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I THINK, IN THE SPIRIT OF THE THEME OF THIS ANNUAL MEETING, THE THEME OF THIS SESSION COULD HAVE BEEN: "KNOWING MAY NOT BE ENOUGH, BUT IT SURE COULD HELP!"

WHEN THE TOPIC IS FORMATIVE ASSESSMENT, AS THESE PAPERS MAKE CLEAR, THE KNOWLEDGE WE ARE TALKING ABOUT IS TEACHER KNOWLEDGE.

IT IS THE KNOWLEDGE THEY NEED TO FIND, OR ATTEND TO, EVIDENCE OF WHERE THEIR STUDENTS ARE IN THEIR UNDERSTANDING OF WHAT THEY ARE SUPPOSED TO BE LEARNING, AND WHETHER THEY ARE, OR ARE NOT, UNDERSTANDING WHAT IS HAPPENING IN INSTRUCTION.

AND IT IS THE KNOWLEDGE THEY NEED TO INTERPRET THAT EVIDENCE IN TERMS OF WHAT IT SUGGESTS FOR WHAT THE TEACHER MIGHT DO TO HELP THE STUDENT OR STUDENTS TO KEEP LEARNING OR TO GET BACK ON TRACK IF THEY HAVE RUN INTO PROBLEMS IN THEIR LEARNING.

THESE PAPERS EXPLORE THE QUESTION OF WHETHER THE KNOWLEDGE TEACHERS NEED CAN COME FROM EDUCATIONAL OR PSYCHOLOGICAL RESEARCH, EITHER IN THE FORM OF SOMETHING CALLED LEARNING PROGRESSIONS, OR AS I WOULD SUGGEST "TEACHING AND LEARNING PROGRESSIONS OR "INSTRUCTIONAL PROGRESSIONS," OR OTHER MORE GENERAL RESEARCH-BASED THEORIES OF HOW STUDENTS LEARN MATHEMATICS. THE PAPERS HAVE, OR REPORT ON, SOMEWHAT DIFFERENT IDEAS ABOUT WHAT PROGRESSIONS LOOK AND FEEL LIKE, BUT TAKEN TOGETHER, I THINK THEY PROVIDE A PRETTY REPRESENTATIVE SAMPLING OF WHAT CURRENT WORK ON PROGRESSIONS LOOKS LIKE AND OF HOW IT FEELS TO BE IN THIS EARLY DEVELOPMENTAL STAGE OF SUCH WORK.

I FOUND SUSAN'S PAPER TO BE JAW-DROPPINGLY SENSIBLE ON THE POINT THAT WHETHER OR NOT STUDENTS' WORK AND RESPONSES PROVIDE EVIDENCE OF THEIR THINKING REQUIRES THAT THERE BE SOME SORT OF INTERPRETIVE AGENT TO MAKE SENSE OF THEM, AND THAT, IN THE CONTEXT OF ONGOING INSTRUCTION, IF THERE IS TO BE A TIMELY RESPONSE TO WHAT SHE (AFTER FRED ERICSON) CALLS "PROXIMAL FORMATIVE ASSESSMENT," THAT AGENT REALLY HAS TO BE THE TEACHER, AND SHE PROVIDES A COMPELLING VINGETTE OF WHAT IT LOOKS LIKE WHEN THE TEACHER'S UNDERSTANDING IS INFORMED BY CONCEPTUAL FRAMEWORKS BASED ON RESEARCH, IN THIS CASE RESEARCH ON THE WAYS IN WHICH STUDENTS ARE LIKELY TO COME TO APPRECIATE THE EQUIVALENCE OF THE ARITHMETIC OF WHOLE NUMBERS AND FRACTIONS, COUPLED WITH NORMS OF CLASSROOM DISCOURSE THAT ENCOURAGE STUDENTS TO GET THEIR THINKING OUT IN THE OPEN WHERE BOTH THE TEACHER AND THE OTHER STUDENTS CAN ATTEND TO WHAT THEY ARE DOING AND HELP EACH OTHER

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MAKE SENSE OF IT. I'LL COME BACK IN A WHILE TO THE QUESTION OF WHETHER THE FRAMEWORKS OF THE SORT SUSAN DESCRIBES NECESSARILY TAKE THE FORM OF PROGRESSIONS, OR WHETHER THEY MAY BE SOMETHING ELSE, BUT THE PICTURE OF THE TEACHER'S INSIGHTFUL MOMENT-TO-MOMENT RESPONSIVENESS IS QUITE COMPELLING.

