ABSTRACT
Our poster is an exploration of the effects of quantifying physical experiences and refashioning them into new, interactive, live experiences through data visualization; in other words, we are exploring how data visualizations are designed to teach and effect change.

Categories and Subject Descriptors
J.1 [Administrative Data Processing]: Education; J.7 [Computers in Other Systems]: Real time; K.3.0 [Computers in Education]: General

Keywords
teacher education, sports, data visualization, real-time computing

1. INTRODUCTION
Our poster is an exploration of the effects of quantifying physical experiences and refashioning them into new, interactive, live experiences through data visualization; in other words, we are investigating how data visualizations are designed to teach and effect change. Specifically, we examine two topics: athletic training and teacher training. Both of these fields have been inundated by data analysis tactics; sports data visualizations are highly developed and hypermediate while teacher training data are still largely immediate and static. Through an analysis related to theories of phenomenography and remediation, we discuss how the use of real-time data analysis and data visualization common in sports training might inform other fields, such as teaching.

2. LITERATURE REVIEW
Several recent studies explore the relationship between learning and phenomenography, a qualitative research method that attempts to explore how people interpret various lived old) experiences of [a] skill or concept to their new experience of the skill or concept” [1]. Teaching principles derived from experiences. When used in relation to learning outcomes, phenomenography allows people “to compare their original (or phenomenographic methods seek to change and/or investigate the ways that students view an aspect of their world [2]. When applied to teachers themselves, phenomenographic studies suggest that teachers have radically different understandings of student engagement and learning [3].

Each of the aforementioned studies uses a type of data visualization and real-time process to reach conclusions about human perception. The reverse is also true: phenomenography can help researchers understand the ways people interpret data visualizations [4]. Specifically, phenomenography can help teachers understand the ways their data visualization tools are received by students [5]. Our research project imagines the opportunities offered by information visualization for changing practice in educational processes like teaching, coaching, and learning through a theoretical interpretation of the power of real-time data analysis and phenomenography.

3. THEORY AND METHODS
This poster specifically reports on a theoretical inquiry into current practices of data analysis and visualization in sports and education. The researchers will use the theory of remediation, described by Jay David Bolter and David Grusin, to conduct an analysis of current practices of data analysis and visualization in athletic training and teacher training [6]. The authors hypothesize that the practice of real-time data collection and analysis in professional sports training is largely hypermediate, while teacher education and assessment continues to rely on data that are immediate and static. These contrasting approaches will be evaluated. Theoretical implications for current data visualization theory, as well as current practices in phenomenography and teacher training will be addressed.

A clear connection exists between the prominence of data visualization and the new media concepts of hypermediacy, immediacy, and remediation [6]. Interactive or artistic remediations of numeric symbols attempt to improve upon raw data while reminding users of the original, immediate symbols; in this way, visualizations of data are hypermediate, interactive, and immersive. Bolter and Grusin explore the influence of this interactivity on mediated human experiences, arguing that “[i]f the logic of immediacy leads one either to erase or to render automatic the act of representation, the logic of hypermediacy acknowledges multiple acts of representation and makes them visible” [6]. Data imagery is hypermediate, acknowledging and making visible acts of remediation. Conversely, raw data is much more immediate or transparent. The numeric symbol, however, is not a window to the real. Kenneth Burke argues that “naïve verbal realism” relies on the immediacy of language; similarly, a certain
“naïve numeric realism” is present in interactions with raw numeric data [7]. If the concept of immediacy is the perfection of the gap between signifier and signified, it should not be surprising that quantitative data feel so “real” and “meaningful”; yet, they are still remediations.

Efforts to promote improvement and change should be based on the analysis and visualization of real-time, hypermediated data, rather than static, immediate data. Such efforts should enable individuals to interpret lived experience in light of hypermediated data in order to improve future practice and outcomes.

4. CONCLUSIONS

Sports data visualizations are highly developed and hypermediate, as in the case of SportVU, a service that provides 25-frames-per-second optical tracking data, quantifying video of player performance for visualization and analysis [8]. At least 15 NBA teams now employ this SportVU system for data capture, which includes cameras originally developed for tracking missiles [9]. SportVU provides the hardware system, tracks the movement of each player in every game played at the given arena, and then provides the derived raw data in the form of spreadsheets to each participating team [10]. The teams themselves are responsible for analyzing and then visually presenting that data so that it can be applied to training as well as game time situations [10]. Data analysts and programmers are currently developing strategies and tools that enable interactive, rapid analysis of SportVU data so that it can be collected and applied in real-time [11, 12, 13]. The collection of data from the physical, lived experience of the players (and hypermediation of that data via visualizations that can be presented back to participants in real-time) has the potential to dramatically impact how players are coached and the game played. An example that illustrates the contrast between the usefulineness of immediate raw data and hypermediated data is seen in the current sports analytics discussion of three point shooting [10]. Analysis of optical tracking data suggests that teams should shoot more three pointers, challenging the naïve numeric realism of coaches who rely on conventional statistical benchmarks to determine who should be taking three point shots, and when.

Teacher training data are still largely immediate and static, as evidenced in the numerical evaluations of the edTPA test, created by Stanford University and administered by Pearson, and the Teacher/Principal Evaluation Project. For example, in the case of the edTPA test, which has been adopted by several states for use as a formative and/or summative assessment of P-12 teacher candidates, feedback on the test is only provided in the form of a set of autonomous scores. At the time of this research, neither the test taker nor the institution that has administered the test is provided with any explanatory feedback tied to this raw data. In another example, under programs such as No Child Left Behind and The Race to the Top, teachers are fired, and schools are shut down on the basis of immediate, static test scores. Major decisions, in an effort to promote change, are made on the basis of data that has not been derived from lived practice, nor has this data been collected and then hypermediated in an effort to inform and shift practice in real-time.

Training teachers using the hypermediated, data visualization strategies deployed in sports could move the discussion of teacher accountability away from the analysis of (raw, autonomous) student test data and towards the real-time analysis and visualization of data derived from the “lived experience” of a teacher in the midst of training. Finally, we suggest that the use of data in this way may move us away from a naïve numerical realism—the trust that raw data will tell the truth of a situation—towards a more insightful analysis and application of data, which are derived from lived experience, represented visually, analyzed in real-time, and used to alter behavior and decision-making.

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6. ADDITIONAL AUTHORS

There are no additional authors of this paper.

7. REFERENCES