.819	14.086	16	0.000
Pair 25	Join_RU Comp_LU	17.529	4.230	1.026	17.088	16	0.000
Pair 26	Join_RU Comp_SU	17.706	4.298	1.042	16.986	16	0.000
Pair 27	Join_RU Comp_DU	11.647	5.098	1.237	9.419	16	0.000
Pair 28	Sep_SU Sep_CU	-0.471	2.004	0.486	-0.968	16	0.347
Pair 29	Sep_SU Sep_RU	-10.412	5.112	1.240	-8.398	16	0.000
Pair 30	Sep_SU PPW_PU	2.235	2.107	0.511	4.373	16	0.000
Pair 31	Sep_SU PPW_WU	-3.765	2.635	0.639	-5.892	16	0.000
Pair 32	Sep_SU Comp_LU	2.235	2.513	0.610	3.667	16	0.002
Pair 33	Sep_SU Comp_SU	2.412	1.805	0.438	5.510	16	0.000
Pair 34	Sep_SU Comp_DU	-3.647	2.760	0.669	-5.448	16	0.000
Pair 35	Sep_CU Sep_RU	-9.941	5.238	1.270	-7.826	16	0.000
Pair 36	Sep_CU PPW_PU	2.706	2.443	0.593	4.566	16	0.000
Pair 37	Sep_CU PPW_WU	-3.294	2.932	0.711	-4.633	16	0.000
Pair 38	Sep_CU Comp_LU	2.706	2.616	0.635	4.264	16	0.001
Pair 39	Sep_CU Comp_SU	2.882	2.571	0.624	4.622	16	0.000
Pair 40	Sep_CU Comp_DU	-3.176	2.628	0.637	-4.984	16	0.000
Pair 41	Sep_RU PPW_PU	12.647	3.690	0.895	14.131	16	0.000
Pair 42	Sep_RU PPW_WU	6.647	4.623	1.121	5.929	16	0.000
Pair 43	Sep_RU Comp_LU	12.647	4.457	1.081	11.699	16	0.000
Pair 44	Sep_RU Comp_SU	12.824	4.915	1.192	10.758	16	0.000
Pair 45	Sep_RU Comp_DU	6.765	4.764	1.155	5.855	16	0.000
Pair 46	PPW_PU PPW_WU	-6.000	2.151	0.522	-11.503	16	0.000
Pair 47	PPW_PU Comp_LU	0.000	1.658	0.402	0.000	16	1.000
Pair 48	PPW_PU Comp_SU	0.176	1.667	0.404	0.436	16	0.668
Pair 49	PPW_PU Comp_DU	-5.882	2.421	0.587	-10.019	16	0.000
Pair 50	PPW_WU Comp_LU	6.000	1.803	0.437	13.723	16	0.000
Pair 51	PPW_WU Comp_SU	6.176	2.243	0.544	11.355	16	0.000
Pair 52	PPW_WU Comp_DU	0.118	2.667	0.647	0.182	16	0.858
Pair 53	Comp_LU Comp_SU	0.176	1.741	0.422	0.418	16	0.681
Pair 54	Comp_LU Comp_DU	-5.882	1.900	0.461	-12.765	16	0.000
Pair 55	Comp_SU Comp_DU	-6.059	1.853	0.449	-13.481	16	0.000

Table-3.1 shows the results of individual t-tests between paired variables. When we look at the table-3.1, it can be obviously seen that numbers of problems used in all 17 websites are significantly different in highlighted pairs of problem types. For instance, number of Join-Start-Unknown (Join_SU) problems are is significantly different from number of Join-Result-Unknown (Join_RU) problems used in all websites. The mean difference between these two categories of problems was found to be (-15.647). This result shows us that Join-Result-Unknown problems were approximately 15 more than Join-Start-Unknown problems. All highlighted significant differences should be interpreted likewise.

On the other hand, no significant differences found between 10 pairs of problem types as seen in table-3.1 (not highlighted pairs). For example, number of Join-Start-Unknown (Join_SU) problems are is not significantly different from number of Join-Change-Unknown (Join_RU) problems used in all websites. The mean difference between these two categories of problems was found to be (-0.647). This result shows us that Join-Change-Unknown problems were approximately 1 more than Join-Start-Unknown problems which shows an insignificant difference. All the pairs which are not highlighted shown on table-3.1 have insignificant differences and should be interpreted likewise.

4. CONCLUSION

This paper dealt with identifying structures of 3rd grade addition and subtraction problems appeared on the online resources which are most of frequently used by students and their parents as learning aid. Specifically, it is originated from questions about extensive usage and overexposure of certain problem structures which may cause difficulties for students in understanding of different problem situations they faced in later grades. The discussion showed, in general terms, that the Carpenter, Fennema, Franke, Levi, & Empson's (1999) framework can provide teachers with a simple and at the same time meaningful structure to assess web-based resources in terms of addition and subtraction problems. These abundant resources require professional judgment in their selection of problems and articulation into the school mathematics curriculum.

After the investigation of 1542 word problems obtained from 17 mostly used web resources, some important results were observed. First, although there is a diversity of addition and subtraction problems, namely: Join, Separate, Part-Part-Whole, and Compare, some problem structures (Join and Separate) were much more extensively used than other problem types such as "Part-Part-Whole" and "Compare". In most resources, the overwhelming emphasis is on the easiest problem types: join and separate, may cause a false de facto definition of addition as "Join" and subtraction as "Separate." The fact is, these are not the definitions of addition and subtraction. It is important that students be exposed to all forms of these different problem structures.

Secondly, results of the study showed that all web resources use "Result Unknown" problems more often than the other two types (Start Unknown and Change Unknown) in "Join" and "Separate" problems. The number of addition and subtraction problems in which "result" is asked (unknown) is way over the number of other two types (Start Unknown and Change Unknown). This result clearly indicates that students are mostly exposed to one type of "Join" and "Separate" problems when they use the web resources. Similarly, it was revealed from the analysis of data that web resources have more "Whole Unknown" problems than "Part Unknown" problems. This result also resembles with the results in "Join" and "Separate" problems in which "Result Unknown" problems are extensively used in all of the web resources. In same way, data suggested that all web resources use "Difference Unknown" problems more often than the other two types (Large Unknown and Small Unknown) in "Compare" problems. This overexposure to a single type of math problems may cause difficulties in understanding the non-routine problems in mathematics and real life. When students develop limited understanding for addition and subtraction, they often have difficulties later on when addition or subtraction is called for but the structure is different from "Join" or "Separate".

Finally, we found some of the problem types are more difficult than other problem types. The join or separate problems in which the start part is unknown are often the most difficult. When modeling the problems directly students may not know how many counters to put down to begin modeling the problem. Problems in which the change amounts are unknown are also difficult. Compare problems are often challenging as the language may confuse students into adding instead of finding the difference.

Generally speaking, online resources should improve their 3rd grade addition and subtraction problem pools. These are comprehensive websites whose online resources are more interactive, pedagogical oriented, sorted by grade level and curriculum objectives, thereby constituting a better search strategy for practicing teachers. Therefore, they need to diversify their addition and subtraction problems in order to prevent students from overexposure to a particular type of problem.

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