MEIRAV'S PAPER WITH CAROLYN WYLIE AND MALCOLM PRESENTS THE CBAL WORK AS A RATHER MORE SYSTEMMATIC DESIGN EFFORT COMPLETE WITH MULTIPLE CYCLES OF TRIAL AND REVISION, IN WHICH THE INTERPRETIVE FUNCTION IS ROOTED MORE SPECIFICALLY IN HYPOTHESIZED PROGRESSIONS REFINED FROM OTHERS' WORK AS WELL AS CBAL'S OWN AND OFFLOADED AT LEAST IN PART ONTO ASSESSMENTS AND TASKS THAT ARE DESIGNED TO REPORT IN TERMS REFERENCED TO THE PROGRESSIONS, MAKING IT EASIER FOR TEACHERS TO INTERPRET THE STUDENT PERFORMANCES AS EVIDENCE FOR LOCATING THEIR LEVELS OF UNDERSTANDING IN TERMS OF THE LEVELS IDENTIFIED BY THE PROGRESSIONS, STILL ASSUMING, OF COURSE, THAT THE TEACHERS HAVE BECOME FAMILIAR WITH THE PROGRESSIONS AND UNDERSTAND THE SIGNIFICANCE OF THE LOCATIONAL REPORTS. THE ASSESSMENTS AND TASKS ARE DESIGNED BY THE RESEARCHER/DESIGNERS TO BE USED – PERIODICALLY IN THE CASE OF THE “LOCATOR” TASKS AND SEEMINGLY MORE ON AN AD HOC BASIS IN THE CASE OF THE “TRANSITIONAL” TASKS, WHEN TEACHERS THINK A STUDENT IS (OR THEIR STUDENTS ARE) READY TO MOVE TO A NEW LEVEL, OR THE TEACHER WANTS TO CHECK WHETHER THAT IS THE CASE. IT SOUNDS AS THOUGH THIS LATTER CLASS OF TASK MAY ALSO AT LEAST IN SOME CASES BE DESIGNED TO PROVIDE DIAGNOSTIC INFORMATION FOR WHEN TEACHERS WANT TO KNOW WHETHER A STUDENT IS HAVING SOME PARTICULAR PROBLEM. AGAIN, SOME QUESTIONS ABOUT ALL THIS IN A WHILE, BUT THE PAPER CERTAINLY PRESENTS A PICTURE OF A VERY THOUROUGH APPROACH TO DEVELOPING HYPOTHESES ABOUT HOW STUDENTS THINKING IN KEY AREAS OF MIDDLE SCHOOL MATH PROGRESSES, AND PROVIDING TOOLS THAT CAN INFORM TEACHERS ABOUT THE STUDENTS' PROGRESS IN THOSE TERMS AND OFFER THEM TASKS TO BE USED TO RESPOND TO THAT INFORMATION TO SUPPORT STUDENTS IN MOVING AHEAD. IT NEVERTHELESS HAS QUITE A DIFFERENT FEEL FROM THE APPROACH OF THE CGI GROUP, MAKING THE EVIDENCE GATHERING MORE PERIODIC, AND EVEN EPISODIC, AND SHIFTING SOME OF THE AGENCY OR RESPONSIBILITY FOR INTERPRETATION OF THE EVIDENCE TO THE DESIGN OF THE TOOLS.

Comment [F1]: After the session, Meirav explained that this project and CBAL are not the same, although CBAL does use some of their progressions.

THE WORK OF KENNY AND HIS COLLEAGUES HAS SOME OF THE SAME FLAVOR OF A MORE SYSTEMATIC APPROACH TO TYING A PROGRESSION TO WHAT IN THIS CASE THEY PREFER TO CALL “DIAGNOSTIC” ASSESSMENT. ACTUALLY I AGREE THAT DIAGNOSTIC IS PROBABLY A BETTER WORD TO USE THAN “FORMATIVE” WHEN YOU ARE REFERRING TO THE ASSESSMENT TOOL ITSELF, SINCE IT IS CLOSER TO WHAT IT IS THE ASSESSMENTS THEMSELVES CAN ACTUALLY OFFER, BUT THERE STILL NEEDS TO BE SOME SORT OF DIAGNOSING AGENT TO MAKE SENSE OF THE INFORMATION. WHAT IS ADDED HERE, HOWEVER, IS THE USE OF TECHNOLOGY – AN INTERACTIVE DIAGNOSTIC ASSESSMENT SYSTEM OR “IDAS” - THAT SELECTS AND PRESENTS ITEMS TO STUDENTS AND PROVIDES SCORES OR REPORTS THAT LOCATE THEIR PERFORMANCES WITH REFERENCE TO LEVELS (AND PRESUMABLY MORE DETAILED SUB-CATEGORIES) OF A WELL WORKED-OUT PROGRESSION, IN THIS CASE JERE AND ALAN'S EQUIPARTITIONING STRAND WITHIN RATIONAL NUMBER REASONING. STUDENTS CAN USE THE SYSTEM TO GIVE THEMSELVES PRACTICE ITEMS OR PACKETS AND GET FEEDBACK ON THEIR PERFORMANCE, AND

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THEY CAN DO THIS IN CONJUNCTION WITH OTHER STUDENTS USING SOCIAL MEDIA FEATURES, BUT TEACHERS CAN ALSO HAVE THEM USE THE SYSTEM PERIODICALLY IN ASSESSMENT MODE IN ORDER TO SEE WHERE INDIVIDUAL STUDENTS OR THEIR CLASS AS A WHOLE ARE IN THEIR LEARNING PROGRESS, WHETHER THEY ARE HAVING PARTICULAR PROBLEMS, AND USE THE INFORMATION TO ADJUST THEIR INSTRUCTION. THERE IS MENTION OF THE IDEA THAT THE SYSTEM ITSELF MIGHT SERVE UP “TARGETED INTERVENTIONS” BASED ON THE STUDENTS’ RESPONSES – WHICH MIGHT INDEED MAKE IT A SELF-CONTAINED DIAGNOSTIC, OR EVEN FORMATIVE, SYSTEM – BUT THAT ASPECT SEEMS STILL TO BE UNDER DEVELOPMENT.

NEVERTHELESS, THE PRESS TO MAKE SURE THIS SYSTEM GIVES “SCIENTIFICALLY VALID” INFORMATION AND THAT SO MANY OF ITS FUNCTIONS SHOULD BE INSTANTIATED IN TECHNOLOGY MEANS THAT EVEN MORE OF THE KNOWLEDGE, OR INTERPRETIVE AGENCY, IS BEING OFFLOADED TO THE SYSTEM AND TO THE RESEARCHER/DESIGNERS WHO ARE BUILDING IT.

IN THE SHORT RUN HOWEVER THIS PAPER GIVES A VERY NICE FEEL FOR WHAT SUCH WORK LOOKS LIKE IN ITS VERY EARLY STAGES, AND FOR THE VIRTUES OF DOING SMALL SCALE DESIGN STUDIES GUIDED BY A GOOD PSYCHOLOGICAL MODEL OF THE UNDERSTANDINGS YOU HOPE TO ASSESS – VIRTUES THAT ALLOW YOU TO SEE ANOMOLIES IN THE EMPIRICAL TRIAL RESULTS AND CORRECT FOR THEM IN WAYS THAT ARE MUCH LESS LIKELY IN THE PRACTICES OF LARGE-SCALE TEST DESIGN.

BECAUSE THE PAPER IS DESCRIBING THE EARLY STAGES OF THE WORK, IT DOESN’T HAVE MUCH TO SAY ABOUT WHAT KINDS OF SENSE TEACHERS, AND FOR THAT MATTER STUDENTS, MAKE OF THE RESULTS, OR OF HOW THEY THINK ABOUT WHAT WILL BE NEEDED TO HELP THEM USE THESE TOOLS WELL. IT ALSO DOESN’T HELP US MUCH TO ANTICIPATE WHAT THIS WILL LOOK LIKE WHEN IT MOVES TO THE HIGHER LEVELS OF THE PROGRESSION AND WHAT MAY BE INVOLVED IN DESIGNING THE AFORMENTIONED TARGETED INTERVENTIONS.

FABIOLA’S (AND CAROLYN’S) PAPER PROVIDES A HELPFUL SUPPLEMENTARY LOOK AT SOME OTHER PROJECTS THAT ARE TRYING TO TIE PROGRESSION-LIKE UNDERSTANDING OF STUDENTS’ LEARNING TO ASSESSMENT PROCESSES, BOTH FORMATIVE AND SUMMATIVE. IT INCLUDES A BROADER LOOK AT THE CBAL AND CGI ENTERPRISES, THAT WE HAVE SAMPLES OF HERE, AND IT ADDS MARGE PETIT’S OGAP WORK IN VERMONT AND MARK WILSON’S BEAR SYSTEM. IT IS VERY USEFUL TO TRY TO APPLY THE SAME SET OF QUESTIONS ABOUT HOW EACH PROJECT TRIES TO INFORM TEACHERS’ UNDERSTANDING OF THE PROGRESSIONS INVOLVED, AND TO HELP THEM USE THAT UNDERSTANDING TO MAKE SENSE OF WHAT THEIR STUDENTS ARE DOING, AND TO RESPOND TO THAT EVIDENCE CONSTRUCTIVELY. IF WE HAVE TIME IT MIGHT BE INTERESTING TO TALK A BIT ABOUT THE WAYS IN WHICH OGAP THINKS ABOUT THE USE OF TECHNOLOGY TO SUPPORT TEACHERS IN CONTRAST TO THE IDAS APPROACH, BUT THAT WORK WASN’T AVAILABLE TO FABIOLA TO INCLUDE IN HER DISCUSSION. BUT OGAP IS RECOGNIZABLY SOMEWHERE IN THE SAME BALLPARK AS CBAL AND IDAS. I HAVE TO CONFESS TO BEING PUZZLED BY THE BEAR APPROACH AS FABIOLA DESCRIBES IT. AS I UNDERSTAND IT, IT SEEMS TO REPRESENT AN EFFORT TO DERIVE SOMETHING LIKE PROGRESSIONS EMPIRICALLY FROM ASSESSMENT DATA (WHERE THE ASSESSMENT ITEMS MAY OR MAY NOT BE ASSOCIATED WITH A PARTICULAR DESIGNED CURRICULUM) BASED ON STATISTICALLY COHERENT PROGRESS MAPS AND PROGRESS VARIABLES (THE

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LATTER IDENTIFIED AND NAMED SORT OF THE WAY YOU MIGHT NAME FACTORS IN A FACTOR ANALYSIS, BUT OBVIOUSLY INFORMED BY THEORY WHEN AVAILABLE). THE DESCRIPTION IS UNDERSTANDABLY SKETCHY ABOUT WHAT SENSE TEACHERS ACTUALLY MAKE OF THIS AND HOW THEY USE IT. JUST AS AN ASIDE, I ALSO WAS PUZZLED BY THE MENTION IN THE DESCRIPTION OF CBAL OF THE INTENTION TO PRODUCE PERIODIC SUMMATIVE ASSESSMENTS FOR ACCOUNTABILITY USES, AND TO CONSIDER THAT THEIR PERIODICITY SOMEHOW WOULD REPRESENT A VIRTUE, BECAUSE THEIR REPORTS WOULD BE MORE RELIABLE THAN END OF YEAR TESTS. THAT SEEMS TO ME TO REPRESENT AN UNUSUALLY BAD IDEA, AT LEAST IN THE CONTEXT OF A DISCUSSION OF PROGRESSIONS AND FORMATIVE ASSESSMENT, BECAUSE IF YOU HAVE THAT INFORMATION ON A PERIODIC BASIS, WOULDN'T THE WHOLE POINT BE TO INTERVENE TO CHANGE IT, IF THE RESULTS WEREN'T SATISFACTORY?

ANYWAY, AS I SAY, AS A GROUP THESE PAPERS PROVIDE A WONDERFUL SNAPSHOT OF WHAT WORK BASED ON THIS HOPE THAT TYING PROGRESSIONS TO FORMATIVE ASSESSMENT WILL HELP US IMPROVE INSTRUCTION LOOKS LIKE IN ITS EARLY AND ONGOING STAGES. THEY ALSO REVEAL SOME SIGNIFICANT DIFFERENCES IN HOW THE HOPE IS INTERPRETED, AND THEY ALLOW US TO SEE HOW THE RESEARCHER/DEVELOPERS ARE HANDLING THE INEVITABLE DIFFICULTIES, AND PERHAPS TO SPOT A FEW MORE THAT THEY WILL NEED TO CONSIDER. JUST A FEW SUGGESTIONS ALONG THESE LINES:

THE CGI WORK, AS REPRESENTED BY SUSAN'S PAPER, IS REALLY PRETTY DIFFERENT. IT IS MUCH MORE DIRECTLY FOCUSED ON TEACHERS' THINKING AND SKILLS AS THEY ARE AFFECTED BY MORE GENERAL RESEARCH-BASED UNDERSTANDING OF STUDENTS' MATHEMATICAL LEARNING, RATHER THAN BY EXPLICITLY DESCRIBED PROGRESSIONS OR TRAJECTORIES, PER SE. I CERTAINLY HAVE NO QUARRELL WITH IT, BUT IT PLACES A HEAVY BURDEN ON TEACHER LEARNING AND EXPERIENCE AND WILL FRUSTRATE PEOPLE WHO LOOK TO PROGRESSIONS TO PROVIDE WIDESPREAD AND POSSIBLY TEACHER PROOF MIRACLES. THE OTHER APPROACHES TRY TO OFFLOAD SOME OF THE INTERPRETIVE BURDEN, OR TO SUPPORT IT MORE EXPLICITLY, IN VARYING DEGREES.

THE CBAL WORK DESCRIBED HERE DOES A GOOD JOB OF TRYING TO COME TO TERMS WITH THE REALITY THAT PROGRESSIONS INTERACT, OR RATHER THAT THE UNDERLYING REALITY IS SURELY SOMETHING LIKE A NETWORK OF INTER-RELATED CONCEPTUAL NODES AND THAT PROGRESSIONS TRACE A SOMEWHAT ARBITRARY BUT HOPEFULLY COHERENT AND MORE UNDERSTANDABLE PATH THROUGH THOSE NODES IN WAYS THAT CAN INFORM TEACHERS', AND STUDENTS', THINKING ABOUT PROGRESS AND WHAT TO DO NEXT. THE WORK APPRECIATES THAT PROGRESSIONS INVOLVE A CLOSE INTERACTION BETWEEN STUDENTS' THINKING AND THE INSTRUCTION OR TEACHING THEY RECEIVE, BUT, LIKE MUCH OF THE WORK IN PROGRESSIONS, IT ISN'T ALWAYS CAREFUL TO KEEP THE INTERACTION CLEAR.

FOR INSTANCE, IN THE PROGRESSION THAT COMBINES THE CONCEPTIONS OF EQUALITY AND VARIABLE, THAT EARLY ON STUDENTS HAVE AN OPERATIONAL UNDERSTANDING OF THE EQUALS SIGN IS TREATED AS SOMEHOW BEING A NATURAL EARLY STEP, WHEREAS I THINK MANY WOULD SAY IT IS QUITE CLEARLY AN ARTIFACT OF INSTRUCTION – OF THE WAYS STUDENTS TYPICALLY SEE PROBLEMS FRAMED

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IN AMERICAN SCHOOLS, AND THERE IS EVIDENCE THAT DIFFERENT APPROACHES COULD SIMPLY AVOID THAT BEING A “STAGE.”

I FIND USING THE LANGUAGE OF “VARIABLE” TO BE A BIT CONFUSING EARLY ON WHEN IT IS REFERRING TO CHILDREN’S INTERPRETATION OF LETTERS OR SYMBOLS IN EXPRESSIONS – ISN’T IT THAT THEY COME TO INTERPRET THE SYMBOLS AS VARIABLES, RATHER THAN THE ANSWER OR THE (FIXED VALUE) UNKNOWN, LATER IN THE PROGRESSION? OF COURSE VARIABLE IS A SCIENTIST’S TERM NOT A MATHEMATICIAN’S, BUT I HAVE LESS PROBLEM WITH THAT.

AND I THINK YOUR USE OF “INCREMENTAL TASKS” IS A MAJOR CONTRIBUTION – AN IMPORTANT PART OF AN ANSWER TO THE “WHAT NEXT” QUESTION – BUT I THINK IT MAY BE A MISTAKE TO THINK OF THEM TOO MUCH IN ASSESSMENT TERMS, RATHER THAN CONSIDERING THEM TO BE INSTRUCTIONAL INTERVENTIONS. I KNOW SOME OF THEM ARE SUPPOSED TO PROVIDE ADDITIONAL INFORMATION ABOUT DIFFICULTIES OR MISCONCEPTIONS, BUT I THINK CALLING THINGS TESTS OR ASSESSMENTS CAUSES A LOT OF MISCHIEF WITH MANY TEACHERS, WHO MIGHT OTHERWISE RESPOND QUITE SENSIBLY TO THE INFORMATION THE TASKS PROVIDE. IN ANY CASE THE PAPER LEAVES ME EAGER TO HEAR MORE ABOUT WHAT TEACHERS MAKE OF IT ALL AND HOW YOU WILL HELP THEM MAKE SENSE OF IT.

I HAVE SIMILAR HOPES AND CONCERNS ABOUT THE IDAS WORK. THE WORK ON SCALING OF THE ITEMS SEEMS CLEARLY TO HAVE BEEN USEFUL IN HELPING YOU REFINE BOTH THE ITEMS AND YOUR CONCEPTION OF THE PROGRESSIONS, BUT IT ISN’T CLEAR TO ME THAT REPORTING IN THOSE TERMS IS LIKELY TO BE USEFUL TO TEACHERS, OR THAT IT WILL BE EASY FOR THEM TO INTEGRATE THE IDAS WITH THEIR NORMAL MATHEMATICS PROGRAM. YOU PROBABLY HAVEN’T HAD TO FACE THE LATTER YET IN THIS SMALL SCALE PHASE OF THE WORK, BUT YOU WILL, AND AS FOR THE SCORES – I WOULD THINK THAT TEACHERS MIGHT FIND THAT THEY GET IN THE WAY OF, OR IN BETWEEN, THE DIRECT EVIDENCE OF STUDENTS’ THINKING AS THEY TACKLE THE TASKS. ARE TEACHERS ABLE TO LOOK AT THE RECORD OF THE ACTUAL WORK, OR IS THAT HIDDEN BY THE SOFTWARE’S SCORING PROCESSES (EXCEPT WHEN THINGS HAVE TO BE HAND-SCORED – AND IN THOSE CASES IS IT THE STUDENT’S TEACHER WHO SCORES?). AGAIN, I WORRY THAT FRAMING THINGS IN TERMS OF ASSESSMENT MAY CAUSE MISCHIEF WHEN YOU ARE HOPING TO IMPROVE INSTRUCTION.

BUT THESE ARE QUIBBLES SEEN AGAINST THE LARGER POINT – IT’S REALLY GOOD TO HAVE THESE EXAMPLES OF SERIOUS WORK UNDER WAY TO TEST WHETHER THE RHETORIC OF PROGRESSIONS MIGHT ACTUALLY HAVE SOMETHING TO OFFER TO INSTRUCTION. THANKS FOR DOING IT, AND THANKS FOR ASKING ME TO COMMENT.